

ETSI TS 101 812 V1.1.2 (2001-10)

Technical Specification

Digital Video Broadcasting (DVB); Multimedia Home Platform (MHP) Specification 1.0.1

European Broadcasting Union



Union Européenne de Radio-Télévision

EBU·UER
DVB
Digital Video
Broadcasting



Reference

RTS/JTC-DVB-113

Keywordsbroadcasting, data, digital, DVB, MPEG,
terrestrial, TV, video**ETSI**

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistré à
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, send your comment to:
editor@etsi.fr

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2001.
© European Broadcasting Union 2001.
All rights reserved.

Contents

Intellectual Property Rights	24
Foreword	24
0 Introduction	24
0.1 Purpose	24
0.2 Application Areas	25
0.3 Profiles	25
1 Scope	26
2 References	26
3 Definitions and abbreviations	31
3.1 Definitions	31
3.2 Abbreviations	34
4 Conventions	35
5 Basic Architecture	36
5.1 Context	36
5.2 Architecture	37
5.2.1 Resources	37
5.2.2 System software	37
5.2.2.1 Application Manager	37
5.2.3 Application	37
5.3 Interfaces Between an MHP Application and the MHP System	39
5.4 Plug-ins	40
5.4.1 Security Model	41
6 Transport Protocols	42
6.1 Introduction	42
6.2 Broadcast Channel Protocols	42
6.2.1 MPEG-2 Transport Stream	43
6.2.2 MPEG-2 Sections	43
6.2.3 DSM-CC Private Data	43
6.2.4 DSM-CC Data Carousel	43
6.2.5 DSM-CC User-to-User Object Carousel	43
6.2.5.1 DVB-J class files	43
6.2.5.2 DVB-HTML document files	43
6.2.5.3 Loss of Carousel Behaviour	44
6.2.6 DVB Multiprotocol Encapsulation	44
6.2.7 Internet Protocol (IP)	44
6.2.8 User Datagram Protocol (UDP)	44
6.2.9 DVB Service Information	44
6.3 Interaction Channel Protocols	45
6.3.1 Network Dependent Protocols	45
6.3.2 Internet Protocol (IP)	45
6.3.3 Transmission Control Protocol (TCP)	45
6.3.4 UNO-RPC	45
6.3.5 UNO-CDR	45
6.3.6 DCM-CC User to User	45
6.3.7 Hypertext Transfer Protocol (HTTP)	46
6.3.7.1 HTTP 1.1	46
6.3.8 Service Specific	46
6.3.9 User Datagram Protocol (UDP)	46
7 Content formats	47
7.1 Static formats	47
7.1.1 Bitmap image formats	47

7.1.1.1	Image encoding restrictions	47
7.1.1.2	JPEG	47
7.1.1.3	PNG	47
7.1.1.4	GIF	47
7.1.2	MPEG-2 I-Frames	47
7.1.3	MPEG-2 Video "drips"	47
7.1.4	Monomedia format for audio clips	49
7.1.5	Monomedia format for text	49
7.1.5.1	Built-in character set	49
7.2	Broadcast streaming formats	49
7.2.1	Audio	49
7.2.2	Video	49
7.2.3	Subtitles	49
7.2.3.1	DVB Subtitles	49
7.2.3.2	Teletext	50
7.3	Resident fonts	50
7.4	Downloadable Fonts	50
7.5	Colour Representation	50
7.5.1	Background (informative)	50
7.5.2	Specification	51
7.5.2.1	The sRGB Reference Viewing Environment	51
7.5.2.2	Colourimetric Definitions and Encodings	51
7.6	MIME Types	53
7.6.1	Rationale	53
8	DVB-HTML	54
8.1	Status of DVB HTML	54
9	Application model	55
9.1	Broadcast MHP applications	55
9.1.1	Basic lifecycle control	55
9.1.2	Starting applications	55
9.1.3	Support for execution of multiple simultaneous applications	56
9.1.4	Stopping applications	56
9.1.4.1	A new service being selected replacing a previously selected one	56
9.1.4.2	The stopping of an application by another application	56
9.1.4.3	Changes in the application signalling to request a particular application be stopped	56
9.1.4.4	Stopping by the MHP terminal due to a shortage of resources	56
9.1.5	Persistence of Applications Across Service Boundaries	56
9.1.6	Management of autostarting	57
9.1.7	When tuning is not service selection!	57
9.1.8	DVB-J Applications and Service Selection	57
9.2	DVB-J Model	58
9.2.1	Starting DVB-J Applications	58
9.2.2	Stopping a DVB-J Application	58
9.2.3	DVB-J Application Lifecycle	58
9.2.3.1	Introduction	58
9.2.3.2	DVB-J Application Lifecycle State Machine	59
9.2.4	Xlet API	61
9.2.4.1	Xlet State Change Semantics	62
9.2.4.2	Xlet state change requests	62
9.2.5	Multiple application environment support	62
9.2.5.1	Control of DVB-J applications by other DVB-J applications	62
9.2.5.2	Input Focus management	62
9.2.5.3	Other resources management	63
9.2.5.4	VM implementation	63
9.3	DVB-HTML Model	63
9.3.1	The DVB-HTML Application	63
9.3.1.1	DVB-HTML Application	63
9.3.1.2	User agent	63

9.3.1.3	DVB-HTML Actor	63
9.3.1.4	Application boundary	64
9.3.1.4.1	Regular Expression Syntax	64
9.3.2	DVB-HTML Application Lifecycle	65
9.3.2.1	Introduction	65
9.3.2.2	Signalling	65
9.3.2.3	Lifecycle control	66
9.3.2.3.1	State diagram	66
9.3.3	The State Model	66
9.3.3.1	Loading	67
9.3.3.1.1	Name	67
9.3.3.1.2	Entry actions	67
9.3.3.1.3	Activities	67
9.3.3.1.4	Resources	67
9.3.3.1.5	Transitions	67
9.3.3.1.6	Comment	67
9.3.3.2	Active	67
9.3.3.2.1	Name	67
9.3.3.2.2	Activities	67
9.3.3.2.3	Entry actions	67
9.3.3.2.4	Resources	67
9.3.3.2.5	Transitions	68
9.3.3.2.6	Comment	68
9.3.3.3	Paused	68
9.3.3.3.1	Name	68
9.3.3.3.2	Activities	68
9.3.3.3.3	Resources	68
9.3.3.3.4	Transitions	68
9.3.3.3.5	Comment	68
9.3.3.4	Destroyed	69
9.3.3.4.1	Name	69
9.3.3.4.2	Activities	69
9.3.3.4.3	Resources	69
9.3.3.4.4	Transitions:	69
9.3.3.4.5	Comment	69
9.3.3.5	Killed	69
9.3.3.5.1	Name	69
9.3.3.5.2	Entry actions	69
9.3.3.5.3	Activities	69
9.3.3.5.4	Resources	69
9.3.3.5.5	Transitions	69
9.3.3.5.6	Comment	69
9.4	Inter application resource management	70
10	Application Signalling	71
10.1	Introduction	71
10.1.1	Summary of common signalling	71
10.1.2	Summary of additional signalling for DVB-J applications	71
10.1.3	Summary of additional signalling for DVB-HTML applications	71
10.1.4	Summary of additional signalling for applications carried via OC	71
10.1.5	Summary of additional signalling for applications carried via IP	72
10.1.6	How to add a new scheme (informative)	72
10.1.7	Service information	72
10.2	Program Specific Information	72
10.2.1	Application signalling stream	72
10.2.2	Data broadcast streams	72
10.3	Notation	73
10.3.1	reserved	73
10.3.2	reserved_future_use	73
10.4	Application Information Table	73

10.4.1	Data errors	73
10.4.2	AIT transmission and monitoring	73
10.4.3	Optimised AIT signalling	74
10.4.4	Visibility of AIT	74
10.4.5	Definition of sub-table for the AIT	74
10.4.6	Syntax of the AIT	74
10.4.7	Use of private descriptors in the AIT	76
10.4.8	Text encoding in AIT	76
10.5	Application identification	76
10.5.1	Encoding	76
10.5.2	Effects on life cycle	77
10.5.3	Authentication of application identification	77
10.6	Control of application life cycle	77
10.6.1	Entering and leaving the domain of an application	77
10.6.2	Dynamic control of the application life cycle	78
10.6.2.1	DVB-J	78
10.6.2.2	DVB-HTML	79
10.7	Generic descriptors	79
10.7.1	Application Signalling Descriptor	79
10.7.2	Data broadcast id descriptor	80
10.7.2.1	Generic descriptor	80
10.7.2.2	MHP data broadcast id descriptor	81
10.7.3	Application descriptor	81
10.7.4	User information descriptors	83
10.7.4.1	Application name descriptor	83
10.7.4.2	Application icons descriptor	84
10.7.5	External application authorisation descriptor	85
10.8	Transport protocol descriptors	86
10.8.1	Transport protocol descriptor	86
10.8.1.1	Transport via OC	87
10.8.1.2	Transport via IP	87
10.8.2	IP Routing Descriptors	88
10.8.2.1	Routing Descriptor IPv4	88
10.8.2.2	Routing Descriptor IPv6	89
10.8.3	Pre-fetch signalling	89
10.8.3.1	Introduction	89
10.8.3.2	Pre-fetch descriptor	90
10.8.3.3	DII location descriptor	90
10.9	DVB-J specific descriptors	91
10.9.1	DVB-J application descriptor	91
10.9.2	DVB-J application location descriptor	92
10.10	DVB-HTML Specific descriptors	93
10.10.1	DVB-HTML application descriptor	93
10.10.2	DVB-HTML application location descriptor	93
10.10.2.1	Example	94
10.10.2.2	Application Entry Point	94
10.10.3	DVB-HTML application boundary descriptor	95
10.11	Constant values	96
10.12	Service Information	97
10.12.1	Service identifier descriptor	97
11	DVB-J Platform	98
11.1	The Virtual Machine	98
11.2	General issues	98
11.2.1	Basic Considerations	98
11.2.2	Approach to Subsetting	98
11.2.3	Class Loading	98
11.2.4	Unloading	99
11.2.5	Event listeners	99
11.2.6	Event model in DAVIC APIs	99

11.2.7	Event model in DAVIC & DVB APIs	99
11.2.8	Tuning as a side-effect.	99
11.2.9	Intra application media resource management	99
11.2.10	Application thread priority	99
11.3	Fundamental DVB-J APIs.	100
11.3.1	Java platform APIs	100
11.3.1.1	java.lang package.	100
11.3.1.2	java.lang.reflect package	101
11.3.1.3	java.util	101
11.3.1.4	java.util.zip.	101
11.3.1.5	java.io.	101
11.3.1.6	java.net.	101
11.3.1.7	java.beans.	102
11.3.1.8	java.math	102
11.3.2	MHP platform APIs.	102
11.3.2.1	org.dvb.lang	102
11.3.2.2	org.dvb.event	103
11.4	Presentation APIs	103
11.4.1	Graphical User Interface API	103
11.4.1.1	The Core GUI API.	103
11.4.1.2	TV user interface	104
11.4.1.3	Extended graphics	105
11.4.1.4	Handling of input events	105
11.4.2	Streamed Media API	107
11.4.2.1	Framework of solution.	107
11.4.2.2	Clarifications	107
11.4.2.3	Default media player behaviour.	107
11.4.2.4	Required controls for video drips	107
11.4.2.5	Extensions to the Framework	108
11.4.2.5.1	DVB specified extensions	108
11.4.2.5.2	Extensions in org.davic	108
11.4.2.5.3	Extensions in javax.tv	108
11.4.2.5.4	Required controls for broadcast profiles	109
11.4.2.5.5	Clarifications	109
11.4.2.6	Restrictions on the Framework for Broadcast	109
11.4.2.7	Intersection Between MediaSelectControl and SubtitlingLanguageControl / AudioLanguageControl.	110
11.4.2.8	Intersection between Streamed Media API and TV User Interface API	111
11.4.2.8.1	Basic Principles	111
11.4.2.8.2	TV Behaviour Control	111
11.4.2.8.3	Application Behaviour Control	111
11.4.2.8.4	Dynamic Behaviour	111
11.4.2.8.5	Resource Management Details.	112
11.5	Data Access APIs	112
11.5.1	Broadcast Transport Protocol Access API	112
11.5.1.1	Constraints on the java.io.File methods for broadcast carousels.	113
11.5.1.2	Methods dealing with write access	113
11.5.1.3	Behaviour following loss of a broadcast file system.	114
11.5.2	Support for Multicast IP over the Broadcast Channel.	114
11.5.3	Support for IP over the Return Channel	115
11.5.4	MPEG-2 Section Filter API.	115
11.5.5	Mid-Level Communications API	115
11.5.6	Persistent Storage API.	115
11.6	Service Information and Selection APIs	116
11.6.1	DVB Service Information API	116
11.6.2	Service Selection API	116
11.6.3	Tuning API	116
11.6.4	Conditional Access API	117

11.6.5	Protocol Independent SI API	117
11.7	Common Infrastructure APIs	118
11.7.1	APIs to support DVB-J application lifecycle	118
11.7.1.1	Xlet properties	118
11.7.1.2	Actions for DVB-J applications to perform in their destroy method	118
11.7.2	Application discovery and launching APIs	118
11.7.3	Inter-Application communication API	119
11.7.3.1	Remote Call Semantics	120
11.7.3.1.1	Objects Passed by Remote Reference	120
11.7.3.1.2	Objects Passed by Remote Copy	121
11.7.3.1.3	Classloading Considerations	121
11.7.3.1.4	Thread Usage	121
11.7.3.1.5	Garbage Collection of Remote Objects	122
11.7.4	Basic MPEG Concepts	122
11.7.5	Resource Notification	122
11.7.6	Content Referencing	122
11.7.7	Common Error Reporting	123
11.8	Security	124
11.8.1	Basic Security	124
11.8.1.1	java.security	124
11.8.1.2	java.security.cert	125
11.8.1.3	Other classes	125
11.8.2	APIs to Support TLS / SSL Over the Return Channel	125
11.8.3	Additional permissions classes	125
11.8.4	General security issues	125
11.9	Other APIs	125
11.9.1	Timer Support	125
11.9.2	User Settings and Preferences API	126
11.9.3	Profile and version properties	126
11.9.3.1	Information on options	127
11.10	Java permissions	127
11.10.1	Permissions for unsigned applications	127
11.10.1.1	java.awt.AWTPermission	127
11.10.1.2	java.net.SocketPermission	127
11.10.1.3	java.util.PropertyPermission	127
11.10.1.4	java.lang.RuntimePermission	128
11.10.1.5	java.io.SerializablePermission	128
11.10.1.6	java.io.FilePermission	128
11.10.1.7	javax.tv.media.MediaSelectPermission	128
11.10.1.8	javax.tv.service.ReadPermission	128
11.10.1.9	javax.tv.service.selection.ServiceContextPermission	128
11.10.1.10	java.util.Locale.setDefault	128
11.10.2	Additional Permissions for signed applications	128
11.10.2.1	java.util.PropertyPermission	128
11.10.2.2	java.io.FilePermission	128
11.10.2.3	org.dvb.net.ca.CAPermission	128
11.10.2.4	org.dvb.application.AppsControlPermission	129
11.10.2.5	org.dvb.net.rc.RCPermission	129
11.10.2.6	org.dvb.net.tuning.TunerPermission	129
11.10.2.7	javax.tv.service.selection.SelectPermission	129
11.10.2.8	org.dvb.user.UserPreferencePermission	129
11.10.2.9	java.net.SocketPermission	129
11.10.2.10	org.dvb.media.DripFeedPermission	129
11.11	Content referencing	130
11.11.1	Transport stream	130
11.11.2	Network	130
11.11.3	Bouquet	130
11.11.4	Service	131

11.11.4.1	MPEG/DVB specific service	131
11.11.4.2	Generic Service	132
11.11.5	DVB Event	132
11.11.6	MPEG elementary stream	133
11.11.7	File	133
11.11.8	Directory	134
11.11.9	Drip feed decoder	134
11.11.10	Irrelevant	134
11.11.11	Methods working on many Locator types	134
11.11.12	Support for the HTTP protocol in DVB-J	135
12	Security	136
12.1	Introduction	136
12.1.1	Overview of the security framework for applications	136
12.1.2	Overview of return channel security	136
12.2	Authentication of applications	136
12.2.1	Overview of authentication messages	136
12.2.1.1	Hash codes	137
12.2.1.2	Signatures	137
12.2.1.3	Certificates	137
12.2.1.4	Authentication of hierarchical file systems	138
12.3	Message transport	138
12.4	Detail of application authentication messages	139
12.4.1	HashFile	139
12.4.1.1	Description	139
12.4.1.2	HashFile location and naming conventions	140
12.4.1.3	Digest value computation rules	140
12.4.1.4	Special authentication rules	140
12.4.2	SignatureFile	141
12.4.2.1	Description	141
12.4.2.2	SignatureFile location and naming conventions	141
12.4.2.3	Supported algorithms	142
12.4.2.4	Signature computation rules	142
12.4.2.5	Authentication rules	142
12.4.3	CertificateFile	142
12.4.3.1	Description	142
12.4.3.2	ASN.1 encoding	143
12.4.3.3	Supported algorithms	143
12.4.3.4	Name matching	143
12.4.3.5	CertificateFile location and naming conventions	143
12.4.3.6	Authentication rules	143
12.4.4	Integration	143
12.5	Profile of X.509 certificates for authentication of applications	144
12.5.1	signatureAlgorithm	144
12.5.1.1	MD5 with RSA	144
12.5.1.2	SHA-1 with RSA	144
12.5.1.3	parameters	144
12.5.2	signatureValue	144
12.5.3	version	144
12.5.4	issuer	145
12.5.4.1	minimum requirement	145
12.5.4.2	certificate authority responsibility	145
12.5.5	validity	145
12.5.6	subject	145
12.5.7	SubjectPublic Key Info	145
12.5.7.1	rsaEncryption	145
12.5.7.2	subjectPublicKey	145
12.5.8	Unique Identifiers	146
12.5.9	Extensions	146
12.6	Security policy for applications	147

12.6.1	General principles	147
12.6.2	Permission request file	148
12.6.2.1	File encoding	148
12.6.2.1.1	Number representation	149
12.6.2.2	File integrity.	150
12.6.2.3	Example	150
12.6.2.4	Permission request file name and location.	150
12.6.2.5	Permission request file.	151
12.6.2.5.1	Minimum permissions	151
12.6.2.5.2	Syntax and semantics	151
12.6.2.6	Credentials	151
12.6.2.7	File Access.	153
12.6.2.7.1	Unsigned applications	153
12.6.2.7.2	Default policy for signed applications	153
12.6.2.7.3	Permission request syntax	154
12.6.2.8	CA API	154
12.6.2.8.1	Unsigned applications	154
12.6.2.8.2	Signed applications	154
12.6.2.8.3	Conditional Access Permission syntax	155
12.6.2.9	Application lifecycle control policy	155
12.6.2.9.1	Unsigned applications	155
12.6.2.9.2	Default policy for Signed applications.	155
12.6.2.9.3	Syntax.	155
12.6.2.10	Return channel access policy.	155
12.6.2.10.1	Unsigned applications	155
12.6.2.10.2	Signed applications	155
12.6.2.10.3	Return channel permission syntax	156
12.6.2.11	Tuning access policy	156
12.6.2.11.1	Unsigned applications	156
12.6.2.11.2	Signed applications	156
12.6.2.11.3	Tuner Permission syntax	156
12.6.2.12	Service selection policy	156
12.6.2.12.1	Unsigned applications	156
12.6.2.12.2	Signed applications	156
12.6.2.12.3	Service Selection Permission	156
12.6.2.13	Media API access policy	157
12.6.2.14	Inter-application communication policy	157
12.6.2.14.1	Unsigned applications	157
12.6.2.14.2	Signed applications	157
12.6.2.15	User Setting and Preferences access policy.	157
12.6.2.15.1	Unsigned applications	157
12.6.2.15.2	Signed applications	157
12.6.2.15.3	Permission syntax.	157
12.6.2.16	Network permissions	157
12.6.2.16.1	Unsigned applications	157
12.6.2.16.2	Signed applications	157
12.6.2.16.3	Permission syntax.	158
12.6.2.17	Dripfeed permissions	158
12.6.2.17.1	Unsigned applications	158
12.6.2.17.2	Default policy for signed applications	158
12.6.2.17.3	Permission request syntax	158
12.7	Example of creating an application that can be authenticated	158
12.7.1	Scenario Example	158
12.7.2	Hashes and signature computations:	159
12.7.2.1	Computation of the hashes of the root/Xlet1/classes/subclasses directory	159
12.7.2.2	Computation of the hashes of the of root/Xlet1/classes directory	159
12.7.2.3	Computation of the hashes of the of root/Xlet1 directory	160
12.7.2.4	Computation of the signature.	160
12.8	Procedures for application certificates and signatures	161

12.9	Certificate management	161
12.9.1	Certificate Revocation Lists	161
12.9.1.1	Introduction (informative)	161
12.9.1.2	Distribution of CRLs (informative)	161
12.9.1.2.1	Distribution via return channel	161
12.9.1.2.2	Distribution via MPEG stream	161
12.9.1.3	CRL retention	162
12.9.1.3.1	Requirement	162
12.9.1.3.2	Storage requirement	162
12.9.1.3.3	Storage management	162
12.9.1.4	CRL file location and naming convention	162
12.9.1.5	Operational model	162
12.9.1.6	Examples	163
12.9.1.6.1	Revocation of a broadcaster's certificate	163
12.9.1.6.2	Revocation of a CA's certificate	163
12.9.1.7	CRL format	163
12.9.1.8	Profile of CRL	164
12.9.1.9	CRL Processing	164
12.9.2	Root certificate management	165
12.9.2.1	Introduction	165
12.9.2.2	Security of RCMM	165
12.9.2.3	Format of RCMM	165
12.9.2.4	Distribution of RCMM	166
12.9.2.5	RCMM Processing	166
12.9.2.6	Example: Renewal of a root certificate	167
12.10	Security on the return channel	167
12.10.1	MHP functionality	167
12.10.2	TLS cipher suites	167
12.10.3	The EDE112 cipher	168
12.10.4	Downloading of certificates for TLS	168
12.10.4.1	Introduction	168
12.10.4.2	Usage of certificate in TLS	168
12.10.4.2.1	When certificates are delivered with the application	168
12.10.4.2.2	When no certificates are provided	169
12.11	The internet profile of X.509 (informative)	169
12.11.1	Main part of the certificate	169
12.11.1.1	Certificate	169
12.11.1.2	signatureAlgorithm	169
12.11.1.3	signatureValue	170
12.11.1.4	tbsCertificate	170
12.11.1.5	version	170
12.11.1.6	serialNumber	171
12.11.1.7	signature	171
12.11.1.8	issuer	171
12.11.1.9	validity	171
12.11.1.9.1	UTCTime	172
12.11.1.9.2	GeneralizedTime	172
12.11.1.10	subject	172
12.11.1.10.1	issuerUniqueID	172
12.11.1.10.2	subjectUniqueID	172
12.11.1.11	SubjectPublic Key Info	173
12.11.1.12	Unique Identifiers	173
12.11.1.13	Extensions	173
12.11.2	Standard certificate extensions	174
12.11.2.1	Authority key identifier	174
12.11.2.2	Subject key identifier	174
12.11.2.3	Key usage	174
12.11.2.4	Private key usage period	174
12.11.2.5	Certificate policies	174

12.11.2.6	Policy mappings	175
12.11.2.7	Subject Alternative Name	175
12.11.2.8	Issuer Alternative Name	175
12.11.2.9	Subject Directory attributes	175
12.11.2.10	Basic Constraints	176
12.11.2.11	Name Constraints	176
12.11.2.12	Policy Constraints	176
12.11.2.13	Extended key usage field	176
12.11.2.14	CRL Distribution points	176
12.12	MHP certification procedures	177
13	Graphics reference model	178
13.1	Introduction	178
13.1.1	Interapplication interaction	178
13.2	General Issues	179
13.2.1	Coordinate Spaces	179
13.2.1.1	Normalised screen space	179
13.2.1.2	User space	180
13.2.1.3	Pixel Aspect Ratio	182
13.2.1.4	Video space	183
13.3	Graphics	183
13.3.1	Modelling of the MHP display stack composition	183
13.3.2	AWT Reference Model in the MHP	185
13.3.3	HAVi devices and AWT components	186
13.3.3.1	Video and graphics pixel aligned	188
13.3.3.2	Zero graphics impact	188
13.3.4	Composition	188
13.3.4.1	AWT paint rule	188
13.3.5	Composition Rules	189
13.3.5.1	Components generally	189
13.3.6	Extensions to the AWT graphics capabilities	190
13.3.6.1	Graphics Objects in the MHP	190
13.3.6.2	Buffered Image	190
13.3.6.3	DVBColor	190
13.3.6.3.1	Modified packed colour representation	190
13.4	Video	191
13.4.1	Component-based players and background players	191
13.4.2	Modelling MPEG decoding and presentation pipeline	191
13.4.3	Coordinate Spaces	192
13.4.4	Video components	193
13.5	Subtitles	194
13.5.1	Language and presentation setting	194
13.5.2	Relation to graphics	194
13.5.3	Coordinate Spaces	194
13.6	Approximations	195
13.6.1	Approximations in composition	195
13.6.1.1	Implementation of modes	195
13.6.1.1.1	Graphics directly over video	195
13.6.1.1.2	Graphics over other graphics	195
13.6.1.2	Approximation of alpha	196
13.6.1.3	Approximation of colour	197
14	System integration aspects	198
14.1	Namespace mapping (DVB Locator)	198
14.1.1	dvb_entity = dvb_service	198
14.1.2	dvb_entity = dvb_service_component	199
14.1.3	dvb_hier_part = dvb_abs_path	199
14.1.4	dvb_abs_path	199
14.2	Reserved names	199
14.3	XML notation	200

14.4	Network signalling	202
14.5	Text encoding of application identifiers	202
14.6	Reserved names for persistent storage	202
14.7	Files and file names	203
14.8	Locators and content referencing	203
14.9	Service identification	204
14.9.1	Syntax of the textual service identifier	204
14.9.2	Handling of the textual service identifiers within the MHP terminal	205
15	Detailed platform profile definitions	206
15.1	PNG - restrictions	208
15.1.1	PNG Aspect ratios	208
15.2	Minimum media formats supported by DVB-J APIs	208
15.3	JPEG - restrictions	208
15.4	Locale support	209
16	Registry of Constants	210
16.1	System constants	210
16.2	DVB-J constants	210
16.2.1	Public and Protected final static primitive fields from DVB packages	210
16.2.2	Public and Protected final static primitive fields from standard Java packages	213
Annex A (normative): External references; errata, clarifications and exemptions		214
A.1	JAE 1.1.8 API [31]	214
A.1.1	java.lang.ThreadGroup.getParent()	214
A.1.2	java.net.URLConnection.setFileNameMap	214
A.1.3	java.util.Locale.setDefault	214
A.1.4	java.lang.Class	214
A.1.5	java.awt.Font	214
A.2	Java Language Spec [32]	214
A.2.1	java.lang.ThreadGroup.getParent()	214
A.2.2	java.lang.Runtime.runFinalizersOnExit()	214
A.2.3	java.lang.System.runFinalizersOnExit()	214
A.3	Java Media Player Specification [33]	215
A.3.1	javax.media.protocol.URLDataSource.sources	215
A.4	Java VM [34]	215
A.5	Java TV [51]	215
A.5.1	javax.tv.service.selection	215
A.5.1.1	PresentationTerminatedEvent	215
A.5.1.2	ServiceContext.select(Locator [])	216
A.5.2	javax.tv.util.TVTimer	216
A.5.2.1	scheduleTimerSpec(TVTimerSpec)	216
A.5.3	javax.tv.util.TVTimerSpec	216
A.5.3.1	setAbsoluteTime(long)	216
A.5.3.2	setTime(long)	216
A.5.4	javax.tv.xlet.Xlet	216
A.6	DAVIC 1.4.1p9 [3]	216
A.6.1	org.davic.mpeg.NotAuthorizedException	216
A.6.2	org.davic.mpeg.dvb	219
A.6.2.1	DvbElementaryStream	219
A.6.3	org.davic.mpeg.sections	219
A.6.3.1	RingSectionFilter	219
A.6.3.2	Section	219
A.6.3.2.1	clone()	219
A.6.3.2.2	Started Section Filters	219
A.6.3.2.3	getData()	219
A.6.3.2.4	getFullStatus()	219
A.6.3.3	SectionFilter	219
A.6.3.3.1	Cross reference error	219
A.6.3.3.2	startFiltering(java.lang.Object, int, int)	220

A.6.3.3.3	startFiltering(java.lang.Object, int, int, int, byte[], byte[]).	220
A.6.3.3.4	startFiltering (appData, pid, tableId) exceptions	220
A.6.3.4	SectionFilterGroup.	220
A.6.3.4.1	NotAuthorizedException	220
A.6.3.4.2	numberOfFilters.	220
A.6.3.4.3	sectionSize	220
A.6.3.4.4	ringSize	220
A.6.3.5	TimeoutEvent	220
A.6.4	org.davic.media	221
A.6.4.1	FreezeControl.resume()	221
A.6.4.2	MediaTimePositionChangedEvent	221
A.6.4.3	NotAuthorizedMediaException	221
A.6.5	org.davic.net	222
A.6.5.1	InvalidLocatorException	222
A.6.5.2	Locator.	222
A.6.5.2.1	Locator().	222
A.6.5.2.2	toExternalForm()	222
A.6.5.3	tuning	223
A.6.5.3.1	NetworkInterfaceController	223
A.6.5.4	ca	223
A.6.5.4.1	CAMessage	223
A.6.5.4.2	CAModule	224
A.6.5.4.3	CAModuleManager	226
A.6.5.4.4	NoFreeCapacityException	226
A.6.5.4.5	MMIOObject.	227
A.6.5.4.6	DescramblerProxy	227
A.6.5.4.7	StartMMIEvent(MMIOObject, int, java.lang.Object)	228
A.6.5.5	dvb.DvbLocator(int onid, int tsid, int serviceid, int eventid, int componenttags[], String filePath).	228
A.6.5.6	dvb.DvbLocator.	228

Annex B (normative):	Object carousel	230
B.1	Introduction.	230
B.1.1	Key to notation	230
B.2	Object Carousel Profile	230
B.2.1	DSM-CC Sections	230
B.2.1.1	Sections per TS packet.	231
B.2.2	Data Carousel	231
B.2.2.1	General.	231
B.2.2.2	DownloadInfoIndication	231
B.2.2.3	DownloadServerInitiate	231
B.2.2.4	ModuleInfo	232
B.2.2.4.1	Label descriptor	232
B.2.2.4.2	Caching priority descriptor	233
B.2.2.5	ServiceGatewayInfo.	234
B.2.2.6	Download Cancel.	234
B.2.3	The Object Carousel	235
B.2.3.1	BIOP Generic Object Message	235
B.2.3.2	CORBA strings	235
B.2.3.3	BIOP FileMessage	235
B.2.3.4	Content type descriptor	236
B.2.3.5	BIOP DirectoryMessage	237
B.2.3.6	BIOP ServiceGateway message.	239
B.2.3.7	BIOP Interoperable Object References	239
B.2.3.7.1	BIOPProfileBody	240
B.2.3.7.2	LiteOptionsProfileBody	241
B.2.3.8	BIOP StreamMessage	243
B.2.3.9	BIOP StreamEventMessage.	245
B.2.4	Stream Events	246

B.2.4.1	Stream & StreamEvent messages	246
B.2.4.1.1	Association with time bases	246
B.2.4.1.2	Event names and event ids	247
B.2.4.1.3	Stream event life time	247
B.2.4.2	Stream Descriptors	247
B.2.4.2.1	NPT Reference descriptor	247
B.2.4.2.2	Stream event descriptor	248
B.2.4.2.3	Unused descriptors	248
B.2.4.2.4	Clarification of number encoding	248
B.2.4.3	DSM-CC Sections carrying Stream Descriptors	249
B.2.4.3.1	Section version number	249
B.2.4.3.2	Single firing of "do it now" events	249
B.2.4.3.3	Section number	249
B.2.4.3.4	DSM-CC sections for DSMCC_descriptor_list()	249
B.2.4.3.5	Encoding of table id extension	249
B.2.4.4	Timebases	249
B.2.4.5	Monitoring stream events	250
B.2.4.5.1	NPT reference monitoring	250
B.2.4.5.2	Timebase stimulated event monitoring	250
B.2.4.5.3	"do it now" events	250
B.2.4.5.4	scheduled events	251
B.2.4.5.5	number of NPT components	251
B.2.5	Assignment and use of transactionId values	251
B.2.6	Mapping of objects to data carousel modules	252
B.2.7	Compression of modules	252
B.2.8	Mounting an Object Carousel	253
B.2.8.1	carousel_id_descriptor	254
B.2.8.2	DVB-J mounting of an object carousel	255
B.2.9	Unavailability of a carousel	255
B.3	AssociationTag Mapping	256
B.3.1	Decision algorithm for association tag mapping	256
B.3.1.1	TapUse is not BIOP_PROGRAM_USE	256
B.3.1.2	TapUse is BIOP_PROGRAM_USE	257
B.3.2	DSM-CC association_tags to DVB component_tags	257
B.3.3	deferred_association_tag_descriptor	257
B.4	Example of an Object Carousel (informative)	258
B.5	Caching	259
B.5.1	Determining file version	259
B.5.2	Transparency levels of caching	259
B.5.2.1	Transparent caching	259
B.5.2.1.1	Active caching	260
B.5.2.1.2	Passive caching	260
B.5.2.1.3	DII repetition rate	260
B.5.2.2	Semi-transparent caching	260
B.5.2.2.1	Implications for the terminal (informative)	260
B.5.2.3	Static caching	261
B.5.2.3.1	Implications for the broadcaster (informative)	261
B.5.2.3.2	Implications for the terminal (informative)	261
Annex C (informative):	References	262
Annex D (normative):	Text presentation	263
D.1	Scope	263
D.2	Fonts	263
D.2.1	Embedded fonts	263
D.2.2	Downloaded fonts	263
D.2.2.1	Font technology	263
D.2.2.2	Font index files	264
D.2.2.2.1	Format of file	264
D.2.2.2.2	Element semantics	264

D.2.2.2.3	Example	265
D.2.2.3	Name and location of font index files	265
D.2.2.3.1	General	265
D.2.2.3.2	Name of file	265
D.2.2.3.3	Location	265
D.2.2.4	Specification of fonts at run time	265
D.2.2.4.1	DVB-J	265
D.3	Text rendering	266
D.3.1	Philosophy	266
D.3.2	Low and high level rendering	266
D.3.2.1	Low level rendering	266
D.3.2.2	High level rendering	266
D.3.3	Font Definition	266
D.3.3.1	"Physical" font data	267
D.3.4	Converting font metrics to display pixels	267
D.3.4.1	Vertical resolution	268
D.3.4.2	Horizontal resolution	268
D.3.5	Rendering within limits	268
D.3.5.1	Vertical limits	269
D.3.5.2	Horizontal limits	270
D.3.6	"logical" text width rules	270
D.3.6.1	Computing "logical" text width	270
D.3.6.1.1	Font sizes	271
D.3.6.1.2	Character widths	271
D.3.6.1.3	Kerning	271
D.3.6.1.4	Tracking	271
D.3.6.2	Logical text width	271
D.3.7	Line breaking	272
D.3.7.1	Truncation of text	272
D.3.8	Tabulation	272
D.3.9	Placing runs of characters & words	273
D.3.10	Control of text flow	274
D.4	Text mark-up	274
D.4.1	White Space Characters	274
D.4.2	Marker characters	274
D.4.3	Non-printing characters	274
D.4.4	Format Control Mark-up	275
D.4.5	Future compatibility	275
Annex E (normative): Character set		276
E.1	Basic Euro Latin character set	276
Annex F (informative): Authoring & Implementation Guidelines		281
F.1	Authoring Guidelines	281
F.2	Implementation Guidelines	281
F.3	Authoring guidelines for DVB-J	281
Annex G (normative): Minimum Platform Capabilities		282
G.1	Graphics	282
G.1.1	Device capabilities	282
G.1.2	Video presentation capabilities	282
G.1.3	Image processing capabilities	283
G.1.4	Alpha capabilities	283
G.1.5	Colour capabilities	283
G.1.6	MPEG I frame and Video drips	284
G.2	Audio	284
G.3	Video	285
G.4	Resident fonts and text rendering	285
G.4.1	The built-in font	285
G.4.2	Presentation to DVB-J	285

G.4.3	Text directions	285
G.5	Input events	286
G.6	Memory	286
G.7	Other resources	287
Annex H (informative): Extensions		288
Annex I (normative): DVB-J fundamental classes		289
	org.dvb.lang	290
	DVBClassLoader	291
Annex J (normative): DVB-J event API		293
J.1	Overview	293
J.2	The resource management	294
J.3	The Event Repository	294
J.3.1	Example	294
	org.dvb.event	296
	EventManager	297
	OverallRepository	300
	RepositoryDescriptor	301
	UserEvent	302
	UserEventListener	305
	UserEventRepository	306
Annex K (normative): DVB-J persistent storage API		309
	org.dvb.io.persistent	310
	FileAccessPermissions	311
	FileAttributes	313
Annex L (normative): User Settings and Preferences API		316
	org.dvb.user	317
	Facility	318
	GeneralPreference	319
	Preference	320
	UnsupportedPreferenceException	323
	UserPreferenceChangeEvent	324
	UserPreferenceChangeListener	325
	UserPreferenceManager	326
	UserPreferencePermission	328
Annex M (normative): SI Access API		329
	org.dvb.si	330
	Descriptor	333
	DescriptorTag	335
	PMTElementaryStream	339
	PMTService	341
	PMTStreamType	343
	SIBouquet	344
	SIDatabase	348
	SIEvent	364
	SIException	368
	SIIllegalArgumentException	369
	SIInformation	370
	SIInvalidPeriodException	374
	SIIterator	375
	SILackOfResourcesEvent	376
	SIMonitoringEvent	377
	SIMonitoringListener	380
	SIMonitoringType	381
	SINetwork	382

SINotInCacheEvent	386
SIOBJECTNotInTableEvent	387
SIRequest	388
SIRequestCancelledEvent	389
SIRetrievalEvent	390
SIRetrievalListener	392
SIRunningStatus	393
SIService	394
SIServiceType	400
SISuccessfulRetrieveEvent	402
SITableNotFoundEvent	403
SITableUpdatedEvent	404
SITime	405
SITransportStream	406
SITransportStreamBAT	408
SITransportStreamDescription	409
SITransportStreamNIT	410
SIUtil	411
TextualServiceIdentifierQuery	412
Annex N (normative): Streamed Media API Extensions	413
org.dvb.media	414
ActiveFormatDescriptionChangedEvent	416
AspectRatioChangedEvent	417
BackgroundVideoPresentationControl	418
CAException	419
CAStopEvent	420
DFCChangedEvent	422
DripFeedDataSource	423
DripFeedPermission	426
NoComponentSelectedEvent	427
PresentationChangedEvent	429
ServiceRemovedEvent	431
StopByResourceLossEvent	433
SubtitleAvailableEvent	435
SubtitleListener	436
SubtitleNotAvailableEvent	437
SubtitleNotSelectedEvent	438
SubtitleSelectedEvent	439
SubtitlingEventControl	440
VideoFormatControl	441
VideoFormatEvent	446
VideoFormatListener	447
VideoPresentationControl	448
VideoTransformation	453
Annex O (normative): Integration of the JavaTV SI API and DVB SI	456
O.1 Introduction	456
O.2 Mapping of the JavaTV SI API to DVB SI	456
O.2.1 javax.tv.service.Service	456
O.2.1.1 getName	456
O.2.1.2 getServiceType	456
O.2.2 javax.tv.service.ServiceComponent	456
O.2.2.1 getComponentName	456
O.2.2.2 getAssociatedLanguage	456
O.2.2.3 getStreamType	456
O.2.3 javax.tv.service.ServiceType	457
O.2.4 javax.tv.service.StreamType	457
O.2.5 javax.tv.service.SIElement	457
O.2.5.1 getServiceInformationType	457

O.2.6	javax.tv.service.SIManager	458
O.2.6.1	getSupportedDimensions	458
O.2.6.2	getRatingDimension	458
O.2.6.3	retrieveSIElement	458
O.2.6.4	getTransports	458
O.2.6.5	filterServices	458
O.2.7	javax.tv.service.navigation.SIElementFilter	458
O.2.8	javax.tv.service.navigation.ServiceDetails	458
O.2.8.1	getLongName	458
O.2.8.2	getServiceType	458
O.2.8.3	retrieveServiceDescription	458
O.2.8.4	retrieveComponents	458
O.2.9	javax.tv.service.navigation.CAIdentification	459
O.2.9.1	getCASystemIds	459
O.2.9.2	isFree	459
O.2.10	javax.tv.service.navigation.RatingDimension	459
O.2.10.1	getDimensionName	459
O.2.10.2	getNumberOfLevels	459
O.2.10.3	getRatingLevelDescription	459
O.2.11	javax.tv.service.navigation.ServiceProviderInformation	459
O.2.11.1	getProviderName	459
O.2.12	javax.tv.service.transport.Transport	459
O.2.13	javax.tv.service.transport.Bouquet	459
O.2.13.1	getBouquetID	460
O.2.13.2	getName	460
O.2.13.3	getLocator	460
O.2.14	javax.tv.service.transport.Network	460
O.2.14.1	getNetworkID	460
O.2.14.2	getName	460
O.2.14.3	getLocator	460
O.2.15	javax.tv.service.transport.TransportStream	460
O.2.15.1	getTransportStreamID	460
O.2.15.2	getDescription	460
O.2.16	javax.tv.service.guide.ProgramEvent	460
O.2.16.1	getDuration	460
O.2.16.2	getStartTime	460
O.2.16.3	getEndTime	460
O.2.16.4	getName	461
O.2.16.5	retrieveDescription	461
O.2.16.6	getRating	461
O.2.17	javax.tv.service.guide.ContentRatingAdvisory	461
O.2.17.1	getDimensionNames	461
O.2.17.2	getRatingLevel	461
O.2.17.3	getRatingText	461
O.2.17.4	getDisplayText	461
O.3	Integration of the JavaTV SI API and the DVB SI API	462

Annex P (normative): Broadcast Transport Protocol Access 463

org.dvb.dsmcc	465
AsynchronousLoadingEvent	467
AsynchronousLoadingEventListener	468
DSMCCException	469
DSMCCObject	470
DSMCCStream	476
DSMCCStreamEvent	480
IllegalObjectTypeException	483
InsufficientResourcesException	484
InvalidAddressException	485
InvalidFormatEvent	486

InvalidFormatException	487
InvalidPathnameEvent	488
InvalidPathNameException	489
LoadingAbortedEvent	490
MPEGDeliveryErrorEvent	491
MPEGDeliveryException	492
NotEntitledEvent	493
NotEntitledException	494
NothingToAbortException	495
NotLoadedException	496
NPTDiscontinuityEvent	497
NPTListener	499
NPTPresentEvent	500
NPTRate	501
NPTRateChangeEvent	502
NPTRemovedEvent	503
NPTStatusEvent	504
ObjectChangeEvent	505
ObjectChangeListener	507
ServerDeliveryErrorEvent	508
ServerDeliveryException	509
ServiceDomain	510
ServiceXFRErrorEvent	514
ServiceXFRException	515
ServiceXFRReference	517
StreamEvent	519
StreamEventListener	521
SuccessEvent	522
UnknownEventException	523
Annex Q (normative): Datagram Socket Buffer Control	524
org.dvb.net	525
DatagramSocketBufferControl	526
Annex R (normative): DVB-J Return Channel Connection Management API	527
org.dvb.net.rc	528
ConnectionEstablishedEvent	529
ConnectionFailedEvent	530
ConnectionListener	531
ConnectionParameters	532
ConnectionRCEvent	534
ConnectionRCInterface	535
ConnectionTerminatedEvent	539
IncompleteTargetException	540
PermissionDeniedException	541
RCInterface	542
RCInterfaceManager	544
RCInterfaceReleasedEvent	546
RCInterfaceReservedEvent	547
RCPermission	548
Annex S (normative): Application Listing and Launching	550
org.dvb.application	551
AppAttributes	552
AppIcon	557
AppID	558
AppProxy	560
AppsControlPermission	564
AppsDatabase	566
AppsDatabaseEvent	570

AppsDatabaseEventListener	572
AppsDatabaseFilter	574
AppStateChangeEvent	575
AppStateChangeListener	577
CurrentServiceFilter	578
DVBHTMLProxy	579
DVBProxy	581
IllegalProfileParameterException	583
LanguageNotAvailableException	584
Annex T (normative): Permissions	585
org.dvb.net.ca	586
CAPermission	587
org.dvb.net.tuning	589
DvbNetworkInterfaceSIUtil	590
TunerPermission	591
Annex U (normative): Extended graphics APIs	592
org.dvb.ui	593
DVBAAlphaComposite	594
DVBBufferedImage	599
DVBColor	606
DVBGraphics	610
DVBRasterFormatException	614
DVBTextLayoutManager	615
FontFactory	622
FontFormatException	624
FontNotAvailableException	625
TestOpacity	626
TextOverflowListener	627
UnsupportedDrawingOperationException	628
Annex V (normative): HAVi Level 2 User Interface	629
V.1 Register of Constants	629
org.havi.ui	634
HActionable	639
HActionInputPreferred	643
HAdjustableLook	644
HAdjustmentInputPreferred	647
HAdjustmentValue	649
HAnimateEffect	653
HAnimateLook	657
HAnimation	662
HBackgroundConfigTemplate	669
HBackgroundConfiguration	672
HBackgroundDevice	674
HBackgroundImage	678
HChangeData	681
HComponent	682
HComponentOrdering	685
HConfigurationException	689
HContainer	691
HDefaultTextLayoutManager	698
HEmulatedGraphicsConfiguration	700
HEmulatedGraphicsDevice	702
HEventMulticaster	704
HFlatEffectMatte	716
HFlatMatte	721
HFontCapabilities	723
HGraphicButton	734

HGraphicLook	743
HGraphicsConfigTemplate	748
HGraphicsConfiguration	752
HGraphicsDevice	757
HIcon	761
HImageEffectMatte	767
HImageHints	772
HImageMatte	774
HInvalidLookException	776
HItemValue	777
HKeyboardInputPreferred	780
HListElement	783
HListGroup	785
HListGroupLook	800
HLook	806
HMatte	812
HMatteException	813
HMatteLayer	815
HMultilineEntry	816
HMultilineEntryLook	820
HNavigable	826
HNavigationInputPreferred	831
HNoInputPreferred	833
HOrientable	834
HPermissionDeniedException	836
HRange	838
HRangeLook	845
HRangeValue	850
HScene	859
HSceneFactory	872
HSceneTemplate	876
HScreen	880
HScreenConfigTemplate	885
HScreenConfiguration	891
HScreenDevice	893
HScreenDimension	897
HScreenPoint	899
HScreenRectangle	901
HSelectionInputPreferred	904
HSinglelineEntry	906
HSinglelineEntryLook	918
HSound	923
HState	926
HStaticAnimation	930
HStaticIcon	936
HStaticRange	939
HStaticText	945
HStillImageBackgroundConfiguration	949
HSwitchable	952
HText	955
HTextButton	962
HTextLayoutManager	971
HTextLook	974
HTextValue	979
HToggleButton	981
HToggleGroup	992
HUIException	996
HVersion	998
HVideoComponent	1000

HVideoConfigTemplate	1002
HVideoConfiguration	1005
HVideoDevice	1007
HVisible	1012
org.havi.ui.event	1033
HActionEvent	1035
HActionListener	1037
HAdjustmentEvent	1038
HAdjustmentListener	1041
HBackgroundImageEvent	1042
HBackgroundImageListener	1045
HEventRepresentation	1046
HFocusEvent	1052
HFocusListener	1055
HItemEvent	1056
HItemListener	1059
HKeyCapabilities	1060
HKeyEvent	1062
HKeyListener	1064
HMouseCapabilities	1065
HRcCapabilities	1066
HRcEvent	1068
HScreenConfigurationEvent	1077
HScreenConfigurationListener	1078
HScreenDeviceReleasedEvent	1079
HScreenDeviceReservedEvent	1080
HScreenLocationModifiedEvent	1081
HScreenLocationModifiedListener	1083
HTextEvent	1084
HTextListener	1088
Annex W (normative): DVB-J examples	1089
W.1 DVB-J Application lifecycle implementation example	1089
W.2 Example of exporting an object for inter-application communication	1090
Annex X (normative): Test support	1091
org.dvb.test	1092
DVCTest	1094
Annex Y (normative): Inter-application communication API	1100
org.dvb.io.ixc	1101
IxcRegistry	1102
Annex Z (informative): Services, Service Contexts and Applications in an MHP Environment	1105
Z.1 Introduction	1105
Z.2 Basic concepts	1105
Z.3 Presenting a service in MHP	1105
Z.3.1 Presenting the media components of a service	1105
Z.3.2 Presenting the application components of a service	1105
Z.4 Multiple service contexts in an MHP platform	1106
Z.5 How does the platform know which services are available?	1107
Index	1108
History	1153

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://www.etsi.org/legal/home.htm>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by the Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECTrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

European Broadcasting Union
CH-1218 GRAND SACONNEX (Geneva)
Switzerland
Tel: +41 22 717 21 11
Fax: +41 22 717 24 81

Founded in September 1993, the DVB Project is a market-led consortium of public and private sector organizations in the television industry. Its aim is to establish the framework for the introduction of MPEG-2 based digital television services. Now comprising over 200 organizations from more than 25 countries around the world, DVB fosters market-led systems, which meet the real needs, and economic circumstances, of the consumer electronics and the broadcast industry.

0 Introduction

0.1 Purpose

The DVB system already provides a comprehensive toolbox to enable interoperable digital video broadcasting systems based on MPEG-2 standards for various transmission media including satellite, cable, terrestrial and microwave. This toolbox also covers interactive services using different kinds of return channels and further supporting functionalities such as service information and many others.

The Multimedia Home Platform (MHP) adds a technical solution for the user terminal that enables the reception and presentation of applications in a vendor, author and broadcaster neutral framework. Here "neutral" includes scenarios that consider legacy infrastructure. Applications from various service providers will be interoperable with different MHP implementations in an horizontal market, where applications, networks, and MHP terminals can be made available by independent providers.

0.2 Application Areas

At the beginning the following application areas are considered - Enhanced Broadcasting, Interactive Broadcasting and Internet Access. Enhanced Broadcasting combines digital broadcast of audio/video services with downloaded applications which can enable local interactivity. It does not need an interaction channel. The application area Interactive Broadcasting enables a range of interactive services associated or independent from broadcast services. This application area requires an interaction channel. The application area of Internet Access is intended for the provisioning of Internet services. It also includes links between those Internet services and broadcast services.

0.3 Profiles

As not all MHP implementations will be able to support all application areas and as there is a further evolution expected over time, different profiles of the MHP are considered. For the first release of the MHP specification, profiles are mapped to the above mentioned application areas.

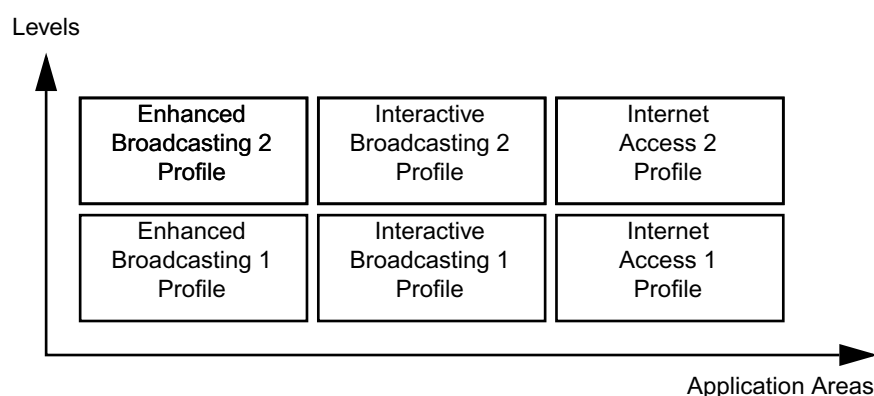


Figure 1 : Application areas and levels of profiles

Fig. 1 shows six example profiles, derived from two levels for each of the three application areas. The specific definition of the profiles and the particular backward and cross compatibility between profiles is provided in the detailed profile definition chapter of the MHP specification. The following initial definitions apply: <profile><n+1> shall be a strict superset of <profile><n>, and Interactive Broadcasting Profile 1 is defined as a strict superset of Enhanced Broadcasting Profile 1. Other dependencies are left to the detailed definition of future profiles.

1 Scope

The present document defines the DVB solution for Multimedia Home Platforms (MHPs) that was developed to fulfil the related DVB commercial requirements [MHP045 \[A\]](#). It relies on the use of appropriate DVB specifications for digital video broadcast and associated interactive services [TR 101 200 \[47\]](#). The MHP is applicable to all DVB defined transmission media and networks such as satellite, cable, terrestrial, microwave.

The final DVB MHP solution is intended to cover the whole range of implementations including Integrated Receiver Decoders (IRDs), integrated TV sets, multimedia computers and local clusters of such devices connected via In-Home Digital Networks (IHDN). This first release focuses on single MHP terminals and does not include such local clusters. Chapters 1-14 specify the applicable technologies and technical definitions in a generic way. Chapter 15 provides detailed profile definitions for the initial profiles Enhanced Broadcasting 1, Interactive Broadcasting 1 and Internet Access 1, which can be extended with future additional profile definitions.

This specification is firstly intended for implementers of MHPs on various hardware and software platforms. Secondly it is intended for developers of applications that use the MHP functionality and APIs.

The MHP specification aims to ensure interoperability between MHP applications and different MHP implementations. Implementers should consult the publisher of this specification regarding conformance.

NOTE: This specification defines the interfaces visible to applications. Application developers should not assume that other related interfaces are available unless they are specifically listed.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Some known errata in these references are identified in [A, "\(normative\): External references; errata, clarifications and exemptions" on page 214](#). These errata take precedence over the published reference.

The following comments apply to particular sources of documents:

[1]	Where the reference is to an ISO specifications it is considered to be a "non-specific" reference additionally officially published amendments and corrigenda are considered to automatically update the referenced document.
[2]	Where an ISBN number is provided for a referenced document it is considered to be "specific reference".
[3]	References to RFCs are considered to be "specific references". An RFC being indicated obsoleted by another RFC is not considered significant.
[4]	URL references with note [4] are provided for convenience to access the document in electronic form.
[5]	URL references with note [5] are the normative method to access the reference

[6]	ETSI specifications are available from the ETSI server at: http://www.etsi.org . However, the ETSI server provides the current edition of the specification and in every case this specification makes "specific" references which in the future may not be the current reference.
[7]	The Sun Specifications for DVB are available from: http://java.sun.com/products/specformhp/ or on CD-ROM (ISBN 1-892488-25-6) published by: Sun Microsystems MS USCA14-103 Palo Alto CA 94303 USA e-mail: docs@java.sun.com Phone: +1 408 276-7426

	Reference	Edition	Description	Note
[1]	CIE 15	2nd Edition, 1986 ISBN 3 900 734 00 3	Colorimetry, CIE, Vienna	[2]
[2]	CORBA/IIOP	2.1	The Common Object Request Broker: Architecture and Specification, Object Management Group. ftp://ftp.omg.org/pub/docs/formal/97-09-01.pdf	[5]
[3]	DAVIC 1.4.1p9	June 1999	DAVIC 1.4.1 Specification Part 9, Complete DAVIC Specifications, DAVIC. http://www.davic.org	[5]
[4]	EN 300 468	1.3.1	Digital broadcasting systems for television, sound and data services; Specification for Service Information (SI) in Digital Video Broadcasting (DVB) systems	[6]
[5]	EN 301 192	1.2.1	Specification for Data Broadcast	[6]
[6]	EN 301 193	1.1.1	DVB Interaction Channel through DECT	[6]
[7]	EN 301 195	1.1.1	DVB Interaction Channel through GSM	[6]
[8]	EN 301 199	1.2.1	DVB Interaction channel for LMDS distribution systems	[6]
[9]	TR 101 154	1.4.1	DVB Implementation Guidelines for the use of MPEG-2 Systems, Video and Audio in Satellite, Cable and Terrestrial Broadcasting Applications.	[6]
[10]	ETR 162		Digital broadcasting systems for television, sound and data services; Allocation of Service Information (SI) codes for Digital Video Broadcasting (DVB) systems	[6]
[11]	ETR 211	2	Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)	[6]
[12]	EN 300 472	1.2.2	DVB Specification for conveying ITU-R System B Teletext in DVB bitstreams.	[6]
[13]	EN 300 743	1	Digital Video Broadcasting (DVB), DVB subtitling	[6]
[14]	ETS 300 800	1	DVB Interaction Channel for Cable TV distribution systems	[6]
[15]	ETS 300 801	1	DVB Interaction Channel through PSTN/ISDN	[6]
[16]	ETS 300 802	1	Network Independent Protocols for Interactive Services	[6]
[17]	GIF 89a		GRAPHICS INTERCHANGE FORMAT(sm) Version 89a, (c)1987, 1988, 1989, 1990 Copyright CompuServe Incorporated Columbus, Ohio http://www.w3.org/Graphics/GIF/spec-gif89a.txt	

Reference	Edition	Description	Note	
[18]	ISO 10646-1	Information technology - Universal multiple-octet coded character set (UCS), part 1: Architecture and Basic Multilingual Plane" (also known as Unicode, UTF)	[1]	
[19]	ISO 639.2	Code for the representation of names of languages	[1]	
[20]	ISO 8859	Information processing - 8-bit single-byte coded graphic character sets, Latin alphabets	[1]	
[21]	ISO/IEC 10918-1	Digital compression encoding of continuous-tone still images (JPEG). http://www.w3.org/Graphics/JPEG/itu-t81.pdf	[1] [4]	
[22]	ISO/IEC 11172-3	1993	Information technology—Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s—Part 3: Audio (Note: known as MPEG-1 Audio)	[1]
[23]	ISO/IEC 13818-1	1996	Information technology - Generic coding of moving pictures and associated audio information: Systems.	[1]
[24]	ISO/IEC 13818-2	1996	Information technology—Generic coding of moving pictures and associated audio information—Part 2: Video (MPEG-2 Video)	[1]
[25]	ISO/IEC 13818-3	2 nd Ed. 1998	Information technology - Generic coding of moving pictures and associated audio - Part 3, MPEG-2 Audio.	[1]
[26]	ISO/IEC 13818-6	1998	Information technology -Generic coding of moving pictures and associated audio information: Extensions for Digital Storage Media Command and Control.	[1]
[27]	IEC 61966-2-1	1	Multimedia systems and equipment - Colour measurement and management - Part 2-1: Colour management - Default RGB colour space - sRGB	
[28]	ITU-R BT.470	6	Conventional television systems	
[29]	ITU-R BT.601	5	Studio Encoding Parameters of Digital Television for standard 4:3 and Wide-Screen 16:9 aspect ratios	
[30]	ITU-R BT.709	3	Parameter values for the HDTV standards for production and international programme exchange	
[31]	JAE 1.1.8 API	Part of ISBN:1-892488-25-6	Java Platform 1.1 API Specification	[7]
[32]	Java Language Spec	ISBN 0-201-63451-1	The Java Language Specification by James Gosling, Bill Joy and Guy Steele. ftp://ftp.javasoft.com/docs/specs/langspec-1.0.pdf including the clarifications at: http://java.sun.com/docs/books/jls/clarify.html	[2] [4]
[33]	Java Media Player Specification	Part of ISBN:1-892488-25-6	Java Media Framework API Version 1.0 specification	[7]
[34]	Java VM	ISBN: 0-201-63452-X	The Java Virtual Machine Specification, T. Lindholm and F. Yellin, Addison-Wesley.	[2]
[35]	JFIF		JPEG File Interchange Format, Eric Hamilton, C-Cube Microsystems. http://www.w3.org/Graphics/JPEG/jfif3.pdf	[5]
[36]	PersonalJAE	Part of ISBN:1-892488-25-6	The OEM PersonalJava Application Environment Version 1.2a specification	[7]
[37]	PNG	V1 01-Oct-96	Portable Network Graphics. Available at http://www.w3.org/TR/REC-png.html	[5]

	Reference	Edition	Description	Note
[38]	RFC 1321	April 1992	The MD5 Message-Digest Algorithm	[3]
[39]	RFC 1990	August 1996	(MP) "The PPP Multilink Protocol", K. Sklower, B. Lloyd, G. McGregor, D. Carr, T. Coradetti.	[3]
[40]	RFC 2616	June 1999	IETF Hypertext Transfer Protocol -- HTTP/1.1	[3]
[41]	RFC 2396	August 1998	IETF Uniform Resource Identifiers (URI): Generic Syntax	[3]
[42]	RFC 768	28.08.1980	(UDP) "User Datagram Protocol", J. Postel.	[3]
[43]	RFC 791	01.09.1981	(IP) "Internet Protocol", J. Postel.	[3]
[44]	RFC 793	01.09.1981	(TCP) "Transmission Control Protocol", J. Postel.	[3]
[45]	RFC 1112	August 1989	IETF Host extensions for IP multicasting.	[3]
[46]	TR 101 194	1.1.1	Guidelines for the use of ETS 300 802	
[47]	TR 101 200	1.1.1	"Digital Video Broadcasting (DVB); Guideline for the use of DVB specifications and standards".	
[48]	TR 101 201	1.1.1	DVB Interaction channel for SMATV systems	
[49]	TR 101 202	1.1.1	Guidelines for the use of EN 301 192	
[50]	HAVi		See annex V, "(normative): HAVi Level 2 User Interface" on page 629.	
[51]	Java TV	Part of ISBN:1-892488-25-6	Java TV API Version 1.0 specification	[7]
[52]	Hunt, R.W.G.	1987	Measuring Colour, Ellis Horwood Series in Applied Science and Industrial Technology. Ellis Harwood Limited, Chichester, England.	
[53]	ITU-T X.501	1993	ITU-T Recommendation X.501: Information Technology - Open Systems Interconnection - The Directory: Models, 1993.	
[54]	ITU-T X.509	08/97	Information technology - Open Systems Interconnection - The Directory: Authentication framework	
[55]	ITU-T X.520	11/93	Information Technology Open Systems Interconnection The Directory: Selected Attribute Types	
[56]	RFC 2313	March 98	PKCS #1: RSA Encryption Version 1.5	[3]
[57]	ASN.1	07/94	ITU-T X.680 "Information Technology Abstract Syntax Notation One (ASN.1): Specification Of Basic Notation" and ITU-T X.690 "Information Technology ASN.1 Encoding Rules: Specification Of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) And Distinguished Encoding Rules (DER)"	
[58]	RFC 2459	January 1999	Internet X.509 Public Key Infrastructure. Certificate and CRL Profile.	[3]
[59]	POSIX	ISBN:1-55937-255-9	IEEE Standard for Information Technology - Portable Operating System Interface (POSIX) - Part 2: Shell and Utilities (Vol. 1); IEEE Std 1003.2-1992; The Institute of Electrical and Electronics Engineers; New York; 1993.	
[60]	JSSE	Part of ISBN:1-892488-25-6	Java Secure Sockets Extension API Specification Version 1.0.2	[7]
[61]	ETS 300 706	Edition 1 - 1997-05	Enhanced Teletext Specification	[6]

Reference	Edition	Description	Note
[62]	FIPS-180-1 April 1995	NIST, FIPS PUB 180-1: Secure Hash Standard http://csrc.nist.gov/fips/fip180-1.txt	[4]
[63]	RFC 2246 January 1999	The TLS Protocol, Version 1.0	[3]
[64]	RFC 2045 November 1996	Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies	[3]
[65]	XML 1.0 Second Edition	Extensible Markup Language (XML) 1.0 http://www.w3.org/TR/2000/REC-xml-20001006	
[66]	ISO 639.2	Codes for the representation of names of languages – Part 2: Alpha-3 code.	
[67]	RFC 1738 December 1994	Uniform Resource Locators (URL)	
[68]	JVM Errata Part of ISBN:1-892488-25-6	Errata for the Java Virtual Machine Specification	[7]
[69]	Inner Classes Part of ISBN:1-892488-25-6	Inner Classes Specification	[7]
[70]	EN 50221	Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications	
[71]	TS 101 699 1.1.1	Digital Video Broadcasting (DVB); Extensions to the Common Interface Specification	
[72]	JAE 1.1.8 const Part of ISBN:1-892488-25-6	JAE 1.1.8 API Constants	[7]
[73]	JAE 1.2.2 const Part of ISBN:1-892488-25-6	JAE 1.2.2 API Constants	[7]
[74]	JMF const Part of ISBN:1-892488-25-6	Java Media Framework API Version 1.0 Constants	[7]
[75]	RFC 1950 May 1996	ZLIB Compressed Data Format Specification version 3.3	
[76]	RFC 1951 May 1996	DEFLATE Compressed Data Format Specification version 1.3	
[77]	XHTML™ 1.0: The Extensible HyperText Markup Language	http://www.w3.org/TR/xhtml1	

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

API: Application Program Interface. An interface between an application and a particular feature, function or resource of the MHP.

application: A functional implementation realised as software running in one or spread over several interplaying hardware entities.

application boundary: A concise general description of the data elements (HTML documents, code files, images etc.) used to form one application and the logical locator of the entry point, the application boundary is described by a regular expression over the URL language. Where no such boundary is drawn, the default boundary shall be the entire set of documents that the MHP platform can access.

application manager: The Application Manager is the entity in the MHP that is responsible for managing the lifecycle of the applications in the MHP. It manages both the DVB-J applications and non-DVB-J applications.

autostart applications: This terms has different definitions depending on the application format:

A DVB-J autostart application is an application that is automatically loaded and executed by the Application Manager as soon as the user selects a service on which the application is signalled as autostart.

Auto start application a DVB-HTML application in a broadcast stream can be signalled as auto start in the same way that other DVB applications can, but note that it may not actually start providing service until it receives a start trigger.

character: A specific "letter" or other identifiable symbol, e.g. "A".

character encoding: A character encoding is a mapping between an integer input value, and the textual character that is represented by this mapping, e.g. in ASCII value 65 (decimal) is character "A", or shift-JIS for Japanese characters.

character set: See character encoding.

communications network: A system of interconnected entities providing data interchange between points or from a point to multiple points.

domain of an application: The domain of an Xlet characterizes the "space" within which the Xlet is able to execute. This includes both the "connection" where the Xlet is delivered and other "connections" where an already executing Xlet is allowed to continue executing.

An application cannot run outside its domain. The maximum lifetime of an application extends from the moment the user navigates to its domain until the moment that the user navigates away from its domain.

In the broadcast case a "connection" corresponds to a DVB-service. Broadcast signalling indicates which services can load an application and which services allow an already active application to continue.

DVB network: A collection of MPEG-2 Transport Stream multiplexes transmitted on a single delivery system, e.g. all digital channels on a specific cable system.

DVB-HTML actor: A DVB-HTML actor is defined as the locus of activity or process involved in running the specific set of DVB-HTML documents for some DVB-HTML application, plus any instantiated context for that data. The actor runs inside a user agent (native, plug-in or downloaded). The nature of the process is not defined explicitly as it depends on the nature of the user agent itself. More than one such locus of activity may be present in any given user agent.

DVB-HTML application: A DVB-HTML application is defined as a set of documents selected from the DVB-HTML family of elements and content formats as defined in the specification. The extent of the set is described by the application boundary.

DVB-HTML application states: DVB-HTML application states are logical states that a DVB-HTML actor can be in, (as opposed to states the user agent may be in), these states may have instance data logically associated with them (e.g. the application id and entry point).

DVB-HTML document: A complete unit of one the HTML family of elements or content formats defined in this specification.

DVB-J: The Java platform defined as part of the MHP specification.

DVB-J API: One of the Java APIs standardised as part of the MHP specification.

DVB-J application: A DVB-J Application is a set of DVB-J classes that operate together and need to be signalled as a single instance to the Application Manager so that it is aware of its existence and can control its lifetime through a lifecycle interface.

events: Asynchronous communication between applications and the MHP on which they are being executed. They provide communication between solution elements.

font: A font is a mechanism that allows the specific rendering of a particular character to be specified – e.g. Tiresias, 12 point. In practice a font file format will incorporate some aspects of a character encoding.

function: A function is a process which conveys or transforms data in a predictable way. It may be effected by hardware, software or a combination of the two.

hardware entity: Is an independent piece of hardware which forms part of a (multiple) local cluster of elements which as a whole is called MHP. A hardware entity is for example: a Set top box, a digital VCR or a conditional access module. A hardware entity includes a number of resources. Each resource provides a number of functions.

interoperability: The reception and presentation of applications in a vendor, author and broadcaster neutral framework (From MHP45r12).

java API: Is a standard interface for use by platform independent application software. It is expressed in the Java language.

lifetime of an application: The lifetime of an application characterizes the time from which the application is Loaded to the time the application is Destroyed.

locator: This term has different definitions depending on the application format:

A DVB-HTML locator is a link, expressed in the syntax in [RFC 2396 \[41\]](#), which provides an unambiguous pointer to a DVB-HTML document accessible to the MHP in a specific transport stream. The scheme specified should resolve to one of the available transports signalled for the DVB-HTML application. For signed DVB-HTML applications the schemes http and https (ftp, others?) may use the return channel. This version of the specification does not include a scheme for transport independent locators, future versions are expected to do so.

This term in the DVB-HTML context should not be confused with the DVB-J class of the same name.

MHP: The Multimedia Home Platform (MHP) consists of an MHP viewer terminal, including all possible low to high functionality implementations, its associated peripherals and the in-home digital network.

MHP connected resource: A resource used as part of the MHP which, on its own, is not conformant to the specification but which is connected to an MHP Terminal in such a way that the whole is part of the MHP.

MHP solution: The MHP solution encompasses the whole set of technologies necessary to implement the MHP including protocols and APIs.

MHP terminal: A single piece of physical equipment conforming to the MHP specification, in particular in that it contains a Virtual Machine and an instance of the MHP API.

navigator: A resident application, typically provided by the manufacturer, which the end-user can activate at any time. The navigator can be used to select services, applications, and initiate Interoperable applications.

object carousel: A repetitively broadcast file system.

OID: X.509 Object Identifier.

persistent storage: Memory available in the MHP which can be read/written to by an application and which may outlive the application's own life.

Persistent storage may be volatile or non-volatile.

plug-in: A set of functionality which can be added to a generic platform in order to provide interpretation of DVB registered, but non-DVB-J, application formats; e.g. HTML3.2 or MHEG-5.

plug-in application: An application that conforms to an application format for which a plug-in has been registered with DVB and which is only interoperable within terminals which have the appropriate plug-in resident or connected to networks where an appropriate Plug-In is being broadcast.

profile: A description of a series of minimum configurations, defined as part of the specification, providing different capabilities of the MHP. It maps a set of functions which characterise the scope of service options. The number of profiles is small. The mapping of functions into resources and subsequently into hardware entities is out of the scope of the specification and is left to manufacturers.

regular expression: A method of capturing a large, possibly infinite set of strings in a compact representation.

resident application: An application available from non-volatile storage in an MHP device which may be expressed in DVB-J but need not be so. Its delivery route is not specified.

resource: Is a well defined capability or asset of a system entity, which can be used to contribute to the realisation of a service. Examples: MPEG decoder, Graphics system.

return channel: The communications mechanism which provides connection between the MHP and a remote server.

sandbox: Unsigned applications and signed applications without a permission file have access to all the APIs for which there is no permission signalling defined. This is commonly called the sandbox.

service: A sequence of programs under the control of a broadcaster which can be broadcast as part of a schedule.

service component: A part of a service. For a DVB service, service components are normally the MPEG elementary streams listed in the PMT for the service. Where multiple streams of subtitles or MPEG-2 audio representing different languages are carried in the same MPEG elementary stream these are logically service components but are not exposed through the MHP APIs as being distinct and separate.

stream: A unidirectional continuous flow of content. Example: MPEG2 video.

system software: Software implementation below the API for a specific platform entirely under control of the manufacturer.

trigger: A trigger is an event that may cause a change in the behaviour of a DVB-HTML application that registers interest in such events. Triggers may come from many sources e.g. the broadcast stream, or may be generated from other data (such as the system clock), or may be generated as a result of user interaction. The trigger may include a reference to time, which may be absolute (UTC), relative to some other event, relative to the NPT of a media stream. It also can carry some semantically significant payload in order to affect changes in an application based on information not available at the time an application was written.

tuning: the act of switching between two MPEG transport streams or multiplexes. Switching between two DVB services carried in the same transport stream is not tuning.

viewer: End-user of the MHP terminal.

xlet: Interface used for DVB-J application life cycle control.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

API	Application Programming Interface
AV	Audio Video
AWT	Abstract Windowing Toolkit
CA	Conditional Access
CI	Common Interface
CLUT	Colour Lookup Table
DAVIC	Digital Audio Visual Council
DCT	Discrete Cosine Transformation
DECT	Digital Enhanced Cordless Telecommunications
DOM	Document Object Model
DSM-CC	Digital Storage Media - Command and Control
DSM-CC-OC	Digital Storage Media - Command and Control Object Carousel
DSM-CC-UU	Digital Storage Media - Command and Control User to User
DVB	Digital Video Broadcasting
ECMA	European Computer Manufacturers Association
EPG	Electronic Program Guide
ETSI	European Telecommunications Standards Institute
GIF	Graphics Interchange Format
GSM	Global System for Mobile communications
GUI	Graphical User Interface
HTML	Hyper Text Mark-up Language
HTTP	Hyper Text Transport Protocol
I/O	Input / Output
IHDN	In Home Digital Network
IP	Internet Protocol
IPR	Intellectual Property Rights
IRD	Integrated Receiver Decoder
ISDN	Integrated Services Digital Network
ISO	International Standardisation Organisation
ITU	International Telecommunication Union
JDK	Java Development Kit
JFIF	JPEG File Interchange Format
JMF	Java Media Framework
JPEG	Joint Picture Expert Group
LMDS	Local Multipoint Distribution System
MHEG	Multimedia Hypermedia Expert Group
MHP	Multimedia Home Platform
MMDS	Multipoint Microwave Distribution System
MPEG	Moving Picture Expert Group
OC	Object Carousel
OS	Operating System

OSD	On Screen Display
PFR	Portable Font Resource
PMT	Program Map Table
PNG	Portable Network Graphics
PSI	Program Specific Information
PSTN	Public Switched Telephone Network
RAM	Random Access Memory
ROM	Read Only Memory
SI	Service Information
SMATV	Satellite Master-Antenna Television
TCP	Transmission Control Protocol
TS	Transport Stream
UCS	Universal Multiple-Octet Coded Character Set
UDP	User Datagram Protocol
UI	User Interface
URL	Uniform Resource Locator
UTF	UCS Transformation Coding
UU	User to User
VM	Virtual Machine
WAN	Wide Area Network

4 Conventions

Void

5 Basic Architecture

5.1 Context

At its simplest level, the MHP is set in the following context (see figure 2). The software of the MHP has access to flows of streams and data, and may write some data to storage. The platform may be able to route streams and data outwards to a sink or store.

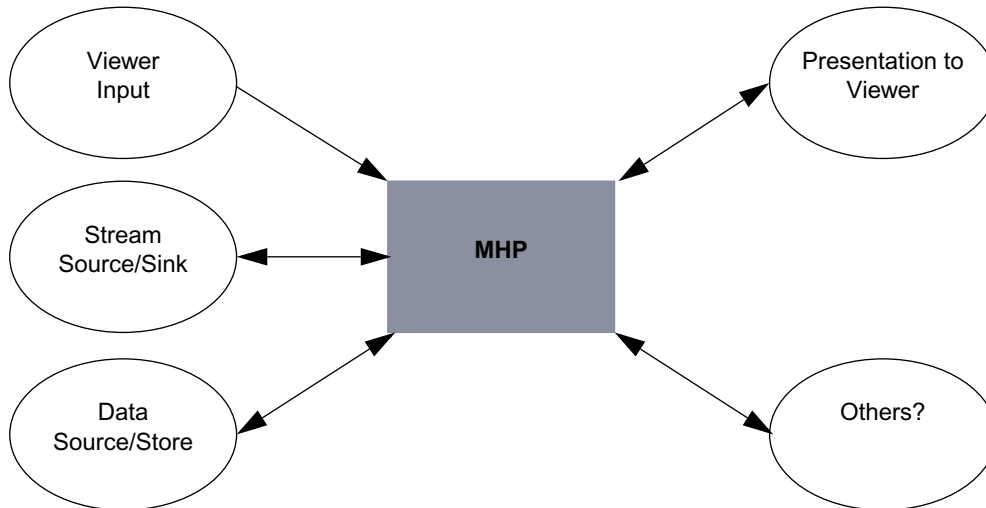


Figure 2 : MHP context

The platform will receive inputs from Viewer input devices and output communications through a screen or other outputs like loudspeakers to present to the viewer. The platform may have access to communications with remote entities.

The diagram in figure 3 shows a possible set of external interfaces between an MHP and the outside world. This is one example only but it serves to illustrate a series of principles.

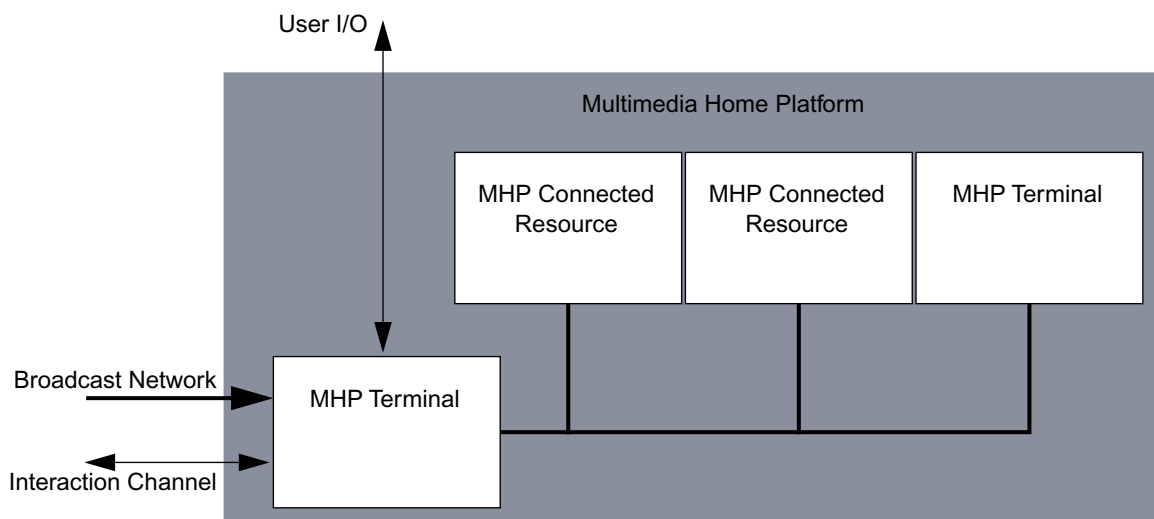


Figure 3 : External interfaces between an MHP and the outside world

The resources of the MHP, accessible by an application, may be contained in a series of different but connected physical entities.

The local cluster may connect a number of MHP terminals and resources

A cluster may also include resources which are not part of the MHP infrastructure and are not available to the application.

The local cluster is understood to be consistent with the DVB IHDN specification. The detailed description of the MHP in the local cluster is not in the first version of the specification.

5.2 Architecture

The Architecture describes how the MHP software elements are organized.

The MHP model considers 3 layers (figure 4):

- Resources
- System software
- Applications

The API lies between the Applications and the System Software seen from the perspective of an application.

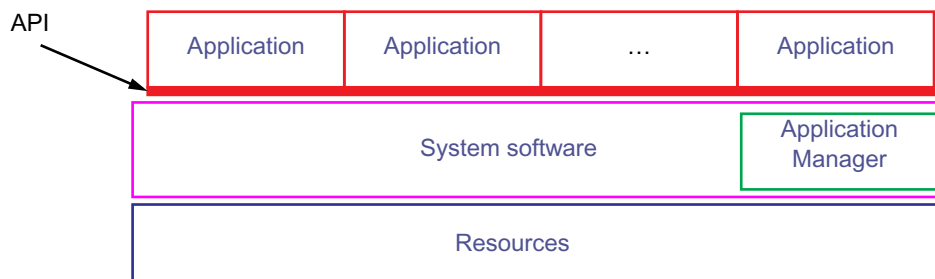


Figure 4 : Basic architecture

5.2.1 Resources

The hardware entities in the platform include a number of functions. They are represented by hardware or software resources. There is no assumption about how they are grouped. The model considers that there can be more than one hardware entity in the total Platform.

From an abstract point of view it makes no difference if the logical resources are mapped into one or several hardware entities. What is important is that resources are provided to the MHP transparently. An application should be able to access all locally connected resources as if they were elements of a single entity.

5.2.2 System software

Applications will not directly address resources. The system software brings an abstract view of such resources. This middle layer isolates the application from the hardware, enabling portability of the application.

The implementations of the Resources and System software are not specified in this document.

5.2.2.1 Application Manager

The system software includes an application management function, which is responsible for managing the lifecycle of all applications, including Interoperable ones.

5.2.3 Application

Applications implement interactive services as software running in one or more hardware entities. The interface for MHP applications is a top view from application to the system software.

Figure 4 on page 37 illustrates an idealised architecture model of the processes which will occur in an MHP. A hierarchy of control is assumed in which each layer controls the processes in adjacent layers. The top layer is responsible for the control of the operation via interactive applications. The Application Manager is part of the System Software and as such is implementation specific. It interacts with all applications.

The System Software implements the API by presenting an abstract model of:

- Streams played from different sources and pipes for conducting them.
- Commands and events
- Data records or files
- The hardware resources

The API provides the associated services to applications.

In fact there are many APIs which implement distinct services and interfaces. These are described in detail in the specification, either by reference to external documents, or by detailed specification.

The specification describes the interfaces between the network, the application and the system software of the MHP terminal. The implementation of any of these three is not specified in this document.

5.3 Interfaces Between an MHP Application and the MHP System

Application(s) use the API to access the actual resources of the receiver, including: databases, streamed media decoders, static content decoders and communications. These resources are functional entities of the receiver and may be finally mapped onto the hardware of the receiver in some manner.

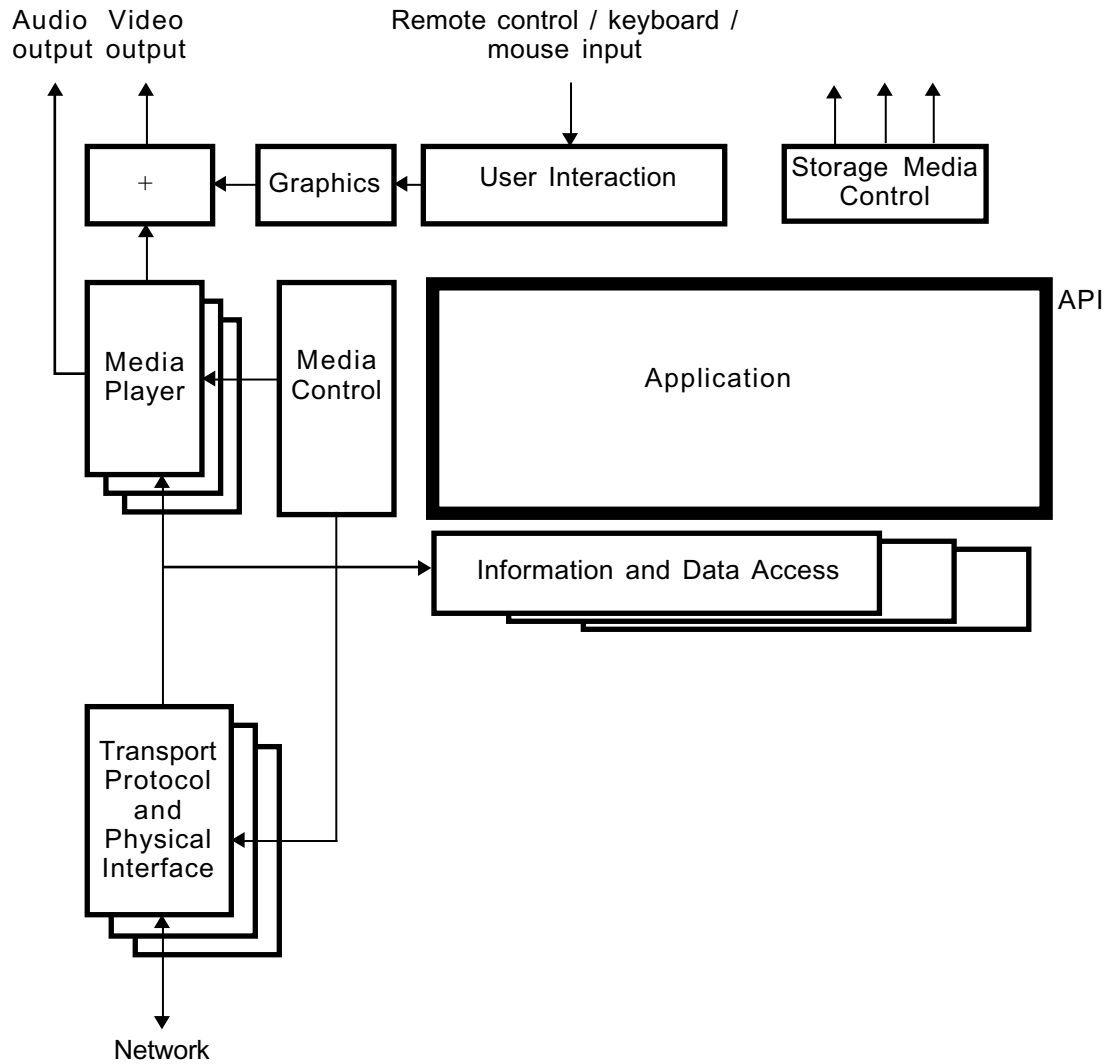


Figure 5 : Interfaces between an MHP application and the MHP system

Figure 7 illustrates the position of two types of Plug-in in the MHP.

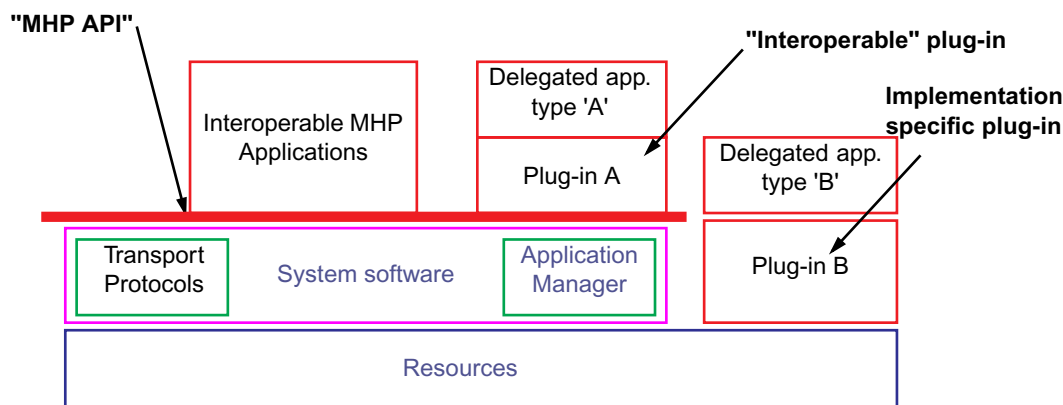


Figure 7 : Illustrative plug-in implementation options

There are two possible types of Plug-in implementation:

- Using implementation-specific code (e.g. in native code, or using implementation-specific Java APIs). This is called an implementation-specific plug-in, illustrated as plug-in "B" in the figure.
- An MHP application. This is called an interoperable plug-in, illustrated as plug-in "A" in the figure.

The internal specification of both plug-ins ("A" and "B") is outside of the scope of this specification. They are illustrated to show their relationship to the platform.

5.4.1 Security Model

Plug-ins must have sufficient access to the resources in the platform to implement the specification concerned. An implementation-specific plug-in may have access to many of the resources of the platform irrespective of the MHP security model. All plug-ins are responsible for managing the security of the applications they execute.

If a plug-ins needs privileged access to resources not available to all downloaded applications (i.e. not in the "sand box") in order to provide equivalent function to the "legacy" supported they will require the appropriate authentication.

6 Transport Protocols

6.1 Introduction

In order to be able to talk to the external world, the MHP has to be able to communicate through different network types. This part of the MHP specification deals with the Network Independent Protocols and on the networks as defined in two specifications from the DVB project, as specified in [ETS 300 802 \[16\]](#) and [EN 301 192 \[5\]](#).

The protocols defined in these standards provide a generic solution for a variety of broadcast only and interactive services, through the use of DSM-CC User-to-User, Data and Object Carousel protocols, as specified in [ISO/IEC 13818-6 \[26\]](#) and support for IP over the interaction channel as well as over the broadcast channel through the Multiprotocol Encapsulation [EN 301 192 \[5\]](#).

Broadcast only services are provided on systems consisting of a downstream channel from the Service Providers to Service consumers.

Interactive services are provided on systems consisting of a downstream channel together with interaction channels.

There are many possible network configurations covering the currently specified DVB broadcast options including satellite, terrestrial, cable, SMATV and MMDS in conjunction with PSTN, ISDN, cable and other interactive channel options.

The network dependent protocols for the interaction channels in the DVB context are specified in [ETS 300 800 \[14\]](#), [ETS 300 801 \[15\]](#), [EN 301 193 \[6\]](#), [EN 301 195 \[7\]](#), [EN 301 199 \[8\]](#), [TR 101 201 \[48\]](#) respectively for CATV, PSTN/ISDN, DECT, GSM, LMDS and SMATV networks. The network dependent protocols work together with the Network Independent Protocols.

6.2 Broadcast Channel Protocols

This section deals with the DVB defined or referenced broadcast channel protocols. This chapter does not consider other protocols and the APIs that would provide access to them.

Other protocols and their APIs are considered as extensions to the DVB MHP platform, see [H, "\(informative\): Extensions" on page 288](#).

Figure 8 illustrates the set of DVB defined broadcast protocols that are accessible by MHP applications in some or all profiles (see 15, "Detailed platform profile definitions" on page 206). The full details of the APIs that provide access to these broadcast protocols are in chapter 11, "DVB-J Platform" on page 98.

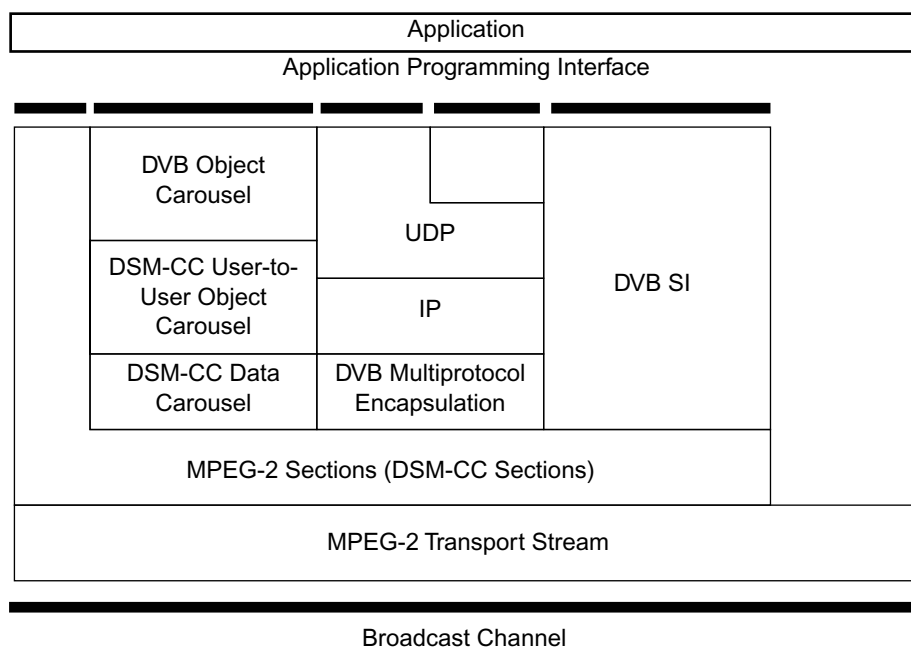


Figure 8 : Broadcast Channel Protocol Stack

6.2.1 MPEG-2 Transport Stream

MPEG-2 Transport Stream is defined in [ISO/IEC 13818-1 \[23\]](#).

6.2.2 MPEG-2 Sections

MPEG-2 private sections as defined in [ISO/IEC 13818-1 \[23\]](#) is [3] is based on the MPEG-2 Transport Stream protocol in 6.2.1.

6.2.3 DSM-CC Private Data

DSM-CC Private Data protocol as defined in [ISO/IEC 13818-6 \[26\]](#).

6.2.4 DSM-CC Data Carousel

DSM-CC Data Carousel as defined in [ISO/IEC 13818-6 \[26\]](#).

6.2.5 DSM-CC User-to-User Object Carousel

DSM-CC User-to-User Object Carousel protocols as defined in [ISO/IEC 13818-6 \[26\]](#) with the restrictions and extensions as defined in [EN 301 192 \[5\]](#), [TR 101 202 \[49\]](#) and annex B, "(normative): Object carousel" on page 230.

6.2.5.1 DVB-J class files

Java bytecode for each Java class is carried as the content bytes of the `BIOP::FileMessage` corresponding exactly to the contents of a "class" file as specified in [Java VM \[34\]](#).

6.2.5.2 DVB-HTML document files

The set of documents defining a DVB-HTML application is transported with the content bytes of `BIOP::FileMessage` messages corresponding exactly to the contents of the documents (i.e. the `BIOP::FileMessage` doesn't include any HTTP headers, etc.).

6.2.5.3 Loss of Carousel Behaviour

Under some conditions, carousels may be lost from the visibility of an application. These conditions are defined in:

- [B.2.9, "Unavailability of a carousel" on page 255](#)
- [9.1.5, "Persistence of Applications Across Service Boundaries" on page 56](#)

When this happens, implementations may continue to provide data from carousels which have been lost where they have that data cached. The extent of this is clearly implementation dependent. It is also implementation dependent how this changes with time. Clearly if data from the lost file system is flushed from a cache, it cannot be replaced. Lost carousels shall never be restored automatically.

Data not in such a cache shall be unavailable to applications. When applications attempt to access data from lost carousels, this shall fail. The failure mode shall be one appropriate to the content format and the mechanism being used to access the data.

Failure modes for DVB-J applications are defined in [11.5.1.3, "Behaviour following loss of a broadcast file system" on page 114](#).

6.2.6 DVB Multiprotocol Encapsulation

DVB Multiprotocol Encapsulation as defined in [EN 301 192 \[5\]](#) provides support for IP and is based on the DSM-CC Private Data protocol.

6.2.7 Internet Protocol (IP)

Internet Protocol as defined in [RFC 791 \[43\]](#).

6.2.8 User Datagram Protocol (UDP)

User Datagram Protocol as defined in [RFC 768 \[42\]](#).

6.2.9 DVB Service Information

DVB Service Information as defined in [EN 300 468 \[4\]](#) and [ETR 211 \[11\]](#).

6.3 Interaction Channel Protocols

This section deals with the DVB defined or referenced interaction channel protocols. This chapter does not consider other protocols and the APIs that would provide access to them. Other private protocols and possibly APIs are not precluded and are outside of the scope of the MHP.

Figure 9 illustrates the set of DVB defined interaction channel protocols that are accessible by MHP applications in some or all profiles (see 15, "Detailed platform profile definitions" on page 206). The full details of the APIs that provide access to these interaction protocols are in chapter 11, "DVB-J Platform" on page 98.

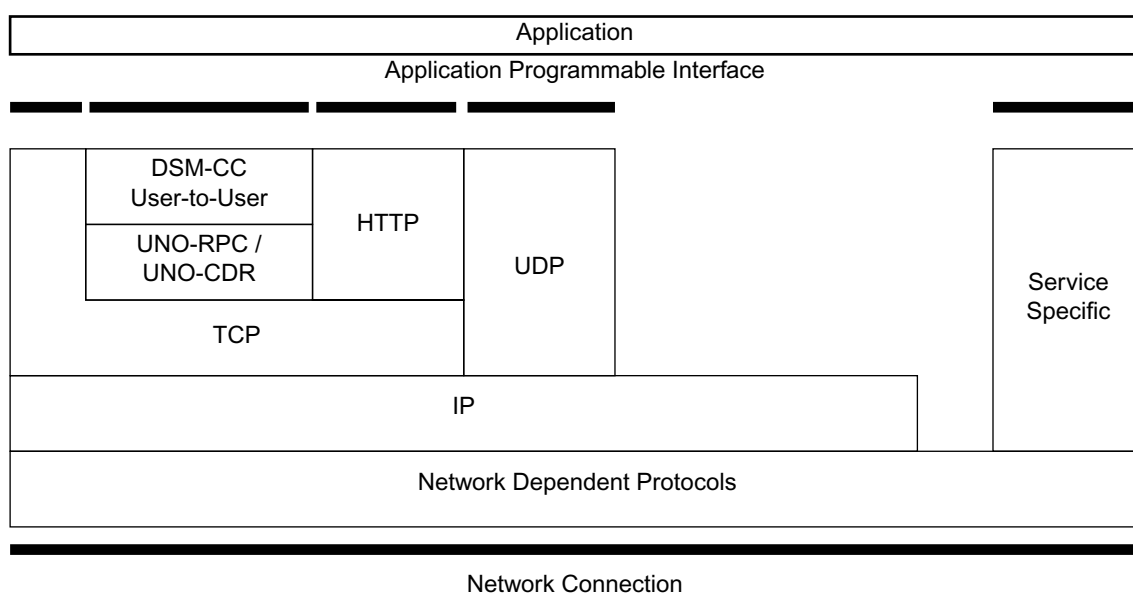


Figure 9 : Interaction Channel Protocol Stack

6.3.1 Network Dependent Protocols

As defined in ETS 300 800 [14], ETS 300 801 [15], EN 301 193 [6], EN 301 195 [7], EN 301 199 [8], TR 101 201 [48] respectively for CATV, PSTN/ISDN, DECT, GSM, LMDS and SMATV networks.

6.3.2 Internet Protocol (IP)

Internet Protocol as defined in RFC 791 [43].

6.3.3 Transmission Control Protocol (TCP)

Transmission Control Protocol as defined in RFC 793 [44].

6.3.4 UNO-RPC

The UNO-RPC consists of the Internet Inter-ORB Protocol (IIOP) as specified in CORBA/IIOP [2].

6.3.5 UNO-CDR

The UNO-CDR as defined in CORBA/IIOP [2].

6.3.6 DCM-CC User to User

DSM-CC User-to-user as defined in ISO/IEC 13818-6 [26] with the restrictions and extensions as defined in EN 301 192 [5] and TR 101 202 [49].

6.3.7 Hypertext Transfer Protocol (HTTP)

6.3.7.1 HTTP 1.1

Hypertext Transfer Protocol as defined in [RFC 2616 \[40\]](#).

HTTP 1.0 is defined in . MHP terminals supporting HTTP 1.0 are required to support persistent connections as defined below. MHP terminals implementing profiles where HTTP 1.0 is required are also allowed to implement subsequent versions of the HTTP specification (e.g. HTTP 1.1,) as long as these are backwards compatible and persistent connections or their equivalent in the subsequent version of the specification are supported.

6.3.8 Service Specific

Service Specific protocols are proprietary protocols used by a service as defined in the guidelines for the Data Broadcast Specification [TR 101 202 \[49\]](#). The DVB provides a registry mechanism for new, proprietary broadcast protocols.

6.3.9 User Datagram Protocol (UDP)

User Datagram Protocol as defined in [RFC 768 \[42\]](#).

7 Content formats

7.1 Static formats

7.1.1 Bitmap image formats

7.1.1.1 Image encoding restrictions

Any indications in the transmitted image with respect to pixel scaling, colour space or gamma are to be ignored in the presenting of the image. One image pixel shall be mapped to one graphics pixel in the current graphics configuration, unless otherwise scaled by the application directly.

See also 7.5, "Colour Representation" on page 50.

7.1.1.2 JPEG

JPEG as defined in ISO/IEC 10918-1 [21] using the JFIF [35] file exchange format.

Only coding using sequential DCT-based mode or progressive DCT-based mode is required to be supported by implementations.

Specifically, lossless and hierarchical modes need not be supported.

7.1.1.3 PNG

PNG is defined as in PNG [37].

See also 15.1, "PNG - restrictions" on page 208.

7.1.1.4 GIF

GIF is defined as in GIF 89a [17].

7.1.2 MPEG-2 I-Frames

MPEG-2 I-Frames are defined as in ISO/IEC 13818-2 [24].

The payload of a file delivering an MPEG -2 I frame shall:

- be a valid `video_sequence()` including a `sequence_extension()`
- contain one I frame only, i.e. one `picture_header()`, one `picture_coding_extension()`, and one `picture_data()` encoded as an intra coded frame, with `picture structure = "frame"`

That is the structure is:

```
sequence_header()
sequence_extension()
extension_and_user_data(0)
optional group_of_pictures_header() and extension_and_user_data(1)
picture_header ( picture_coding_type = "I frame")
picture_coding_extension ( picture_structure = "frame picture")
extension_and_user_data(2)
picture_data()
sequence_end_code()
```

7.1.3 MPEG-2 Video "drips"

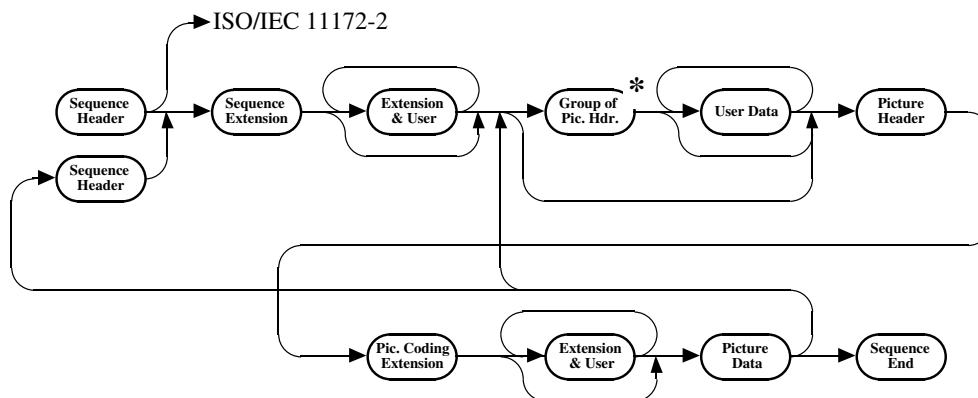
The drip feed mode consists of letting an application progressively feed the MPEG-2 video decoder with chunks of an MPEG-2 video stream. In this mode, it is only required for the decoder to handle I and P frames (i.e. not B frame). Each chunk shall contain one frame and a certain number of syntactic elements (as described in ISO/IEC 13818-2 [24]) such as `sequence_header()` or `group_of_picture_header()`.

Firstly, the content of each of the chunks of bytes fed to the decoder shall comply with the following syntax:

```
optional {
  sequence_header()
  sequence_extension()
  extension_and_user_data(0)
  optional {
    group_of_pictures_header()
    extension_and_user_data(1)
  }
}

picture_header ( picture_coding_type = "I frame" or "P frame")
picture_coding_extension ( picture_structure = "frame picture")
extension_and_user_data(2)
picture_data()
optional {
  sequence_end_code()
}
```

In addition, the overall concatenation of chunks over time shall respect the authorized combinations of syntactic elements described in ISO/IEC 13818-2 [24] to build a legal MPEG-2 video stream. The following diagram, extracted from ISO/IEC 13818-2 [24], reflect the rules defined in that standard:



* After a GOP the first picture shall be an I-picture

Figure 10 :

The following restrictions are applied to P-frames:

- The P-frame shall contain no prediction information (i.e. no motion vector shall be present in macroblock elements).
- The allowed macroblock_types for P-frames are:
 - "Intra" (i.e. VLC code 0001 1)
 - "Intra, Quant" (i.e. VLC code 0000 01)
 - "No MC, Coded" (i.e. VLC code 01)
 - "No MC, Coded, Quant" (i.e. VLC code 0000 1)

NOTE: The standard semantics for P-frames allow macroblock_escape and macroblock_address_increment to signal skipped macroblocks. This allows P-frames to be very sparse, only carrying macroblocks positioned at certain locations on the screen. This contrasts with semantics for an I-frame where macroblocks are required to fill the full screen.

If invalid content is fed to the MPEG-2 video decoder, the content is discarded and there are no guarantees when subsequent valid chunk of byte fed to the decoder will be displayed (unless the decoder is restarted).

This mode requires the decoder to be in the "low delay" mode as defined in ISO/IEC 13818-2 [24].

This mode can be used by connecting a `org.dvb.media.DripFeedDataSource` instance to a Player representing a MPEG-2 video decoder. See [N, "\(normative\): Streamed Media API Extensions" on page 413](#).

7.1.4 Monomedia format for audio clips

The format for audio clips is MPEG-1 Audio (Layer 1 & 2) ES data as defined as in [ISO/IEC 11172-3 \[22\]](#) and constrained in [TR 101 154 \[9\]](#).

Each "file" of audio content is a binary data file carrying Audio elementary stream data. Each "file" delivers an integer number of audio access units and the first byte of each file is the first byte of an audio access unit. The MPEG Audio data in all other respects conforms to the specifications provided in [TR 101 154 \[9\]](#).

Implementations decoding audio clips can assume that they have an approximately constant number of bytes per second. If this not true then the behaviour is implementation dependent.

7.1.5 Monomedia format for text

Java modified UTF-8 as defined in [Java Language Spec \[32\]](#) section 22.2.14 "writeUTF" is the coding of text in MHP.

NOTE: Based on [ISO 10646-1 \[18\]](#) but modified with respect to the encoding of the character code zero.

7.1.5.1 Built-in character set

See [E, "\(normative\): Character set" on page 276](#).

7.2 Broadcast streaming formats

7.2.1 Audio

MPEG Audio with the restrictions and enhancements defined in [TR 101 154 \[9\]](#)

7.2.2 Video

Standard Definition 25 Hz MPEG Video with the restrictions and enhancements defined in [TR 101 154 \[9\]](#).

7.2.3 Subtitles

The content formats supported for subtitles are:

- DVB Subtitles
- Teletext

See [13.5, "Subtitles" on page 194](#).

In the event that both DVB Subtitles and DVB Teletext are available then DVB Subtitles will take precedence (i.e. if a stream is flagged as having both DVB Subtitles and Teletext Subtitles then the DVB Subtitles will be displayed).

Teletext Subtitles conform to the same display model, as DVB subtitles.

Application control and detection of subtitles, whether they be DVB Subtitles or Teletext Subtitles, will be through JMF. The application will have no knowledge of the delivery/presentation protocol being used to provide subtitles.

No APIs will be provided to access Teletext data packets and no timing model is provided for the decoding of Teletext subtitle. Text subtitles will be decoded as soon as the data becomes available.

7.2.3.1 DVB Subtitles

DVB Subtitles are defined as in [EN 300 743 \[13\]](#).

7.2.3.2 Teletext

Transmission of the text is as defined in [EN 300 472 \[12\]](#). The data format is as defined in [ETS 300 706 \[61\]](#) but restricted to presentation level 1.5 or lower. Signalling of the Teletext subtitle page will be via the Teletext descriptor as defined in [EN 300 468 \[4\]](#).

Within the MHP specification Teletext is only supported as an alternative content format for delivery of subtitles. The MHP specification does not address its possible use as a navigable content format.

NOTE: Manufactures remain free to implement full Teletext support based on regulatory requirement or market demand. Such support would be implemented outside of the MHP environment, by VBI re-insertion of the non-subtitle text or through a native Teletext Decoder. The user interface integration is then an issue for the manufacturer to resolve.

It is envisaged that broadcasters will use MHP applications to deliver navigable text services providing a greater level of interactivity and enhanced graphics.

7.3 Resident fonts

See section G.4, "Resident fonts and text rendering" on page 285.

See also annex D, "(normative): Text presentation" on page 263.

7.4 Downloadable Fonts

PFR0 (Portable Font Resource version 0) is defined as in [DAVIC 1.4.1p9 \[3\]](#) as the coding format for fonts. Receivers are only required to provide support for the outline version of the font.

The `charCode` value in the PFR `charRecord` shall be the [ISO 10646-1 \[18\]](#) code for the glyph encoded using UCS-2.

See also D.2.2, "Downloaded fonts" on page 263.

7.5 Colour Representation

7.5.1 Background (informative)

The method of colour encoding is critical to how consistently the colours in an image can be reproduced across different systems. The description must be cast in a way which is independent of the mechanisms by which it will finally be reproduced for the viewer.

The International Colour Consortium (ICC) has proposed a thorough solution to the precise communication of colour in open systems. However the ICC profile format is somewhat over-specified for the MHP. The ICC mechanism for ensuring that a colour is correctly mapped from an input to the output colour space is by attaching a profile for the input colour space to the image in question. This is appropriate for high end systems, especially those in the print media. However, a primarily CRT based home platform neither needs, nor has the processing power and available bandwidth, to handle an embedded profile mechanism. It would also require some sophistication on the part of the end consumer to set up properly.

Fortunately by adopting a single default colour space that can be processed as an **implicit** ICC profile the advantages of the ICC approach are gained, and the system is later scalable to a full colour management system with a clear relationship to existing ICC colour management systems while minimizing software and support requirements in an MHP today.

A colour space is a model for representing colour numerically in terms of three or more coordinates or tristimulus values. An RGB colour space represents colours in terms of Red, Green and Blue coordinates. The MHP format shall use the specific RGB encoding for colour imagery, sRGB as defined in [IEC 61966-2-1 \[27\]](#). This is suitable for a wide range of presentation environments including TV's and has become widely adopted in the computer environment and WWW. It is, for example, compatible with CCIR Recommendation [ITU-R BT.709 \[30\]](#) standard for colour encoding in HDTV. This format has the advantage of device independence without a great deal of additional overhead.

For sRGB, the goal is to communicate the appearance of colours as displayed on a reference monitor in terms of 8-bit digital code values for each coordinate. sRGB colour values represent colour appearance with respect to a defined reference viewing environment.

For colour stimuli viewed in the reference viewing environment, sRGB values are defined by a series of simple mathematical operations from standard CIE colourimetric values.

The sRGB format is a good match for 24 bit colour on most CRT's. In devices where a great deal of damage is done to the colour space it may not give consistent results. For example dithering to a 4-bit per primary colour map will violate the gamma assumptions.

7.5.2 Specification

All images transmitted shall be within the gamut encompassed by the sRGB colourspace. Where possible this should be coded so that the terminal does not have to translate. Where this is impractical the sRGB image may be transcoded into a different colourspace provided the gamut assumption is not violated (i.e. to be consistent with JFIF, JPEG images shall be sent in the region of the $Y_C C_b$ colourspace that overlaps with the sRGB gamut).

NOTE: that the presentation of images using colours outside of the sRGB gamut shall be platform dependent.

Images created in the MHP will be in the sRGB colourspace by default, although manufacturers are free to provide support for other colour spaces if they choose. All MHPs shall support transformations from sRGB to the colour spaces allowed by the MPEG-2 definition (e.g. BT 709 and BT 420) and vice versa, manufacturers may choose to support transformations to and from other colour spaces.

7.5.2.1 The sRGB Reference Viewing Environment

The reference display conditions and viewing environment for sRGB are partly described in table 1. A reference viewing environment must be provided to allow for the unambiguous definition of colour, the sRGB reference viewing environment corresponds to conditions typical of indoor viewing of CRTs – further details can be found in the IEC 61966-2-1 [27].

The sRGB reference conditions therefore provides a well defined reference compatible with ITU-R BT.709 [30].

Table 1 : sRGB reference Display conditions

Condition	sRGB
Viewing flare	1,0 %
Reference Background	20 %
Display model Offset	0,055
Display Gun/Phosphor Gamma	2,4
Display white point	$x = 0,3127$ $y = 0,3290$ (D65 Hunt, R.W.G. [52])
Ambient Lighting	64 lx
Display Luminance level	80 cd/m ²

7.5.2.2 Colourimetric Definitions and Encodings

sRGB tristimulus values can be computed as follows, firstly linear sRGB tristimulus are computed as linear combinations of the 1931 CIE XYZ (CIE 15 [1]) values using the following relationship:

$$\begin{bmatrix} R_{sRGB} \\ G_{sRGB} \\ B_{sRGB} \end{bmatrix} = \begin{bmatrix} 3,2410 & -1,5374 & -0,4986 \\ -0,9682 & 1,8760 & -0,0416 \\ 0,0556 & -0,2040 & -1,0570 \end{bmatrix} \begin{bmatrix} X_{D65} \\ Y_{D65} \\ Z_{D65} \end{bmatrix}$$

In the encoding process, negative sRGB tristimulus values, and sRGB tristimulus values greater than 1,00 are not retained. The luminance dynamic range and colour gamut of sRGB is limited to the tristimulus values between 0,0 and 1,0 by simple clipping. This gamut, however, is large enough to encompass most colours that can be displayed on CRT monitors.

For comparison, the CIE chromaticities for the red, green, and blue ITU-R BT.709 and ITU-R BT.470 reference primaries, and for CIE Standard Illuminant D65 (IEC 61966-2-1 [27]), are given in tables 2, 3. From these primaries the $Y C_b C_r$ transmitted values are computed by similar relationships.

Therefore ITU-R BT.709 $Y C_b C_r$ colour space and similar video colour spaces can be converted to sRGB and vice versa by way of CIE XYZ. Chromaticities for other video formats allowed in MPEG streams can be found in their respective standards.

Table 2 : ITU-R BT.709 reference primaries and CIE standard illuminant

	Red	Green	Blue	D65
x	0,6400	0,3000	0,1500	0,3127
y	0,3300	0,6000	0,0600	0,3290
z	0,0300	0,1000	0,7900	0,3583

Table 3 : TU-R BT.470-2 reference primaries and CIE standard illuminant

	Red	Green	Blue	D65
x	0,6700	0,2100	0,1400	0,3100
y	0,3300	0,7100	0,0800	0,3160
z	0,0100	0,0800	0,7800	0,3740

The linear sRGB tristimulus values are next transformed to non linear sR'G'B' values. This process closely approximates the effect of a "gamma" curve of 2,2 with a slight offset. This makes sRGB consistent with legacy systems and images.

if $R_{sRGB} > 0,00304$ and $G_{sRGB} > 0,00304$ and $B_{sRGB} > 0,00304$

then

$$R'_{sRGB} = 1,055 * R_{sRGB}^{(1,0/2,4)} - 0,055$$

$$G'_{sRGB} = 1,055 * G_{sRGB}^{(1,0/2,4)} - 0,055$$

$$B'_{sRGB} = 1,055 * B_{sRGB}^{(1,0/2,4)} - 0,055$$

else

$$R'_{sRGB} = 12,92 * R_{sRGB}$$

$$G'_{sRGB} = 12,92 * G_{sRGB}$$

$$B'_{sRGB} = 12,92 * B_{sRGB}$$

end if

Finally, the non-linear sR'G'B' values are converted to digital code values. This conversion scales the sR'G'B' values by using the equation below where WDC represents the white digital count and KDC represents the black digital count.

$$R_{8bit} = ((WDC - KDC) * R'_{sRGB}) + KDC$$

$$G_{8bit} = ((WDC - KDC) * G'_{sRGB}) + KDC$$

$$B_{8bit} = ((WDC - KDC) * B'_{sRGB}) + KDC$$

The current sRGB specification uses a black digital count of 0 and a white digital count of 255 for 24-bit (8-bits/channel) encoding, and the MHP shall adopt the same convention. However, note that some digital video signals may use a black digital count of 16 and a white digital count of 235 in order to provide a larger encoded colour gamut.

Details of the reverse transformation from sRGB to CIE XYZ are given in IEC 61966-2-1 [27], mappings from ITU-R BT.709 and ITU-R BT.470 to CIE XYZ are given in ISO/IEC 13818-2 [24].

7.6 MIME Types

Table 4 : File type identification

MIME type	Extension (note 1)	Definition of content
"image/jpeg"	".jpg"	As defined in 7.1.1.2, "JPEG" on page 47.
"image/png"	".png"	As defined in 7.1.1.3, "PNG" on page 47 possibly with a constrained profile as defined in 15.1, "PNG - restrictions" on page 208.
"image/gif"	".gif"	As defined in 7.1.1.4, "GIF" on page 47.
"image/mpeg"	".mpg"	As defined in 7.1.2, "MPEG-2 I-Frames" on page 47.
"video/mpeg"	".mpg"	As defined in 7.2.2, "Video" on page 49.
"video/dvb.mpeg.drip"	".drip"	As defined in 7.1.3, "MPEG-2 Video "drips"" on page 47.
"audio/mpeg"	".mp2"	As defined in 7.1.4, "Monomedia format for audio clips" on page 49 or as defined in 7.2.1, "Audio" on page 49.
"text/dvb.utf8"	".txt"	As defined in 7.1.5, "Monomedia format for text" on page 49.
"image/dvb.subtitle"	".sub"	As defined in 7.2.3, "Subtitles" on page 49.
"text/dvb.subtitle"		
"text/dvb.teletext"	".tlx"	As defined in 7.2.3.2, "Teletext" on page 50.
"application/dvb.pfr"	".pfr"	As defined in 7.4, "Downloadable Fonts" on page 50.
"application/dvbj"	".class"	A DVB-J class file. See 6.2.5.1, "DVB-J class files" on page 43.
"multipart/dvb.service"	".svc"	An MPEG Program (DVB Service) conforming to DVB norms.
NOTE 1: Future formats may use more characters in the extension		

7.6.1 Rationale

The MIME types are defined to reserve a name space for the possible future support of downloadable JMF players.

The file name extensions shall be included in broadcasts to assist receivers identify the type of the content. For DVB-J applications, this is described in table 41, "Return types of URL.getContent()" on page 102).

Not all MIME and filename extensions defined in the above table are actually used in this specification. For DVB-J, the APIs which consume media types are described in 15.2, "Minimum media formats supported by DVB-J APIs" on page 208. With MIME types whose corresponding media is not listed for a particular profile, access to that content type from files is not defined for that profile.

8 DVB-HTML

8.1 Status of DVB HTML

The DVB MHP specification provides the basic definitions needed for integration of DVB HTML applications into the MHP:

- Definition of the term DVB HTML application and its lifecycle in 9.3.1, "The DVB-HTML Application" on page 63.
- How to signal a DVB HTML application in 10, "Application Signalling" on page 71.
- Extensions on how to transport a DVB HTML application in 6.2.5.2, "DVB-HTML document files" on page 43.

A definition of the content and application format elements from the HTML family is not in this release of the specification. Such a definition will be based on content formats defined by recognized bodies including W3C plus own developments.

9 Application model

9.1 Broadcast MHP applications

9.1.1 Basic lifecycle control

The basic control of the lifecycle of broadcast MHP applications is through the selection of broadcast services. Selection of a broadcast service can be initiated by the user of the MHP terminal using the Navigator as well as by MHP applications offering EPG functionality.

The unit for the presentation and execution of content in the MHP specification is the service. A service in MHP represents a group of pieces of content which are intended to be presented together to the end-user. In this version of the specification, the service is the contents of a broadcast DVB service, including audio/video streams, data streams and all the service information, applications and application signalling that is being broadcast.

Every service that gets presented by an MHP platform is presented within a service context. These form one of the foundations for the runtime environment and the execution model. A service context is an "environment" in which a service gets presented. It defines the boundaries of the service (letting the platform and applications identify which of the pieces of content that are being presented make up a given service). It also enables that service to be addressed and controlled as a single entity.

- In a DVB-J application, a service context is represented by an instance of the ServiceContext class. Where multiple DVB-J applications are being presented in the same service context, the number of ServiceContext objects representing a service context is implementation dependant, but each application sees only one such instance. Changes made by one application to the ServiceContext object that it has are visible to the ServiceContext objects representing the same service context in other applications. DVB-J applications may obtain a reference to the service context within which they are executing through using the method `getServiceContext(XletContext)` on the ServiceContextFactory class.

The means by which the navigator of an MHP terminal supports selection of services is implementation dependent. However, where an MHP application is using the numeric keys of the remote control, the navigator shall not respond to the user pressing these keys by causing service selection. Hence the user pressing the numeric keys to enter his pincode does not cause service selection.

A service context can present only one service at any one time. Selecting a service to be presented in a service context causes any previous service being presented in that service context to stop being presented. Any content part of the previous service which is not part of the new service shall stop being presented. MHP terminals may limit on the number of broadcast service contexts which can be presented simultaneously.

- In a DVB-J application, selecting a service corresponds to calling the `select()` method on such an instance.

9.1.2 Starting applications

When a broadcast service is selected, applications which are listed in the AIT of the service and identified as auto-start shall be launched as described in section 10.6, "Control of application life cycle" on page 77 without explicit intervention of the user. Applications which are started after the selection of a service will be controlled by signalling associated with that service. The MHP terminal shall monitor that signalling for changes made by the broadcaster. These changes may include the termination of particular applications as well as the addition of new auto-start applications.

Applications which are not identified as auto-start in the AIT shall not be automatically launched by the MHP terminal, but require explicit launching. This explicit launching can be done by the resident Navigator on the MHP terminal or by an MHP application. For example, the user can launch such applications after they have been offered a choice of applications through some user interface.

Where the currently selected service in a service context includes multiple MHP applications, any running applications may be able to launch other applications from that set. The launched applications shall be presented inside that same service context.

- A DVB-J application is able to achieve this using the application listing and launching API.

9.1.3 Support for execution of multiple simultaneous applications

The set of applications that are signalled within a service can be presented and executed concurrently.

MHP terminals shall be able to support applications from that set (using the same screen) at least as defined in the minimum platform capabilities section of this specification. MHP terminals are required to support execution of the set of such applications for each broadcast service which they permit to be presented simultaneously.

Broadcasters should ensure that simultaneous running of the set of applications for a service is comprehensible to the user and does not yield perceptible interference problems.

9.1.4 Stopping applications

MHP applications may stop themselves voluntarily using the MHP APIs or may be stopped by the MHP terminal in a number of situations. Examples of situations where this shall be allowed include:

9.1.4.1 A new service being selected replacing a previously selected one

When a new service is selected and replaces a previously selected one, applications from the former service shall only continue to execute where they are signalled in the new service. If an application is not signalled in that signalling then it will be stopped by the MHP terminal. Where an application is known to be bound to a single service, the broadcaster can identify that application as service bound using the `service_bound_flag` in the application descriptor. Such applications shall be stopped as soon as possible by the MHP terminal and without needing the AIT for the new service to be available. This allows the autostart application(s) of the new service to be started earlier than would otherwise be the case.

9.1.4.2 The stopping of an application by another application

Subject to the security policy of an MHP terminal, one application may request to stop another application. In such a case, the resident Application Manager, after a successful security check, kills the application otherwise that application shall continue running, without interruption.

9.1.4.3 Changes in the application signalling to request a particular application be stopped

The broadcaster may request an MHP terminal to stop an application using the control codes in the AIT. The precise semantics of these are dependent on the application format.

9.1.4.4 Stopping by the MHP terminal due to a shortage of resources

Where an MHP terminal has insufficient resources to continue the execution of one of the running applications, the MHP terminal is allowed to decide to stop an application without user intervention (e.g. memory, CPU and resources managed by the resource management API). When this happens the MHP shall first kill the applications by increasing order of the priority fields signalled in the `application_priority` field in the application descriptor for each application.

NOTE: The precise resources of an MHP terminal are implementation dependant.

9.1.5 Persistence of Applications Across Service Boundaries

Where a running application is signalled in both the new service and the former service, and is not signalled as service bound in the former service, it shall continue to run and shall not be restarted. In this case, the running application shall become controlled by the application signalling of the new service where it is signalled and not the signalling of the former service. Hence the MHP terminal shall monitor the AIT of the new service and shall stop responding to the AIT of the former service.

If the application is signalled as service bound in the former service then it is terminated in the normal way as the new service is selected. If it is signalled as auto-start in the new service it will restart with no volatile context from the previous instantiation.

If an application survives a service selection operation it shall run in the new service context without automatically getting any access to the broadcast file system of the new service. The broadcast file system shall be lost as defined in 6.2.5.3, "Loss of Carousel Behaviour" on page 44. Applications are responsible for implementing their own strategy for continuing to execute after this point.

9.1.6 Management of autostarting

The receiver shall launch autostart applications under the following conditions:

- the signalling indicates that the application can be supported by the receiver, as defined by the application profile & versioning information contained in the application descriptor,
- only a single application with a given [Application identification](#) is allowed to run at any time,
- the application is a newly introduced autostart application or has newly been given autostart status.

So:

- when a service is selected the receiver shall launch at most one instance of each autostart application that it can support,
- if after service selection an autostart application that the receiver can support is introduced or a previously listed supportable application gains autostart status then the application shall be launched subject to normal resource limitations, etc.

However, if an autostart application terminates it is not restarted unless it again becomes a new autostart application. An application becomes a new autostart application in the following cases:

- The receiver navigates away from the service and then selects a service where the application is autostart.
- The application is removed from the AIT and then is re-introduced.
- The autostart status of the application is reset then set again.

NOTE 1: In summary the autostart status of an application is in effect an edge trigger rather than level trigger signal.

NOTE 2: These semantics for the autostart behaviour address "de-bouncing" the case where an autostart application terminates voluntarily. They do not address the case where the receiver terminates the application.

NOTE 3: This specification does not describe in detail the timing required for the broadcast signalling to renew the autostart status of an application.

9.1.7 When tuning is not service selection!

MHP applications may cause tuning to another transport stream by mechanisms other than service selection. Usage of these mechanisms does not constitute service selection and therefore no applications from the target transport stream or service shall be started either by the MHP terminal or by MHP applications. The MHP terminal shall continue monitoring the AIT of the logically selected service where this is available on the target transport stream. Where the AIT of the selected service is not available, the application shall continue executing as described in 10.4.4, "Visibility of AIT" on page 74. The service being presented in the service context shall not be changed by an application using these mechanisms:

- DVB-J tuning API or streamed media APIs

9.1.8 DVB-J Applications and Service Selection

DVB-J applications may select services using the service selection API. The service selection API includes a class `ServiceContext` to represent environments in which services may be presented. Calling the `select` method on a `ServiceContext` causes a new service to be presented in that context and any former service being presented in that context will be stopped.

Where one MHP application uses the application listing and launching API to successfully start a second MHP application, the second MHP application shall be considered as executing inside the service context of the first MHP application. The number of `ServiceContext` objects representing a service context is implementation dependant, but each application sees only one such instance. Changes made by one application to the `ServiceContext` object that it has are visible to the `ServiceContext` objects representing the same service context in other applications.

DVB-J applications started in response to a service selection operation are considered to be executing "inside" a service context. They may obtain a reference to the service context within which they are executing through using the method `getServiceContext(XletContext)` on `javax.tv.service.selection.ServiceContextFactory`.

DVB-J applications may cause tuning to another transport stream using the tuning API. Usage of these APIs does not constitute service selection and therefore no applications from the target transport stream or service of these APIs shall be started either by the MHP terminal or by MHP applications. The MHP terminal shall continue monitoring the AIT of the selected service where this is available on the target transport stream. Where the AIT of the selected service is not available, the application shall continue executing as described in 10.4.4, "Visibility of AIT" on page 74. The service being presented in the service context shall not be changed by usage of these APIs.

9.2 DVB-J Model

9.2.1 Starting DVB-J Applications

DVB-J applications may be started by any of the means defined for general MHP applications. The application listing and launching API defined in annex S, "(normative): Application Listing and Launching" on page 550 allows one MHP application to start another MHP application subject to security policy. The `start()` method of the `AppProxy` interface will then cause the Application Manager to start the new MHP application subject to normal resource limitations.

The Xlet interface is defined in the `javax.tv.xlet.Xlet` interface [Java TV \[51\]](#). DVB-J applications provide a class implementing this interface and reference that class in the DVB-J application location descriptor. In order to start a DVB-J application, the application manager shall call the constructor of this class, the `initXlet()` and the `startXlet()` methods of this interface.

9.2.2 Stopping a DVB-J Application

DVB-J applications may stop for any of the reasons listed for general MHP applications. An application shall be able to notify that it is stopped by finishing its execution and informing the Application Manager through the `notifyDestroyed()` method on the `javax.tv.xlet.XletContext` interface. This interface also includes other methods to allow a DVB-J application to request or notify changes in its state.

The application listing and launching API allows an application to indirectly control the lifecycle of another application subject to security policy. This control is indirect because an application cannot invoke an Xlet state method directly, but goes through this API. This ensures that the resident Application Manager can always keep track of all the application that are running.

When a DVB-J application is stopped by an MHP terminal, the `destroyXlet` method of the signalled Java class implementing the Xlet interface, i.e. the start of the application shall be called by the application manager. In the case of the application being stopped due to a service selection operation, the stopping of the application shall be unconditional. This method call gives applications their last opportunity to save state before their execution stops. Applications which wish to survive the user of the MHP terminal zapping away from their service (e.g. during an advertising break) must save their state and reload that state when they are re-started if the user returns to that service later.

9.2.3 DVB-J Application Lifecycle

9.2.3.1 Introduction

This section describes the Xlet lifecycle model for the DVB-J API. This describes the capabilities of the Xlet in each state and the methods by which the application manager influences the life cycle state. This section is not directly related to other aspects of a system, such as graphics or shared resource allocation/management.

NOTE: The traditional Java platforms define a number of application models that have their own lifecycles associated with them. In general, they are designed to address specific issues on that platform. For instance, the Applet was designed to provide support for executable content in web pages. However, none of the existing application technology fully addresses the specific requirements of television receivers. The application lifecycle defined in this section is meant to be compatible with existing Java platforms and virtual machine technology.

9.2.3.2 DVB-J Application Lifecycle State Machine

The Xlet state machine ensures that the behaviour of an Xlet is close to the behaviour that television viewers expect, specifically:

- The perceived start-up latency of an Xlet can be very short.
- It is possible to put an Xlet into a state where it is not providing its service.
- It is possible to destroy an Xlet at any time.

The figure 11 shows the state machine model for Xlets. The Xlet states are defined in more detail in table 5.

The different influences that can cause an Xlet to change state include:

- The application manager uses the [Xlet API](#) to signal these changes to the Xlet.

Various factors may stimulate the application manager to act in this way, for example:

- Broadcast signalling (e.g. a change in the state of the [application_control_code](#) parameter carried by the AIT (see 10.4, "Application Information Table" on page 73)).
- User selection of an application in a host provided UI
- The Xlet itself "decides" to change state

The application uses the `XletContext` Object to communicate or request such changes to the application manager.

- Another Xlet acts via the application launching API (see 11.7.2, "Application discovery and launching APIs" on page 118).

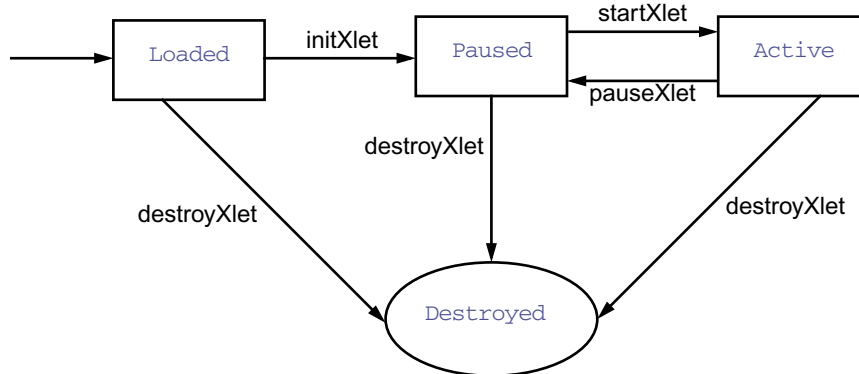


Figure 11 : Xlet lifecycle state machine diagram

Table 5 : Valid DVB-J application lifecycle states (Sheet 1 of 2)

State Name	Description
Loaded	<p>The DVB-J application has been loaded and has not been initialized.</p> <p>The signalled Java class used to initiate a DVB-J application must implement the <code>javax.tv.xlet.Xlet</code> interface. Otherwise, the class (and hence the application) may be ignored. An instance of the signalled Java class is created by the application manager e.g. using the <code>Class.newInstance</code> method. Therefore a DVB-J application must have a public "default constructor". Otherwise, the class (and hence the application) will be ignored. If the default constructor returns without throwing an uncaught exception, then the application is considered to be "Loaded", otherwise the application immediately enters the <code>Destroyed</code> state and is discarded. Once the application has been successfully loaded and instantiated, the application manager can transition the application to the <code>Paused</code> state by invoking the <code>initXlet</code> method on the signalled class (implementing the <code>Xlet</code> interface).</p> <p>If the <code>initXlet()</code> method throws an <code>XletStateChangeException</code> then the application shall remain in the <code>Loaded</code> state. The only possible state transition for such an application is into the <code>destroyed</code> state. The application can request this itself or wait for the application manager to cause this transition.</p> <p>Notes:</p> <ul style="list-style-type: none"> • Application initialisation is intended to occur in the <code>initXlet</code> method, rather than in the default constructor. • This state is entered only once per instance of an DVB-J application.
Paused	<p>A <code>Paused</code> DVB-J application should minimize its usage of resources if it wants to maximize its probability of survival. This does not imply that it cannot be holding any resources, but in such a case, it would have a lower priority as concerns access to resources than it had when it was in the <code>Active</code> state.</p> <p>This state is entered:</p> <ul style="list-style-type: none"> • From the <code>Loaded</code> state after the <code>Xlet.initXlet()</code> method returns successfully when invoked by the application manager (the first time). Other invocations of this method do not cause the change of state. <p>Note that the application manager shall only call <code>initXlet()</code> once per instance of a DVB-J application.</p> <ul style="list-style-type: none"> • From the <code>Active</code> state after the <code>Xlet.pauseXlet()</code> method returns successfully when invoked by the application manager. Other invocations of this method do not cause the change of state. • From the <code>Active</code> state upon entering the <code>XletContext.notifyPaused()</code> method.

Table 5 : Valid DVB-J application lifecycle states (Sheet 2 of 2)

State Name	Description
Active	<p>The DVB-J application is functioning normally and providing service.</p> <p>This state is entered:</p> <ul style="list-style-type: none"> From the <code>Paused</code> state after the <code>Xlet.startXlet()</code> method returns successfully.
Destroyed	<p>The DVB-J application has released all of its resources and terminated.</p> <p>This state is entered:</p> <ul style="list-style-type: none"> When the Xlet's <code>destroyXlet()</code> method returns successfully. The <code>destroyXlet()</code> method shall release all resources held and perform any necessary clean up so it may be garbage collected. Upon entering the <code>XletContext.notifyDestroyed()</code> method. The Xlet performs its clean up actions before calling the <code>notifyDestroyed()</code> method. <p>Note: This state is only entered once.</p>

Only the DVB-J application can determine if it is able to provide the service for which it was designed. As such, in some respects an application manager cannot guarantee whether an DVB-J application can, or is, providing its service; and application manager can only indicate that the DVB-J application is able to do so. A typical sequence of DVB-J application execution is:

Table 6 : Typical DVB-J application lifetime walk through

Application Manager	DVB-J application
The application manager creates a new instance of an Xlet.	The Xlet's default (no argument) constructor is called, it is in the <code>Loaded</code> state.
The application manager creates the necessary context object for the DVB-J application to run, and initializes the Xlet.	The DVB-J application uses the context object to initialize itself. It is now in the <code>Paused</code> state.
The application manager has decided that it is an appropriate time for the DVB-J application to perform its service, so it signals it to enter the <code>Active</code> state.	The DVB-J application acquires any resources it needs and begins to perform its service.
The application manager no longer needs the DVB-J application to perform its service, so it signals the DVB-J application to stop performing its service.	The DVB-J application stops performing its service and might choose to release some resources it currently holds.
The application manager has determined that the DVB-J application is no longer needed, or perhaps needs to make room for a higher priority application in memory, so it signals the DVB-J application that it is a candidate to be destroyed.	If it has been designed to do so, the DVB-J application saves state or user preferences and performs clean up.

9.2.4 Xlet API

The Xlet API provides MHP application developers with an API that provides life cycle signalling. The Xlet API uses the callback approach to signal state changes.

This API is specified in section 11.7.1, "APIs to support DVB-J application lifecycle" on page 118.

9.2.4.1 Xlet State Change Semantics

An Xlet's state can change either by having one of the methods on its Xlet Interface called, or by making an internal state transition and notifying the application manager via the `XletContext` Object. The semantics of when that state change actually happens are important:

- Calls to `Xlet`: this interface indicates a successful state change only when the call successfully returns.
- Calls to `XletContext`: the `notifyDestroyed()` and `notifyPaused()` methods indicate a state change on entry. The `resumeRequest()` method indicates no state change, instead only a request to change state.

If a method on the Xlet interface throws an `XletStateChangeException`, the Xlet shall remain in the state it was in immediately prior to the call of the method throwing the exception unless otherwise specified. In this specification, the only exception to this rule is the `destroyXlet` method when the `unconditional` flag is `true` where throwing the `XletStateChangeException` is specified to have no effect. For the case of `initXlet` which may only be called once, the application manager may choose to transition the Xlet to the destroyed state (without calling `destroyXlet`) some implementation specific time later.

9.2.4.2 Xlet state change requests

The following table defines those states in which calls to the methods on `XletContext` relating to state management are valid;

Table 7 : States for valid state management calls

Call	State
<code>notifyDestroyed</code>	all states
<code>notifyPaused</code>	started only
<code>resumeRequest</code>	paused only

Calls to these methods when an Xlet is in any other state shall have no effect.

9.2.5 Multiple application environment support

The DVB-J platform allows for the simultaneous execution of several DVB-J applications.

Allowing several DVB-J applications to run simultaneously implies that some rules be defined for these DVB-J applications to share the resources of the MHP, and in particular for them to share the Input Focus and the Output Focus.

9.2.5.1 Control of DVB-J applications by other DVB-J applications

The MHP provides support for control of the lifetime of a DVB-J application by another DVB-J application. This feature enables broadcasters to write their own "Launcher applications" that take care of the presentation to the user of the availability of DVB-J applications, and that enables eventually the user to launch DVB-J applications. Note that the actual control of the lifetime of an DVB-J applications is done by the Application Manager only. The MHP only provides APIs that enable DVB-J applications to ask the Application Manager to start, stop, pause and resume DVB-J applications.

See [11.7.2, "Application discovery and launching APIs" on page 118](#).

9.2.5.2 Input Focus management

The input focus is defined as follows:

- the application that has input focus is in principle able to receive user-input events.
- other applications not having the input focus can request to receive a subset of user-input events via a dedicated API. See ["org.dvb.event" on page 103](#).

9.2.5.3 Other resources management

The APIs defined in this specification provide support for resource allocation/revocation and resource revocation notification. The semantics of the APIs, however does not define under which circumstances an access to a resource is granted or revoked. While it is well understood that in most cases, it is up to the MHP implementation to define its own policy in terms of resource management, this section defines the basic rules that an MHP implementation has to follow.

The MHP specification describes a multi-application environment. Hence several applications may be competing for access to the same atomic resource. The resource notification API described in section 11.7.5 on page 122 provides a common way for applications to negotiate access to scarce atomic resources when such competition happens. This API allows for the MHP terminal to inform the application that currently holds the resource that another application wants to access this resource. It also provides a means for the owner of the resource and to the requester of the resource to communicate by private means. This private communication is reflected by the request_data object that the requester may pass to the owner. The semantics of this object is private and has to be known by both applications.

Some existing and general purposes java APIs that were developed before the MHP work was started do not use this general resource sharing mechanism. Hence access to resources addressed by these APIs are not subject to negotiation. For example, when an application holds a JMF player, if another application was to create a JMF player for the same content-type, the MHP has to decide by itself whether it withdraws the resource underlying the JMF player from the current owner and grants it to the requester.

It is also possible for applications to use the inter-application communication API to establish private communication channels enabling them to negotiate access to resources.

9.2.5.4 VM implementation

Where there are multiple DVB-J applications being executed as part of the same service, MHP terminals are allowed implement these in a single actual virtual machine instance. Regardless this shall conform to 11.2.1, "Basic Considerations" on page 98.

9.3 DVB-HTML Model

9.3.1 The DVB-HTML Application

9.3.1.1 DVB-HTML Application

A DVB-HTML application is defined as a set of documents selected from the DVB-HTML family of elements and content formats as defined in the specification. The extent of the set is described by the application boundary.

9.3.1.2 User agent

A user agent is an application that interprets a content format (in this case DVB-HTML documents).

Note This could be implemented as a plug-in.

9.3.1.3 DVB-HTML Actor

A DVB-HTML actor is defined as the locus of activity or process involved in running the specific set of DVB-HTML documents for some DVB-HTML application, plus any instantiated context for that data. The actor runs inside a user agent (native, plug-in or downloaded). The nature of the process is not defined explicitly as it depends on the nature of the user agent itself. More than one such locus of activity may be present in any given user agent.

There is a single DVB-HTML Actor for each running DVB-HTML Application, each DVB-HTML Application can consist of multiple documents several of which could be simultaneously displayed.

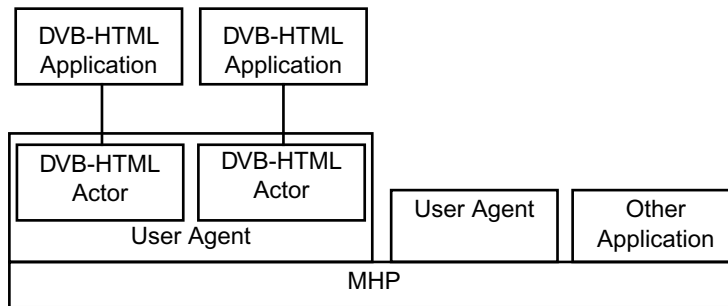


Figure 12 : Relationships between actors and applications

9.3.1.4 Application boundary

The application boundary defines the namespace of the DVB-HTML application, all content documents within this namespace are considered to be part of the DVB-HTML application, content documents outside the namespace are considered to be in other DVB-HTML applications. This namespace is used to determine: to which application each piece of cached material belongs, to determine when one DVB-HTML application should start another, to assist an MHP in more efficient pre-fetching and to facilitate storing applications.

The logical extent of a DVB-HTML application could potentially be quite large, and for various reasons might not all be on the MHP terminal at one time. Part of it might be broadcast, part of it might be on local storage, part of it might be on the world wide web - some of it may even be generated on demand. For this reason the compact format of the regular expression is used to define the extent. The set of documents making up a DVB-HTML application is defined by a regular expression over the locator language, broadly a locator consists of a text string in the following form from RFC 2396 [41] and acts as the glue which holds the application together.

```
scheme://host/dir1/dirn/file#subref
```

A regular expression is the definition of a set by a pattern which can test whether a given string is or is not a member of the set, for example the regular expression:

```
https?://www\.(dvb|etsi)\.org/[a-z0-9/]+\\.html?
```

Matches the logical locator of any file on both www.dvb.org or www.etsi.org, either reached by http or https, if and only if it is a DVB-HTML file (its name ends in ".htm" or ".html"), and its pathname contains only alphanumeric characters. Quite terse definitions can match a large set of files [see for example Compilers [C]].

9.3.1.4.1 Regular Expression Syntax

A regular expression (RE) specifies a set of character strings to match against. A member of this set of strings is said to be matched by the regular expression.

In order for a locator to match a boundary regular expression the whole locator must be matched by the whole regular expression; any parameters (characters including and after the first "?" or "#" in the locator) are not considered as part of the locator for purposes of boundary matching.

The form of regular expression used for defining application boundaries is defined as a POSIX Extended Regular Expression from POSIX [59] section 2.8.4.:

Relative locators in the DVB-HTML application are expanded to a full URI as defined in RFC 2396 [41], (the default base URI being that carried in the application location descriptor) before being matched.

A pattern may be broken into sub patterns in a set of application boundary descriptors (see signalling). The full pattern is formed from the OR of all the sub patterns. Each application boundary descriptor may be associated with a label (see 10.10.3, "DVB-HTML application boundary descriptor" on page 95). This label can be used for pre fetching in a transport specific manner, for example in an object carousel it defines that all modules matching the label should be preloaded.

For example: an application consists of an entry web page /phase0/index.html, and is factored into three sub sections, each of which has an associated stylesheet and image directory.

```
labelA: (/phase0/.\.html | /phase0/images1/.\.png | /phase0/scripts1/.\.js)
labelB: (/phase1/.\.html | /phase1/images/.\.png | /phase1/scripts/.\.js)
labelC: (/phase2/.\.html | /phase2/images/.\.png | /phase2/scripts/.\.js)
```

The entry point locator signalled for this application matches the first regular expression, this allows the pre-fetch mechanism to load the modules labelled with labelA (which the broadcaster arranges to contain the contents of directory phase0), Once the user agent is running, it can use this information to detect which if any links from the current page might transition to a new phase and therefore require more pre-fetching.

9.3.2 DVB-HTML Application Lifecycle

9.3.2.1 Introduction

There are three key parts of the DVB-HTML application lifecycle model:

- a) How applications are signalled as available to the MHP, and for auto start and prefetch applications how the start time is synchronized with any associated media stream.
- b) How and when the application manager or other launcher application makes the presence of an non auto-start application known to the user and provides it with a trigger. This is covered by the application discovery and launching mechanisms.
- c) How a broadcaster controls an actor after it has started.

9.3.2.2 Signalling

The DVB-HTML Application is signalled as described in chapter 10, "[Application Signalling](#)" on page 71.

The application manager can be requested to start a DVB-HTML application either because it is signalled as auto start, or through the application launching API.

On receiving the request that a DVB-HTML application is to be started (i.e. an [AUTOSTART](#) or [PREFETCH](#) appears in the AIT or it is user instantiated), and there is no application with the same applicationID already instantiated, the application manager should attempt to find a suitable user agent. It can also at this point begin pre-fetching material.

If the application manager is unable to instantiate a user agent either through lack of resources, or no suitable user agent being available then any pre-fetching can be aborted, and any trigger signal can be ignored.

It is platform dependant at what time a DVB-HTML autostart application starts. For a pre-fetched DVB-HTML application a trigger is required which carries the time at which the application should start providing service.

The DVB-HTML actor can be in one of 5 DVB-HTML Application states.

- [Loading](#)
- [Active](#)
- [Paused](#)
- [Destroyed](#)
- [Killed](#)

Each of these states has a precise meaning outlined in the following sections. The transitions between states are made as a result of, for example:

- A trigger, such as a request to go to a new document,
- A trigger such as the DVB-HTML application making an explicit request to change state,
- A change in the external environment i.e. the application_control_code in the AIT changes.

Since a user agent may be performing as several actors, it can be in several of these states at one time, each actor however will be labelled with a unique application ID.

A DVB-HTML application proceeds by moving between documents, while the documents remain within the DVB-HTML application boundary the DVB-HTML application continues to run normally.

Links within an DVB-HTML application normally replace the existing document, but attributes may be present on a link which cause both the new and old document to be visible at the same time.

9.3.2.3 Lifecycle control

The state model for the DVB-HTML application lifecycle control model described in this section reflects the signalling (see 10.6, "Control of application life cycle" on page 77) and is an abstract view of how a DVB-HTML application operates, and considers the kinds of resources that a user agent would need in order to function properly: resources concerned with output (rendering), input (event catching) and connection (the availability of the content).

The abstract model however is mostly illustrative and does not imply any resource management strategy nor is it intended to overly constrain the implementation of a user agent;

9.3.2.3.1 State diagram

The following transition diagram summarizes the states and the transitions between them.

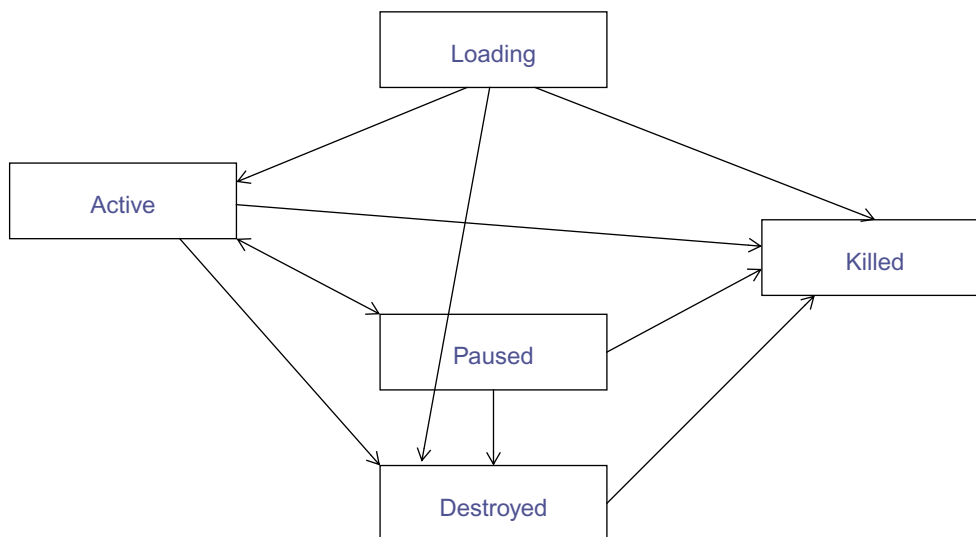


Figure 13 : DVB-HTML application life cycle state diagram

9.3.3 The State Model

The entry state of the state machine, Loading, is characterized by access to the content resources and signalling resources but does not have or require input and output resources. This implies the actor can prefetch content and receive triggering events for transition to the Active state, but will not be presented to the viewer.

On entry into the Active state the actor would be assumed to have full access to the content of the current document and all resources of the MHP, subject to resource management and security issues.

The paused state is a reduced operational state. If the application manager or the user agent needs resources for other purposes, an actor may be moved to the paused state, when in this state it may no longer have full (or even any) access to resources. When the actor is reactivated it returns to its previous state.

The destroyed state can be characterized as loss of the content resource. The actor may still be able to run the DVB-HTML application due to caching or other mechanisms but must be prepared for loading of some or all of the documents from within the DVB-HTML application to fail. It is implementation dependent how such failure is handled. This is a way for the broadcaster to signal to the MHP that it is on it's own.

The killed state is characterized by the loss of all resources, and is the signal for actions concerned with cleanup of the actor. The MHP reclaims whatever resources it deems necessary. It is implementation dependent whether cached material is disposed of.

If the AIT signal is **KILL**, an actor is forcibly terminated (and all resources associated with it reclaimed) regardless of state.

9.3.3.1 Loading

9.3.3.1.1 Name

Loading

9.3.3.1.2 Entry actions

Instantiation of an actor.

9.3.3.1.3 Activities

Waiting for documents to be available and loading documents without rendering them.

9.3.3.1.4 Resources

Content, signalling, Output

9.3.3.1.5 Transitions

Active. preconditions:

- enough data is available to present something sensible.

Killed. preconditions:

- If the DVB-HTML application is signalled as **KILL**,

Destroyed. preconditions:

- If the DVB-HTML application is signalled as **DESTROY**,

9.3.3.1.6 Comment

This is the entry state of the state machine This state is entered only once in the lifetime of the DVB-HTML actor. Any start-up phase of a user agent can also be considered as part of this state. When an actor is in this state it is not rendering anything. This state should not be confused with any prefetching of modules which may be carried out by the MHP prior to application launch.

9.3.3.2 Active

9.3.3.2.1 Name

Active

9.3.3.2.2 Activities

Gathering and parsing current document and related resources., rendering document, Maintaining rendered documents. receptive to events, waiting for triggering event to show loaded documents.

9.3.3.2.3 Entry actions

If application is signalled as pre-fetch wait for trigger before displaying anything.

9.3.3.2.4 Resources

Content, signalling, output, input.

9.3.3.2.5 Transitions

Pause.

- If the user agent or application manager puts the DVB-HTML application in PAUSE.

Destroyed.

- If the DVB-HTML application is signalled as DESTROY.

Killed.

- If the DVB-HTML application is signalled as KILL

9.3.3.2.6 Comment

This state is the steady state,

In this state it is user agent specific as to whether a partially loaded document is displayed, or deals with input triggers.

If a transition is made to a new document within the application, the actor remains in this state

if a related resource document of the main document changes, then the resource may be reloaded, causing the DVB-HTML actor to receive appropriate DOM events, however the DVB-HTML actor is not considered to change state. Similarly the DVB-HTML actor may gain and lose the focus while in this state, receiving the appropriate DOM events – it may receive fewer input events when it does not have the focus.

If the AIT no longer refers to the DVB-HTML application no special action is taken for DVB-HTML actors that are in the Active state.

9.3.3.3 Paused

9.3.3.3.1 Name

Paused

9.3.3.3.2 Activities

DVB-HTML actor should minimise its use of resources.

9.3.3.3.3 Resources

Application specific.

9.3.3.3.4 Transitions

Active.

- If the DVB-HTML application is resumed.

Destroyed.

- If the DVB-HTML application is signalled as DESTROY.

Killed.

- If the DVB-HTML application is signalled as KILL

9.3.3.3.5 Comment

The semantics of this state are both user agent and DVB-HTML application specific. When the DVB-HTML application returns from the "Pause" state, the environment might have changed (loss of resources or network connections) and some events may not have been reported.

9.3.3.4 Destroyed

9.3.3.4.1 Name

Destroyed

9.3.3.4.2 Activities

Loading documents. Rendering documents. Consuming events. Interact with the user.

9.3.3.4.3 Resources

input and output.

9.3.3.4.4 Transitions:

Killed.

- {If the DVB-HTML application is signalled as KILL} OR {local event forces the actor to terminate, possibly through application manager}

9.3.3.4.5 Comment

This state indicates the MHP may no longer be able to access the content resources required to run the DVB-HTML application. It is DVB-HTML application and user agent specific as to whether the actor continues to run, and if it does how the user should be informed if any link is no longer available because the content it refers to is no longer available, or a cached copy has expired. The DVB-HTML actor may continue to execute in the destroyed state until the user actively dismisses it.

9.3.3.5 Killed

9.3.3.5.1 Name

Killed

9.3.3.5.2 Entry actions

Release of resources.

9.3.3.5.3 Activities

Termination of the DVB-HTML application.

9.3.3.5.4 Resources

none.

9.3.3.5.5 Transitions

none

9.3.3.5.6 Comment

After the activities in this state are finished, the application is deemed to have terminated. This state is the exit state of the state machine.

9.4 Inter application resource management

This is implementation dependent except as detailed below.

- Where there is a resource conflict between two applications signalled as part of the same service and running in the same service context, this shall be resolved using the priority signalled in the `application_priority` field in the application descriptor for each application.

10 Application Signalling

10.1 Introduction

This section covers the following topics:

- how the receiver identifies the applications associated with a service and finds the locations from which to retrieve them
- the signalling that enables the broadcast to manage the lifecycles of applications
- how the receiver can identify the sources of broadcast data required by the applications of a service

Much of the signalling is generic. For example, the [Application descriptor](#) is independent of the application representation. Other signalling is specific to the application representation or transport protocol (such as the [DVB-J application descriptor](#) and the [IP Routing Descriptors](#)).

10.1.1 Summary of common signalling

The minimum signalling requirements for any MHP applications are summarised as follows:

- PMT with [Application Signalling Descriptor](#) to identify the service component carrying the [Application Information Table](#).
- [Application Information Table](#) with the following information in its common descriptor loop:
 - [Transport protocol descriptor](#) (all applications descriptions shall be within the scope of at least one [Transport protocol descriptor](#). These can be placed in either or both of the descriptor loops)
- [Application Information Table](#) with the following information in its application information descriptor loop:
 - [Application descriptor](#)
 - [Application name descriptor](#)

10.1.2 Summary of additional signalling for DVB-J applications

The minimum additional signalling required for DVB-J applications are summarised as follows:

- [Application Information Table](#) with the following information in its application information descriptor loop:
 - [DVB-J application descriptor](#)
 - [DVB-J application location descriptor](#)

10.1.3 Summary of additional signalling for DVB-HTML applications

The minimum additional signalling required for DVB-HTML applications are summarised as follows:

- [Application Information Table](#) with the following information in its application information descriptor loop:
 - [DVB-HTML application descriptor](#)
 - [DVB-HTML application location descriptor](#)

10.1.4 Summary of additional signalling for applications carried via OC

In either the "common" (first) descriptor loop or the "application" (inner) descriptors loop:

- [Transport protocol descriptor](#), with the selector bytes containing the OC specific information as defined in table 27

10.1.5 Summary of additional signalling for applications carried via IP

[Application Information Table](#) with the following information in its common descriptor loop:

- [Routing Descriptor IPv4](#) or [Routing Descriptor IPv6](#) as appropriate.

In either the "common" (first) descriptor loop or the "application" (inner) descriptors loop:

- [Transport protocol descriptor](#), with the selector bytes containing the IP specific information as defined in [table 28](#).

10.1.6 How to add a new scheme (informative)

The signalling scheme is intended to be extensible with regard to the application representations and transport protocols that are supported. The areas that need to be addressed when doing this are summarised below.

To add further transport protocols:

- Extend [table 26, "Semantic of selector bytes" on page 86](#)
- Possibly define further specialist descriptors such as the [IP Routing Descriptors](#)

To add further application representations:

- Define further specialist descriptors such as the [10.9, "DVB-J specific descriptors" on page 91](#)
- Define the application type specific life cycle control codes in [10.6, "Control of application life cycle" on page 77](#).

Where constant values are registered by this specification extend the [table 39, "Registry of constant values" on page 96](#).

10.1.7 Service information

See [10.12, "Service Information" on page 97](#).

10.2 Program Specific Information

The elementary stream (inner) loop of the PMT for a DVB service supporting one or more MHP applications must reference streams for the following:

- location of the stream transporting the [Application Information Table](#)
- location of the stream(s) transporting the application code and data

10.2.1 Application signalling stream

The elementary stream information for the PMT entry describing the elementary stream carrying the [Application Information Table](#) has the following characteristics:

- The `stream_type` is set to 0x05 (ITU-T Rec. H.222.0 | ISO/IEC 13818-1 private sections).
- An [Application Signalling Descriptor](#)

There may be more than one elementary stream carrying application signalling information for a service.

10.2.2 Data broadcast streams

The minimum signalling in the PMT associated with data broadcast components is the value of the PMT `stream_type` field required by the DVB data broadcasting specification ([EN 301 192 \[5\]](#)) for the transport protocol. The full details of the data broadcast protocol, the location of its "principal" component etc. are provided in the AIT (see [10.4, "Application Information Table" on page 73](#)).

Optionally the PMT may include [Data broadcast id descriptors](#).

NOTE: Inclusion of **Data broadcast id descriptors** enables receivers to start mounting the file system that delivers applications concurrently with acquiring the AIT that identifies which applications are of interest. Enabling this concurrent operation may allow receivers to accelerate their activation of an interactive application. See B.2.8, "Mounting an Object Carousel" on page 253.

The **Data broadcast id descriptor** identifies the "principal" component of the data broadcast. The detailed semantics of this optional signalling reflects the transport protocol. For example, in the case of a DVB Object Carousel it identifies the component carrying the DSI.

There may also be certain protocol specific descriptors in the PMT. For example, the Object Carousel requires the inclusion of the **carousel_id_descriptor** (see B.2.8, "Mounting an Object Carousel" on page 253).

In its minimum form (with no selector information) a **Data broadcast id descriptor** just identifies the "principal" component. This optionally may be extended with selector information that identifies the application types of the autostart applications delivered by that data broadcast. See 10.7.2, "Data broadcast id descriptor" on page 80.

10.3 Notation

10.3.1 reserved

The term "reserved" when used in the clause defining the coded bit stream, indicates that the value may be used in the future for ISO defined extensions. Unless otherwise specified within the present chapter all "reserved" bits shall be set to "1".

10.3.2 reserved_future_use

The term "reserved_future_use", when used in the clause defining the coded bit stream, indicates that the value may be used in the future for ETSI defined extensions. Unless otherwise specified within the present chapter all "reserved_future_use" bits shall be set to "1".

10.4 Application Information Table

The **Application Information Table** (AIT) provides full information on the data broadcast, the required activation state of applications carried by it etc.

Data in the AIT allows the broadcaster to request that the receiver change the activation state of an application.

10.4.1 Data errors

AITs which contain errors shall be processed as follows:-

- An error in an application loop shall result in that entry in the application loop being silently discarded. Processing of that application loop shall continue with the next entry (if any).
- An error in an application information section outside of an application loop shall result in that entire application information section being silently discarded. Processing of the AIT shall continue with the next application information section (if any).

10.4.2 AIT transmission and monitoring

The minimum repetition rate for each AIT subtable is 10 seconds.

Provided that AITs for the selected service are delivered on 3 or fewer elementary streams then the maximum time interval between the moment the AIT is updated and the moment the new version is detected by the MHP shall be no more than 30 seconds.

Note If broadcasts use more than 3 elementary streams to deliver AITs then receiver response time may degrade in an unpredictable way.

The MHP terminal is only required to monitor AIT sections for application types that it can decode. The terminal's ability to decode also comprehends the interoperable plug-ins available to the terminal.

The set of application types listed in the application database reflects the set of AIT sections being monitored. So, this may be a subset of the application types being broadcast in the case that the broadcast carries a superset of the terminal's capabilities.

10.4.3 Optimised AIT signalling

The optional `AIT_version_number` carried by the `Application Signalling Descriptor` allows a possible optimisation of receiver burden as it allows receivers to acquire the AIT only after they see changes in the AIT version advertised in the PMT.

See 10.7.1, "Application Signalling Descriptor" on page 79.

10.4.4 Visibility of AIT

If an application tunes away from a transport stream where its signalling is carried without selecting a new service, it will continue running although the AIT is not visible.

In MHP terminals with multiple network interfaces, if the AIT of the selected service is visible via any of them, then the AIT signalling is used as normal.

10.4.5 Definition of sub-table for the AIT

All sections on the same PID with the AIT `table_id` and the same value of `application_type` are members of the same sub-table.

10.4.6 Syntax of the AIT

The Application Information Section describes applications and their associated information. Each Application Information Section includes one "common" descriptor loop at the top level for descriptors that are shared between applications of that sub table and a loop of applications. Each application in the application loop has an "application" descriptor loop containing the descriptors associated with that application.

Like DVB SI tables, the scope of common loop descriptors is the sub-table. So, any descriptors present in the common descriptor loop apply to all sections of the sub-table. Typically, common descriptors would normally only be present in section 0 of a sub-table, unless there was not enough space.

Like other DVB SI tables, any strings contained in these tables shall not have null terminations.

Table 8 : Application Information Section syntax (Sheet 1 of 2)

	No.of Bits	Identifier
<code>application_information_section() {</code>		
<code>table_id</code>	8	uimsbf
<code>section_syntax_indicator</code>	1	bslbf
<code>reserved_future_use</code>	1	bslbf
<code>reserved</code>	2	bslbf
<code>section_length</code>	12	uimsbf
<code>application_type</code>	16	uimsbf
<code>reserved</code>	2	bslbf
<code>version_number</code>	5	uimsbf
<code>current_next_indicator</code>	1	bslbf
<code>section_number</code>	8	uimsbf
<code>last_section_number</code>	8	uimsbf
<code>reserved_future_use</code>	4	bslbf
<code>common_descriptors_length</code>	12	uimsbf
<code>for (i=0; i<N; i++) {</code>		
<code>descriptor()</code>		
<code>}</code>		
<code>reserved_future_use</code>	4	bslbf
<code>application_loop_length</code>	12	uimsbf

Table 8 : Application Information Section syntax (Sheet 2 of 2)

	No.of Bits	Identifier
<pre> for(i=0;i<N;i++){ application_identifier() application_control_code reserved_future_use application_descriptors_loop_length for(j=0;j<N;j++){ descriptor() } } CRC_32 </pre>	<p>8</p> <p>4</p> <p>12</p> <p>32</p>	<p>uimsbf</p> <p>bslbf</p> <p>uimsbf</p> <p>rpchof</p>

table_id: This 8 bit integer with value 0x74 identifies this table.

section_syntax_indicator: The section_syntax_indicator is a 1-bit field which shall be set to "1".

section_length: This is a 12-bit field, the first two bits of which shall be '00'. The remaining 10 bits specify the number of bytes of the section starting immediately following the section_length field, and including the CRC_32. The value in this field shall not exceed 1021 (0x3FD).

application_type: This is a 16-bit field which identifies the type of the applications described in this AIT sub_table. See table 9.

Table 9 : Application types

application_type	description
0x0000	reserved
0x0001	DVB-J application
0x0002	DVB-HTML application
0x0003...0xFFFF	subject to registration with DVB

version_number: This 5-bit field is the version number of the sub_table. The version_number shall be incremented by 1 when a change in the information carried within the sub_table occurs. When it reaches value "31", it wraps around to "0". When the current_next_indicator is set to "1", then the version_number shall be that of the currently applicable sub_table. When the current_next_indicator is set to "0", then the version_number shall be that of the next applicable sub_table.

current_next_indicator: This 1-bit indicator, when set to "1" indicates that the sub_table is the currently applicable sub_table. When the bit is set to "0", it indicates that the sub_table sent is not yet applicable and shall be the next sub_table to be valid.

section_number: This 8-bit field gives the number of the section. The section_number of the first section in the sub_table shall be "0x00". The section_number shall be incremented by 1 with each additional section with the same table_id, and application_type.

last_section_number: This 8-bit field specifies the number of the last section (that is, the section with the highest section_number) of the sub_table of which this section is part.

common_descriptors_length: This 12-bit field gives the total length in bytes of the following descriptors. The descriptors in this descriptor loop apply for all of the applications contained in this AIT sub_table.

application_control_code: This 8-bit field controls the state of the application. The semantics of this field is application type dependant. See 10.6, "Control of application life cycle" on page 77.

application_loop_length: This 12-bit field gives the total length in bytes of the following loop containing application information.

application_identifier(): This 48 bit field identifies the application. The structure of this field is defined in 10.5, "Application identification" on page 76.

The same application_identifier() shall appear only once within an AIT subtable.

application_descriptors_loop_length: This 12-bit field gives the total length in bytes of the following descriptors. The descriptors in this loop apply to the specific application.

CRC_32: This is a 32-bit field that contains the CRC value that gives a zero output of the registers in the decoder defined in annex B of EN 300 468 after processing the entire section.

10.4.7 Use of private descriptors in the AIT

Private descriptors may be included in the AIT provided that they are in the scope of a DVB-SI [4] private data specifier descriptor. The scope rules for the private data specifier descriptor are as follows:

- If this descriptor is located within any descriptor loop of the AIT, then any specifier identified within this descriptor loop applies to all following descriptors and user-defined values in the particular descriptor loop until the end of the descriptor loop, or until another occurrence of a private_data_specifier_descriptor.
- The use of the descriptor in the common (first) descriptor loop does not apply to descriptors or user-defined values in the application (second) descriptor loop.

10.4.8 Text encoding in AIT

Unless otherwise specified, all fields interpreted as text strings in the AIT shall be encoded as UTF8 (see 7.1.5, "Monomedia format for text" on page 49). See also 14.5, "Text encoding of application identifiers" on page 202.

10.5 Application identification

10.5.1 Encoding

Each application is associated with an application identifier. This is a 6 byte string with the following structure:

Table 10 : Application identifier syntax

	No. of Bits	Identifier	Value
application_identifier {			
organisation_id	32	bslbf	
application_id	16	bslbf	
}			

organisation_id: This 32 bit field is a globally unique value identifying the organisation that is responsible for the application. These values are registered in ETR 162 [10].

This field is reproduced in the organisationName field of the subject name in the "leaf" certificate of an authenticated application (see 12.5.6, "subject" on page 145).

Note The inclusion of this field in the leaf certificate provides authentication of the value.

application_id: This 16 bit field uniquely identifies the application function. This is allocated by the organisation registered with the organisation_id who decides the policy for allocation within the organisation.

The application id values are divided into two ranges: one for unsigned applications and one for signed applications. This is for security reasons (see 12.1.1, "Overview of the security framework for applications" on page 136). Applications transmitted as unsigned shall use an application id from the unsigned applications range and applications transmitted as signed shall use an application id from the signed applications range.

Table 11 : Value ranges for application_id

application_id values	Use
0x0000...0x3fff	Application_ids for unsigned applications
0x4000...0x7fff	Application_ids for signed applications
0x8000...0xffffd	Reserved for future use by DVB
0xffffe	Special wildcard value for signed applications of an organisation
0xffff	Special wildcard value for all application of an organisation

Application id values 0xffff and 0xffffe are wild cards. They shall not be used to identify an application but, for example, are allowed for use in the [External application authorisation descriptor](#) see 10.7.5 on page 85. The value 0xffff matches all applications with the same [organisation_id](#). The value 0xffffe matches all signed applications with the same [organisation_id](#).

The same application identifier may be used in different application types for applications performing essentially the same function.

10.5.2 Effects on life cycle

The main concepts here are:

- On service change, currently running, previously broadcast, applications whose `service_bound_flag` is set to "0" shall (subject to resource restrictions) continue running if their application identifier is listed in the [Application Information Table](#) of the newly selected service.
- On service change, currently running, previously broadcast, applications whose `service_bound_flag` is set to "0" shall (subject to resource restrictions) continue running if their application identifier is suitably listed in the [External application authorisation descriptor](#) even if they are not part of the current service.
- Only a single instance of an application with a particular application identifier is allowed to execute at any time. So, if an application is already running then another instance of the same application shall not be launched. This affects the behaviour with respect to the application launching API and autostart applications after service selection.
- If the application signalling for an application has the "`service_bound_flag`" is set to "1", then the application is killed upon service selection.

See also S, "(normative): [Application Listing and Launching](#)" on page 550.

10.5.3 Authentication of application identification

See 12.5.6, "subject" on page 145.

10.6 Control of application life cycle

The broadcast signalling provides a mechanism for broadcasters to control the life cycle of standard application types. See also 9.1, "[Broadcast MHP applications](#)" on page 55.

10.6.1 Entering and leaving the domain of an application

The domain of an application is defined as the set of services where the application is listed in the AIT. This can be either as applications listed in the application (inner) loop of the AIT or as applications listed in the [External application authorisation descriptor](#). Services where the application is not listed in either of these two ways are outside of the domain of the application.

10.6.2 Dynamic control of the application life cycle

The dynamic control of the application life cycle is signalled through the `application_control_code` for the application in the AIT.

This control code allows the broadcaster to signal to the receiver what to do with the application with regard to its lifecycle. The set of codes have some differences between application types and so are defined on an application type specific basis.

If the receiver receives a code that it does not recognise the application shall continue in its current state.

When a change in these control codes causes a state change of a running MHP application, an `AppStateChangeEvent` shall be generated to all DVB-J applications which have registered to receive such events for the application concerned.

10.6.2.1 DVB-J

The application control codes for DVB-J applications are listed in 12.

Table 12 : DVB-J application control code values

code	identifier	semantics
0x00		reserved
0x01	AUTOSTART	The file system element(s) (e.g. an Object Carousel module) containing the class implementing the Xlet interface is loaded, The class implementing the Xlet is loaded into the VM and an Xlet object is instantiated, and the application is started subject to usual restrictions, etc.
0x02	PRESENT	Indicates that the application is present in the service, but is not autostarted.
0x03	DESTROY	When the control code changes from AUTOSTART or PRESENT to DESTROY, the destroy method of the Xlet is called (with the unconditional parameter set to false) by the application manager and the application is allowed to destroy itself gracefully.
0x04	KILL	When the control code changes from AUTOSTART or PRESENT to KILL, the destroy method of the Xlet is called (with the unconditional parameter set to true) by the application manager.
0x05	reserved	
0x06	REMOTE	This identifies a remote application that is only launchable after tuning.
0x07...0xFF		reserved for future use

See 9.2.3, "DVB-J Application Lifecycle" on page 58.

10.6.2.2 DVB-HTML

The application control codes for DVB-HTML applications are listed in 13.

Table 13 : DVB-HTML application control code values

code	identifier	semantics
0x00		reserved
0x01	AUTOSTART	The Application Entry Point of the DVB-HTML application is loaded. This is loaded into the user agent, and the DVB-HTML actor is created (in the Loading state) and the DVB-HTML application is started. When these steps are complete the DVB-HTML actor is in the Active state.
0x02	PRESENT	Indicates that the DVB-HTML application is present in the service, but is not autostarted.
0x03	DESTROY	When the control code changes from AUTOSTART or PRESENT to DESTROY, the DVB-HTML actor goes to the Killed state.
0x04	KILL	When the control code changes from AUTOSTART or PRESENT to KILL the DVB-HTML actor is terminated.
0x05	PREFETCH	As for AUTOSTART except that the DVB-HTML actor holds on entry to the Active state and waits for a trigger before completely transitioning to the Active state.
0x06	REMOTE	This identifies a remote application that is only launchable after tuning.
0x07...0xFF		reserved for future use

See 9.3.2, "[DVB-HTML Application Lifecycle](#)" on page 65.

10.7 Generic descriptors

10.7.1 Application Signalling Descriptor

The application signalling descriptor is defined for use in the elementary stream loop of the PMT where the `stream_type` of the elementary stream is 0x05. It identifies that the elementary stream carries an [Application Information Table](#).

The application signalling descriptor optionally carries a loop of `application_type` and `version_number` pairs. These allow the descriptor to optionally reproduce the current version number state of the associated [Application Information Table](#). This allows the receiver to be informed of the version of the AIT as a side effect of monitoring the PMT (which is expected to be monitored closely, under normal conditions). See 10.4.3, "[Optimised AIT signalling](#)" on page 74.

When the MHP detects a change of the content of the application signalling descriptor, it shall acquire the new version of the AIT and respond accordingly.

The presence of the `application_type` and `AIT_version` subfields is optional. If not present then the [AIT transmission and monitoring](#) applies, see 10.4.2, "AIT transmission and monitoring" on page 73.

Table 14 : application signalling descriptor syntax

	No.of Bits	Identifier
<code>application_signalling_descriptor() {</code>		
<code>descriptor_tag</code>	8	uimsbf
<code>descriptor_length</code>	8	uimsbf
<code>for(i=0; i<N; i++){</code>		
<code>application_type</code>	16	uimsbf
<code>reserved_future_use</code>	3	bslbf
<code>AIT_version_number</code>	5	uimsbf
<code>}</code>		
<code>}</code>		

descriptor_tag: This 8 bit integer with value `0x6F` identifies this descriptor.

descriptor_length: This 8 bit field indicates the number of bytes following the descriptor length field.

application_type: This 16 bit field identifies the application type of an [Application Information Table](#) sub-table that is on this elementary stream.

AIT_version_number: This 5 bit field provides the "current" version number of the [Application Information Table](#) sub-table identified by the application type field.

10.7.2 Data broadcast id descriptor

The data broadcast id descriptor is defined for use in the elementary stream information of the PMT. The descriptor identifies:

- the transport format of the data broadcast whose "principal component" is on this elementary stream.

The semantics of "principal component" is transport protocol specific.

- the set of application types for any autostart applications delivered by the data broadcast.

For a single elementary stream more than one data broadcast id descriptor may be used to list additional applications types, however, each descriptor shall indicate the same data broadcast id.

More than one elementary stream may have a data broadcast id descriptor indicating that auto start applications are carried by more than one delivery mechanism (for example a single service may have more than one object carousel delivering auto start applications).

10.7.2.1 Generic descriptor

The data broadcast id descriptor is defined in a generic form by the DVB SI-DAT specification (illustrated in table 15). Where no "id specific data" is provided the descriptor just identifies the "principal" component of a data broadcast.

Table 15 : generic data broadcast id descriptor syntax

	No.of Bits	Identifier	Value
<code>data_broadcast_id_descriptor() {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>data_broadcast_id</code>	16	uimsbf	
<code>for (i=0; i<N; i++) {</code>			
<code>id specific data</code>	8	bslbf	
<code>}</code>			
<code>}</code>			

10.7.2.2 MHP data broadcast id descriptor

When the data broadcast id is one of those defined by this specification (see table 39) the syntax of the data broadcast id descriptor is as shown in table 16. This allows the data broadcast id descriptor to provide information about the autostart applications that exist within the data broadcast.

Table 16 : MHP data broadcast id descriptor syntax

	No.of Bits	Identifier	Value
<code>data_broadcast_id_descriptor() {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>data_broadcast_id</code>	16	uimsbf	
for (i=0; i<N; i++) {			
<code>application_type</code>	16	uimsbf	
}			
}			

descriptor_tag: This 8 bit integer with value 0x66 identifies this descriptor.

data_broadcast_id: This 16 bit field indicates the format of the data broadcast transport protocol. These values are registered in ETR 162.

application_type: This 16 bit field indicates the type of the application (i.e. the engine or plug-in on which the application can be executed). See table 9 on page 75.

10.7.3 Application descriptor

Exactly one instance of the application descriptor shall be contained in every "application" (inner) descriptor loop of the AIT.

Table 17 : application descriptor syntax

	No.of Bits	Identifier	Value
<code>application_descriptor() {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>application_profiles_length</code>	8	uimsbf	
for(i=0; i<N; i++) {			
<code>application_profile</code>	16	uimsbf	
<code>version.major</code>	8	uimsbf	
<code>version.minor</code>	8	uimsbf	
<code>version.micro</code>	8	uimsbf	
}			
<code>service_bound_flag</code>	1	bslbf	
<code>visibility</code>	2	bslbf	
<code>reserved_future_use</code>	5	bslbf	
<code>application_priority</code>	8	uimsbf	
for(i=0; i<N; i++) {			
<code>transport_protocol_label</code>	8	uimsbf	
}			
}			

descriptor_tag: This 8 bit integer with value 0x00 identifies this descriptor.

application_profiles_length: This 8-bit field indicates the length of the application_profile loop in bytes.

application_profile: This 16 bit field is an integer value which represents the application type specific profile. This indicates that a receiver implementing one of the profiles listed in this loop is capable of executing the application.

version.major: This 8 bit field carries the numeric value of the major sub-field of the profile version number.

version.minor: This 8 bit field carries the numeric value of the minor sub-field of the profile version number.

version.micro: This 8 bit field carries the numeric value of the micro sub-field of the profile version number.

The four above fields indicate the minimum profile on which an application will run. Applications may test for features found in higher (backwards compatible) profiles and exploit them. The MHP terminal shall only launch applications if the following expression is true for at least one of the signalled profiles:

$$\begin{aligned}
 & (\text{application_profile} \in \text{terminal_profiles_set}) \\
 & \wedge \{ (\text{application_version.major} < \text{terminal_version.major}(\text{application_profile})) \\
 & \quad \vee [(\text{application_version.major} = \text{terminal_version.major}(\text{application_profile})) \\
 & \quad \wedge (\{ \text{application_version.minor} < \text{terminal_version.minor}(\text{application_profile}) \} \\
 & \quad \vee \{ [\text{application_version.minor} = \text{terminal_version.minor}(\text{application_profile})] \\
 & \quad \quad \wedge [\text{application_version.micro} \leq \text{terminal_version.micro}(\text{application_profile})] \})] \}
 \end{aligned}$$

Where:

∈ represents "belongs to the set of"

∧ represents "logical AND"

∨ represents "logical OR"

See table 68, "Profile encoding" on page 210 for the encoding of these values.

service_bound_flag: If this field is set to "1", the application is only associated with the current service and so the process of killing the application shall start at the beginning of the service change regardless of the contents of the destination AIT.

visibility: This 2 bit field specifies the intended visibility of the application for possible presentation to the user for possible launching. Table 18 lists the allowed values of this field.

Table 18 : Definition of visibility states for applications

visibility	description
00	This application shall not be visible either to applications via an application listing API or to users via the navigator with the exception of any error reporting or logging facility, etc.
01	This application shall not be visible to users but shall be visible to applications via an application listing API.
10	Reserved
11	This application can be visible to users and shall be visible to applications via the application listing API.

application_priority: This field identifies a relative priority between the applications signalled in this service.

- Where there is more than one application with the same [Application identification](#) this priority shall be used to determine which application is started.
- Where there are insufficient resources to continue running a set of applications, this priority shall be used to determine which applications to stop or pause.
- A larger integer value indicates higher priority.
- If two applications have the same application identification and the same priority, the MHP may make an implementation-dependent choice on which to start.

transport_protocol_label: This 8-bit field identifies a transport protocol that delivers the application. See [transport_protocol_label](#) in [Transport protocol descriptor](#).

If more than one protocol is signalled then each protocol is an alternative delivery mechanism. The ordering indicates the broadcaster's view of which transport connection will provide the best user experience (first is best). This may be used as a hint by MHP terminal implementations. It shall be evaluated only once during the life time of the application.

The protocol selection by the MHP terminal may depend on a variety of factors including user preferences and the performance of the transport connections to the terminal.

10.7.4 User information descriptors

The user information descriptors complement the "[Application descriptor](#)" by providing information suitable for presentation to the user (where the "[Application descriptor](#)" provides technical information for automatic use by the receiver).

These descriptors are defined for use in the application loop of the AIT.

10.7.4.1 Application name descriptor

Exactly one instance of this descriptor shall be included in the application information of an application. The application name shall distinguish the application and shall be informative to the user.

Table 19 : application name descriptor syntax

	No.of Bits	Identifier	Value
<code>application_name_descriptor() {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>for (i=0; i<N; i++) {</code>			
<code>ISO_639_language_code</code>	24	bslbf	
<code>application_name_length</code>	8	uimsbf	
<code>for (i=0; i<N; i++) {</code>			
<code>application_name_char</code>	8	uimsbf	
<code>}</code>			
<code>}</code>			
<code>}</code>			

descriptor_tag: This 8 bit integer with value `0x01` identifies this descriptor.

ISO_639_language_code: This 24-bit field contains the [ISO 639.2 \[19\]](#) three character language code of the language of the following bouquet name. Both ISO 639.2/B and ISO 639.2/T may be used.

Each character is coded into 8 bits according to [ISO 8859 \[20\]](#) and inserted in order into the 24-bit field.

application_name_length: This 8 bit unsigned integer specifies the number of bytes in the application name.

application_name_char: This field carries a string (not null terminated) of characters encoded in accordance with annex A of ETS 300 468. The string names the application in a manner intended to be informative to the user.

10.7.4.2 Application icons descriptor

Zero or one instance of this descriptor shall be included in the application information of an application. It allows icons to be associated with the application. The content format for these possible icons shall be restricted PNG as specified in section 15.1, "PNG - restrictions" on page 208.

Table 20 : application icons descriptor syntax

	No. of Bits	Identifier	Value
<code>application_icons_descriptor() {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>icon_locator_length</code>	8	uimsbf	
for (i=0; i<N; i++) {			
<code>icon_locator_byte</code>	8	uimsbf	
}			
<code>icon_flags</code>	16	bslbf	
for (i=0; i<N; i++) {			
<code>reserved_future_use</code>	8	bslbf	
}			
}			

descriptor_tag: This 8 bit integer with value `0x0B` identifies this descriptor.

icon_locator_length: This 8 bit integer specifies the number of characters in the string that prefixes standard icon file name.

icon_locator_byte: This 8 bit value is one byte of the icon locator string.

The icon locator is the first part of the string that specifies the location of the icon files. This is application type dependant. See table 21. The `icon_locator` shall not end with a "/" slash character.

Table 21 : Icon locator semantics

application_type	description
0x0000	reserved
0x0001	For DVB-J this is a path relative to the base directory of the application as defined in 10.9.2, "DVB-J application location descriptor" on page 92.
0x0002	For DVB-HTML this is a path relative to the physical root of the application as defined in 10.10.2, "DVB-HTML application location descriptor" on page 93.
0x0003...0xFFFF	

icon_flags: This 16 bit field carries a value which is the bitwise OR of the flag bits that identify the icons that are provided for the application. The flag bits are defined in table 22.

Table 22 : Definition of different icon flags (Sheet 1 of 2)

Icon flag bits	Description of icon size and pixel aspect ratio
0000 0000 0000 0001	32 x 32 for square pixel display
0000 0000 0000 0010	32 x 32 for broadcast pixels on 4:3 display (note 1)
0000 0000 0000 0100	24 x 32 for broadcast pixels on 16:9 display
0000 0000 0000 1000	64 x 64 for square pixel display
0000 0000 0001 0000	64 x 64 for broadcast pixels on 4:3 display
0000 0000 0010 0000	48 x 64 for broadcast pixels on 16:9 display
0000 0000 0100 0000	128 x 128 for square pixel display

Table 22 : Definition of different icon flags (Sheet 2 of 2)

Icon flag bits	Description of icon size and pixel aspect ratio
0000 0000 1000 0000	128 x 128 for broadcast pixels on 4:3 display
0000 0001 0000 0000	96 x 128 for broadcast pixels on 16:9 display
xxxx xxx0 0000 0000	Reserved for future standardisation
NOTE 1: approx. 15/16 pixel aspect ratio on 50 Hz system	

The file names for the icon files are encoded in a standard way:

```
filename      = icon_locator "/"dvb.icon." hex_string
hex_string    = 4*4hex
hex           = digit | "A" | "B" | "C" | "D" | "E" | "F" | "a" | "b" | "c" | "d" | "e" | "f"
digit        = "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
```

Where `hex_string` is the 4 digit hexadecimal representation of the value carried by `icon_flags`.

10.7.5 External application authorisation descriptor

The "common" (first) descriptor loop of the [Application Information Table](#) may contain zero or more `external_application_authorisation_descriptors`. Each descriptor contains information about external applications that are allowed to continue to run with the applications listed in this [Application Information Table](#) sub-table but cannot be launched from this service. The external authorization applies to applications with the identified `application_identifier()` that are of the `application_type` identified by the AIT subtable where this descriptor is contained.

Table 23 : external application authorisation descriptor syntax

	No.of Bits	Identifier	Value
<code>external_application_authorisation_descriptor() {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>for(i=0; i<N; i++) {</code>			
<code>application_identifier()</code>			
<code>application_priority</code>	8	uimsbf	
<code>}</code>			
<code>}</code>			

descriptor_tag: This 8-bit integer with value `0x05` identifies this descriptor.

application_identifier(): This 48-bit field identifies an application. The structure of this field is defined in [10.5](#), "Application identification" on page 76.

application_priority: This 8-bit integer specifies the priority that this application assumes in the context of the current service.

If the `0xffff` or `0xfffe` wildcard is used for the `application_id` within the `application_identifier()` and there are some applications from the same `organisation_id` explicitly signalled in the application loop of the AIT, the priority for those applications shall be the one signalled in the `application_descriptor` (see [10.7.3](#) on page 81).

See `application_priority` under [10.7.3](#), "Application descriptor" on page 81.

10.8 Transport protocol descriptors

10.8.1 Transport protocol descriptor

The transport protocol descriptor identifies the transport protocol associated with a service component and possibly provides protocol dependent information.

The descriptor may be used in either the "common" (first) descriptor loop or the "application" (inner) descriptors loop. When in the "common" loop it applies to all of the applications in that sub-table. Any such descriptors in the "application" loop describe additional transport protocols available to a specific application.

Each application described in this section shall be in the scope of at least one transport protocol descriptor.

Table 24 : transport protocol descriptor syntax

	No.of Bits	Identifier	Value
<code>transport_protocol_descriptor() {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>protocol_id</code>	16	uimsbf	
<code>transport_protocol_label</code>	8	uimsbf	
<code>for(i=0; i<N; i++) {</code>			
<code>selector_byte</code>	8	uimsbf	N1
<code>}</code>			
<code>}</code>			

descriptor_tag: This 8 bit integer with value `0x02` identifies this descriptor.

protocol_id: An identifier of the protocol used for carrying the applications. The values of the `protocol_id` are be registered here and in ETR162.

Table 25 : Protocol_id

protocol_id	description
0x0000	reserved
0x0001	MHP Object Carousel as defined in annex B, "(normative): Object carousel" on page 230.
0x0002	IP via DVB multiprotocol encapsulation as defined in EN 301 192, TR 101 202
0x0003...0x00FF	Reserved for use by DVB
0x0100...0xFFFF	Subject to registration in ETR162

transport_protocol_label: Thus 8 bit field uniquely identifies a transport protocol within this AIT section. The [Application descriptor](#) refers to this value to identify a transport connection that carries the application.

selector_byte: Additional protocol specific information.

Table 26 : Semantic of selector bytes

protocol_id	selector byte data
0x0000	reserved
0x0001	See 10.8.1.1 "Transport via OC".
0x0002	See 10.8.1.2 "Transport via IP".
0x0003...0xFFFF	Not defined in this version of the specification

10.8.1.1 Transport via OC

When the protocol ID is 0x0001 the selector bytes in the [Transport protocol descriptor](#) shall be as shown in table 27.

Table 27 : Syntax of selector bytes for OC transport

Syntax	Bits	Mnemonic
<code>remote_connection</code>	1	bslbf
<code>reserved_future_use</code>	7	bslbf
<code>if(remote_connection == "1") {</code>		
<code>original_network_id</code>	16	uimsbf
<code>transport_stream_id</code>	16	uimsbf
<code>service_id</code>	16	uimsbf
<code>}</code>		
<code>component_tag</code>	8	uimsbf

component_tag: Identifies the "principal" service component that delivers the application. The identified component is the elementary stream that carries the DSI of the object carousel.

remote_connection: This single bit flag if set to "1" indicates that the transport connection is provided by a service that is different to the one carrying the AIT. When set the following 3 fields ([original_network_id](#), [transport_stream_id](#) and [service_id](#)) are included in the selector bytes. This flag shall be set to "0" when the transport connection is provided by the current service.

Such applications shall not be autostarted by receivers but are visible (subject to the visibility field of the application descriptor) via an application listing API for possible launching by service selection (but not via an application launching API).

Applications with this flag set shall have their application control code set to REMOTE (see table 12 on page 78 and 13 on page 79).

See 11.7.2, "[Application discovery and launching APIs](#)" on page 118.

original_network_id: This 16 bit field identifies the DVB-SI original network id of the transport stream that provides the transport connection.

transport_stream_id: This 16 bit field identifies the MPEG transport stream id of the transport stream that provides the transport connection.

service_id: This 16 bit field identifies the DVB-SI service id of the service that provides the transport connection.

10.8.1.2 Transport via IP

When the protocol ID is 0x0002 the selector bytes in the [Transport protocol descriptor](#) shall be as shown in table 28.

This structure includes two important components of the `data_broadcast_descriptor` defined in EN 301 192 [5]. It provides all the information necessary for the MHP to acquire applications and application data components delivered by IP protocols. The profiles where this is an optional or mandatory feature are listed in 15, "[Detailed platform profile definitions](#)" on page 206.

Table 28 : Syntax of selector bytes for IP transport (Sheet 1 of 2)

Syntax	Bits	Mnemonic
<code>remote_connection</code>	1	bslbf
<code>reserved_future_use</code>	7	bslbf
<code>if(remote_connection == "1") {</code>		
<code>original_network_id</code>	16	uimsbf
<code>transport_stream_id</code>	16	uimsbf
<code>service_id</code>	16	uimsbf
<code>}</code>		

Table 28 : Syntax of selector bytes for IP transport (Sheet 2 of 2)

Syntax	Bits	Mnemonic
<code>alignment_indicator</code>	1	bslbf
<code>reserved_future_use</code>	7	bslbf
<code>for(i=0; i<N; i++){</code> <code>URL_length</code>	8	uimsbf
<code>for(j=0; j<URL_length; j++){</code> <code>URL_byte</code>	8	uimsbf
<code>}</code>		
<code>}</code>		

remote_connection: This and the associated 3 fields (`original_network_id`, `transport_stream_id` and `service_id`) have identical syntax and semantics to the fields with the same names under 10.8.1.1, "Transport via OC" on page 87.

alignment_indicator: This 1-bit field indicates the alignment that exists between the bytes of the `datagram_section` and the Transport Stream bytes (equivalent to the field with this name defined in the EN 301 192 [5] MPE `data_broadcast_descriptor`).

URL_length: This 8-bit field indicates the number of bytes in the URL.

URL_byte: These bytes form a URL conforming to RFC 2396 [41].

For URL using the "server" field including the host:port notation as defined in RFC 2396 [41], only numeric IP addresses shall be used for identifying IP transmissions carried in the broadcast channel as there is no Domain Name Service in the broadcast-only scenario to be used for resolving names.

IP to MAC mapping shall be done as described in RFC 1112 [45].

10.8.2 IP Routing Descriptors

The routing descriptors are defined for use in the "common" descriptor loop of the AIT. They indicate the service component location of packets for specified multicast IP addresses. The routing descriptors shall provide a complete list of all multicast IP addresses that applications in that AIT section may require.

Routing descriptors are mandatory where multicast IP is used in a service. Multiple descriptors may be used.

Two similar descriptors are defined, one for IPv4 and one for IPv6.

10.8.2.1 Routing Descriptor IPv4

Table 29 : Syntax of the IPv4 routing descriptor

Syntax	Bits	Mnemonic
<code>routing_descriptor_ip4 () {</code>		
<code>descriptor_tag</code>	8	uimsbf
<code>descriptor_length</code>	8	uimsbf
<code>for(i=0; i<N; i++) {</code>		
<code>component_tag</code>	8	uimsbf
<code>address</code>	32	uimsbf
<code>port_number</code>	16	uimsbf
<code>address_mask</code>	32	uimsbf
<code>}</code>		
<code>}</code>		

descriptor_tag: This 8-bit field with value `0x06` identifies this descriptor.

descriptor_length: This 8-bit field identifies the number of bytes following the length field.

component_tag: This 8-bit field identifies the service component that carries multicast IP packets for the specified IP address set and port.

An IP address is carried in this service component if the result of AND-ing that address with the address_mask field is equal to the address field.

address: This 32-bit field carries an IPv4 IP address.

port_number: This 16-bit field carries a port number. The value zero is a "wild card" value and indicates any port number.

address_mask: This 32-bit field carries a mask to be applied to the address field.

10.8.2.2 Routing Descriptor IPv6

Table 30 : Syntax of the IPv6 routing descriptor

Syntax	Bits	Mnemonic
routing_descriptor_ip6 () {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for(i=0; i<N; i++) {		
component_tag	8	uimsbf
address	128	uimsbf
port_number	16	uimsbf
address_mask	128	uimsbf
}		
}		

descriptor_tag: This 8-bit field with value `0x07` identifies this descriptor.

descriptor_length: This 8-bit field identifies the number of bytes following the length field.

component_tag: This 8-bit field identifies the service component that carries multicast IP packets for the specified IP address set and port.

An IP address is carried in this service component if the result of AND-ing that address with the address_mask field is equal to the address field.

address: This 128-bit field carries an IPv6 IP address.

port_number: This 16-bit field carries a port number. The value zero is a "wild card" value and indicates any port number.

address_mask: This 128-bit field carries a mask to be applied to the address field.

10.8.3 Pre-fetch signalling

10.8.3.1 Introduction

This signalling is defined to enable implementations to start fetching files that will be required during the early part of an application's life. Later in an applications' life it can actively request file pre-fetching using API mechanisms. Descriptors in this section do not have a relation to the API-based pre-fetching for this version of this specification.

This signalling is optional to broadcast and optional for implementations to consider.

10.8.3.2 Pre-fetch descriptor

Zero or one pre-fetch descriptors can be included in the "application" (inner) descriptor loop of the AIT. It is defined for use where the `protocol_id` of the transport is `0x0001` (MHP Object Carousel). Each descriptor is associated with a specific [Transport protocol descriptor](#) via the `transport_protocol_label`.

MHP terminals may use this descriptor to improve application start-up time by pre-fetching modules that have the indicated labels (see "Label descriptor" on page 232).

Table 31 : Syntax of the pre-fetch descriptor

Syntax	Bits	Mnemonic
<code>prefetch_descriptor () {</code>		
<code>descriptor_tag</code>	8	uimsbf
<code>descriptor_length</code>	8	uimsbf
<code>transport_protocol_label</code>	8	uimsbf
<code>for(i=0; i<N; i++) {</code>		
<code>label_length</code>		
<code>for(j=0; j<label_length; j++) {</code>		
<code>label_char</code>	8	uimsbf
<code>}</code>		
<code>prefetch_priority</code>	8	uimsbf
<code>}</code>		
<code>}</code>		

descriptor_tag: This 8-bit field with value `0x0C` identifies this descriptor.

descriptor_length: This 8-bit field identifies the number of bytes following the descriptor length field.

transport_protocol_label: This 8-bit field identifies the [Transport protocol descriptor](#) that specifies the transport connection that delivers the modules to which this prefetch descriptor refers. See "[transport_protocol_label](#)" on page 82.

label_length: This 8-bit field identifies the number of bytes in the module label.

label_char: These 8-bit fields carry an array of bytes that are a module label. This label matches a label on one or more module carried by [Label descriptors](#) in the `userInfo` fields of the `moduleInfo` structure of DIIs (see "Label descriptor" on page 232).

The same module label may be attached to several modules.

prefetch_priority: A value between 1 and 100 (both inclusive). It expresses a pre-fetching hint of the modules with the corresponding label using the specified priority (100 highest, 1 lowest).

10.8.3.3 DII location descriptor

For each application zero or one DII location descriptors can be provided. It can be located in either the "common" (first) or "application" (inner) descriptor loop of the AIT. It is defined for use where the `protocol_id` of the transport is `0x0001` (MHP Object Carousel). Each descriptor is associated with a specific [Transport protocol descriptor](#) via the `transport_protocol_label`.

The modules that are part of a DSM-CC object carousel are signalled in `DownloadInfoIndication` (DII) messages. The object carousel does not list all the existing DII messages in a single place.

In order to find all of the modules that match a particular pre-fetch label (see 10.8.3.2, "Pre-fetch descriptor" on page 90), it is necessary that all the relevant DII messages can be found. The DII location descriptor lists the locations of these DII.

If DII location descriptor is not included, then only the DII that signals the module that contains the `ServiceGateway` shall be taken into account when looking for modules matching a particular label.

The DII identifications in the loop should be sorted on importance. The DII that contains the label(s) with the highest pre-fetch priority should be listed first. Receivers that implement module-based pre-fetching should examine the DIIs for labels in the order in which they are listed in the DII location descriptor.

Table 32 : Syntax of the DII location descriptor

Syntax	Bits	Mnemonic
<code>DII_location_descriptor () {</code>		
<code>descriptor_tag</code>	8	uimsbf
<code>descriptor_length</code>	8	uimsbf
<code>transport_protocol_label</code>	8	uimsbf
<code>for(i=0; i<N; i++) {</code>		
<code>reserved_future_use</code>	1	bslbf
<code>DII_identification</code>	15	uimsbf
<code>association_tag</code>	16	uimsbf
<code>}</code>		
<code>}</code>		

descriptor_tag: This 8-bit field with value `0x0D` identifies this descriptor.

descriptor_length: This 8-bit field identifies the number of bytes following the descriptor length field.

transport_protocol_label: This 8-bit field identifies the [Transport protocol descriptor](#) that specifies the transport connection that delivers the modules to which this prefetch descriptor refers. See "[transport_protocol_label](#)" on page 82.

DII_identification: This 15-bit field identifies the DII message. It corresponds to the identification portion of the transactionId. See B.32, "[Sub-fields of the transactionId](#)" on page 251.

association_tag: This 16-bit field identifies the connection (i.e. elementary stream) on which the DII message is broadcast.

10.9 DVB-J specific descriptors

10.9.1 DVB-J application descriptor

One instance of this descriptor shall be contained in the "application" (inner) descriptor loop of the AIT for each DVB-J application. It provides start-up parameter information.

Table 33 : DVB-J application descriptor syntax

	No.of Bits	Identifier	Value
<code>dvb_j_application_descriptor(){</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>for(i=0; i<N; i++) {</code>			
<code>parameter_length</code>	8	uimsbf	
<code>for(j=0; j<parameter_length; j++) {</code>			
<code>parameter_byte</code>	8	uimsbf	
<code>}</code>			
<code>}</code>			
<code>}</code>			

descriptor_tag: This 8 bit integer with value `0x03` identifies this descriptor.

parameter_length: This 8 bit integer specifies the number of bytes in the `parameter_byte` string.

parameter_byte: The parameter bytes contain an array of strings that are passed to the application as parameters.

10.9.2 DVB-J application location descriptor

One instance of this descriptor shall be contained in the "application" (inner) descriptor loop of the AIT for each DVB-J application. It provides various items of path information to allow the DVB-J application to be found and then operated.

Table 34 : DVB-J application location descriptor syntax

	No. of Bits	Identifier	Value
<code>dvb_j_application_location_descriptor {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>base_directory_length</code>	8	uimsbf	
<code>for(i=0; i<N; i++) {</code>			
<code>base_directory_byte</code>	8	uimsbf	
<code>}</code>			
<code>classpath_extension_length</code>	8	uimsbf	
<code>for(i=0; i<N; i++) {</code>			
<code>classpath_extension_byte</code>	8	uimsbf	
<code>}</code>			
<code>for(i=0; i<N; i++) {</code>			
<code>initial_class_byte</code>	8	uimsbf	
<code>}</code>			
<code>}</code>			

descriptor_tag: This 8 bit integer with value `0x04` identifies this descriptor.

base_directory_length: This 8 bit integer specifies the number of bytes in the `base_directory_byte` string.

base_directory_byte: These bytes contain a string specifying a directory name starting from the root of the file system with directories delimited by the slash character "/" (0x2F). This directory is used as a base directory for relative path names. This base directory is automatically considered to form the first directory in the class path (after the path to the system's classes).

If the base directory is the root the string shall be "/".

classpath_extension_length: This 8 bit integer specifies the number of bytes in the `classpath_extension_byte` string.

classpath_extension_byte: These bytes contain a string specifying a further extension for the DVB-J class path where the classes of the application are searched in addition to the base directory. The class path extension string contains path names where the elements in the path are delimited by the semicolon character ";" (0x3B). The elements of the path may be either absolute paths starting from the root of the file system or they can be relative to the base directory. The directories are delimited by the slash character "/" (0x2F) and absolute path names begin with the slash character "/" (0x2F).

initial_class_byte: These bytes contain a string specifying the name of the object in the file system that is the class implementing the Xlet interface.

This string is a DVB-J class name that is found in the class path (e.g. "com.broadcaster.appA.MainClass").

10.10 DVB-HTML Specific descriptors

10.10.1 DVB-HTML application descriptor

One instance of this descriptor shall be contained in the "application" (inner) descriptor loop of the AIT for each DVB-HTML application. It indicates the value of the application parameters and signals the control applied by the broadcaster on the state of the application.

Table 35 : DVB-HTML application descriptor syntax

	No. of Bits	Identifier	Value
<code>dvb_html_application_descriptor() {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>appid_set_length</code>	8	uimsbf	N1
<code>for(i=0; i<N1; i++) {</code>			
<code>application_id</code>	16	bslbf	
<code>}</code>			
<code>for(j=0; j<N; j++) {</code>			
<code>parameter_bytes</code>	8	uimsbf	
<code>}</code>			
<code>}</code>			

descriptor_tag: This 8 bit integer with value `0x08` identifies this descriptor.

appid_set_length: This 8 bit integer specifies the length of the list of `application_ids`.

application_id: The values of these 16 bit fields form a set of application ids (see 10.5, "Application identification" on page 76). The semantics of this information is not defined in this specification.

parameter_bytes: The parameter bytes contain the string that is appended to the application initial path as parameters.

10.10.2 DVB-HTML application location descriptor

This descriptor is for use in the application loop of the AIT. It indicates the physical location of the application entry point in the transport media.

Table 36 : DVB-HTML application location descriptor syntax

	No. of Bits	Identifier	Value
<code>dvb_html_application_location_descriptor () {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
<code>physical_root_length</code>	8	uimsbf	N1
<code>for(i=0; i<N1; i++) {</code>			
<code>physical_root_bytes</code>		uimsbf	
<code>}</code>			
<code>for(i=0; i<N; i++) {</code>			
<code>initial_path_bytes</code>	8	uimsbf	
<code>}</code>			
<code>}</code>			

descriptor_tag: This 8 bit integer with value `0x09` identifies this descriptor.

physical_root_length: This 8 bit integer specifies the length of the `physical_root_byte` string.

physical_root_bytes: These bytes contain a string specifying the physical root of the application entry point. The semantic of this string is transport protocol specific as shown in table 37 "Transport specific semantic of physical root bytes".

Table 37 : Transport specific semantic of physical root bytes

protocol_id	semantic
0x0000	reserved
0x0001	A directory specification
0x0002	One of the base URLs defined in the Transport protocol descriptor signalled for the application (see 10.8.1.2, "Transport via IP" on page 87).
0x0003...0xFFFF	TBD

initial_path_bytes: These bytes contain a string specifying the URL path component to the entry point document. This path is relative to the root defined in the [physical_root_bytes](#) field.

10.10.2.1 Example

The following example describes the usage of the DVB-HTML application location descriptor.

An application author designs an HTML application in the following manner:

- The application data is distributed among several directories, let say an "image" directory and a "main" directory.
- The application entry point is an HTML document called "index.htm" and stored in the "main" directory.

10.10.2.2 Application Entry Point

From the application author's point of view, the application entry point is specified by the path "main/index.htm". This path is stored in the [initial_path_bytes](#) string of the location descriptor.

If the broadcaster inserts this application in a file system sub-directory called "application", the [physical_root_bytes](#) content of the location descriptor will be the string "application/".

If the broadcaster uses a transport via IP for this application, they shall signal the used protocol and IP address in the [Transport protocol descriptor](#) associated with this application and the [physical_root_bytes](#) field shall contain the corresponding URL string.

10.10.3 DVB-HTML application boundary descriptor

This descriptor is defined for use in the application loop of the AIT. It provides a regular expression that describes the data elements that form the application.

This descriptor is optional. When absent, the application boundary defaults to the complete set of all content coming from the transport signalled in the [Transport protocol descriptor](#) associated with the application.

Multiple boundary descriptors can be used for the same application. In this case, the equivalent global regular expression is the OR combination (union) of the individual regular expressions.

Table 38 : DVB-HTML application boundary descriptor syntax

	No.of Bits	Identifier	Value
<pre> dvb_html_application_boundary_descriptor { descriptor_tag descriptor_length label_length for(i=0; i<N1; i++) { label_bytes } for(i=0; i<N; i++) { regular_expression_bytes } } </pre>	8	uimsbf	N1
	8	uimsbf	
	8	uimsbf	
	8	uimsbf	

descriptor_tag: This 8 bit integer with value `0x0A` identifies this descriptor.

label_length: This 8 bit integer specifies the length of the `label_bytes` string.

label_bytes: These bytes contain a string specifying the label that is associated with the set of data identified by the regular expression. This label can be used for pre-fetching in a transport specific manner.

regular_expression_bytes: These bytes contain a string specifying the regular expression that can generate all URLs that are in the domain of the application.

See 9.3.1.4.1, "Regular Expression Syntax" on page 64.

10.11 Constant values

Table 39 : Registry of constant values

Where used	Type	Value	Where Defined	Scope			
private data specifier descriptor	descriptor tag	0x5F	PSI & SI tables	SI			
Data broadcast id descriptor		0x66	PMT				
Application Signalling Descriptor		0x6F	PMT				
Service identifier descriptor		0x71	SDT				
Label descriptor	descriptor tag	0x70	DII moduleInfo userInfo	SI-DAT			
Caching priority descriptor		0x71					
Content type descriptor		0x72	BIOP objectInfo (note 1)				
reserved to MHP for future OC descriptors		0x73-0x7F	OC				
reserved to MHP for future use	table ID on AIT PID	0x00-0x73		MHP			
Application Information Table		0x74					
reserved to MHP for future use		0x75-0x7F					
reserved for private use		0x80-0xFF					
Application descriptor	descriptor tag	0x00	AIT	MHP			
Application name descriptor		0x01					
Transport protocol descriptor		0x02					
DVB-J application descriptor		0x03					
DVB-J application location descriptor		0x04					
External application authorisation descriptor		0x05					
Routing Descriptor IPv4		0x06					
Routing Descriptor IPv6		0x07					
DVB-HTML application descriptor		0x08					
DVB-HTML application location descriptor		0x09					
DVB-HTML application boundary descriptor		0x0A					
Application icons descriptor		0x0B					
Pre-fetch descriptor		0x0C					
DII location descriptor		0x0D					
reserved to MHP for future use		0x0E-0x5E					
private data specifier descriptor (note 2)		0x5F					
reserved to MHP for future		0x60-0x7F					
User defined (note 3)		0x80-0xFE					
MHP Object Carousel		data broadcast id			0x00F0	PMT, AIT	SI
reserved for MHP Multi Protocol Encapsulation					0x00F1		
reserved to MHP use	0x00F0 - 0x00FE		PMT, AIT	SI			
MHP Application Service	service type	0x10	SDT	SI			
<p>NOTE 1: Strictly MessageSubHeader::ObjectInfo in the file message and the bound object info in a file binding of a directory or service gateway message.</p> <p>NOTE 2: The DVB SI private data specifier descriptor is defined for use in the Application Information Table to introduce private descriptors.</p> <p>NOTE 3: All user defined descriptors shall be within the scope of a private data specifier descriptor (see 10.4.7, "Use of private descriptors in the AIT" on page 76).</p>							

10.12 Service Information

10.12.1 Service identifier descriptor

Zero or more service identifier descriptors may be included in the SDT description of a service. Each such descriptor defines a single textual identifier for the service. The syntax of this identifier is specified in 14.9.1, "Syntax of the textual service identifier" on page 204.

A single service identifier can be assigned to services in different physical networks even if they have different `original_network_id` and `service_id`. A given service identifier shall only be associated with services that are considered to be the same service.

NOTE: It is up to the service provider to decide which services are "same" and which are not. For example, two services in two different networks where the service have the same programme content but different regional adverts could be generally considered to be the "same" service. However, this decision is entirely up to the service provider.

More than one service identifier may be allocated to a service instance.

Table 40 : Service identifier descriptor

	No.of Bits	Identifier	Value
<code>service_identifier_descriptor () {</code>			
<code>descriptor_tag</code>	8	uimsbf	
<code>descriptor_length</code>	8	uimsbf	
for (i = 0; i < descriptor_length; i++) {			
<code>textual_service_identifier_bytes</code>	8	uimsbf	
}			
}			

descriptor_tag: This 8 bit integer with value `0x71` identifies this descriptor.

textual_service_identifier_bytes: These bytes contain the unique identifier for a service encoded using the normal encoding for text strings in DVB SI.

11 DVB-J Platform

11.1 The Virtual Machine

The DVB-J virtual machine is defined in [Java VM \[34\]](#), as amended by [JVM Errata \[68\]](#) plus the Inner Classes specification in [Inner Classes \[69\]](#).

11.2 General issues

11.2.1 Basic Considerations

Unless otherwise specified in this specification, MHP implementations are not required to include any classes or methods marked as deprecated in those API specifications which are either referenced by or included in this specification.

A DVB-J application is considered to logically run in its own virtual machine instance. For this reason, it cannot rely on finalizers that are defined in application classes being run when the application terminates. When the application manager terminates the entity that represents the virtual machine in which the application is run, a conformant implementation is permitted to not run application finalizers, as spelled out in section 2.17.9 of the [Java Language Spec \[32\]](#).

DVB-J applications shall not synchronize on system classes or other exposed system static objects else undefined behaviour may occur.

SecurityExceptions shall only be thrown either where they are declared as part of the description of the method concerned or where identified in this specification for those referenced packages which do not include any SecurityExceptions.

It is an allowable implementation choice to not override methods as long as the defined semantics are respected. The implication of this is that such differences between implementations will be visible when using the `java.lang.reflection` package.

The inclusion of java packages shall not imply the inclusion of other sub packages e.g. the inclusion of the `javax.tv.media` package does not automatically imply the inclusion of the `javax.tv.media.protocol` sub package. Inclusion of sub packages shall be explicitly listed in this specification.

DVB-J applications shall not use additional public or protected methods or fields in the `org.dvb` namespace which are not listed in this specification. Applications which scale to run on multiple revisions of this specification shall only use `org.dvb` methods etc. appropriate to the version of the platform on which they are running.

11.2.2 Approach to Subsetting

Where a class included in this specification has methods with signature dependencies on classes not included in the implemented profile, these methods are not required to be present in an implementation. A compliant implementation choice may require these methods and classes to be present.

Where this specification subsets a package, inclusion of the complete package is allowed but clearly not required. The behaviour of the additional features is not specified for broadcast applications.

11.2.3 Class Loading

The DVB-J application environment shall be written such that each application appears to run within its own classloader or classloader hierarchy for all classes that are not a part of the platform. As a consequence, two applications will never be able to access the same copy of any application-defined static variable.

Signed applications shall only load classes signed by the same leaf certificate.

See 12, "Security" on page 136.

Inappropriate, meaningless or illegal locators are silently skipped and searching continues.

11.2.4 Unloading

Class unloading as defined by section 12.8 of [Java Language Spec \[32\]](#) and section 2.16.8 of [Java VM \[34\]](#) will be supported.

11.2.5 Event listeners

In `org.dvb` and `org.davic` all methods to remove event listeners shall have no effect if the listener is not registered.

11.2.6 Event model in DAVIC APIs

Events defined in the DAVIC APIs [DAVIC 1.4.1p9 \[3\]](#) shall extend `java.util.EventObject`. Event listeners defined in [DAVIC 1.4.1p9 \[3\]](#) shall extend `java.util.EventListener`.

11.2.7 Event model in DAVIC & DVB APIs

Each class in `org.dvb` and `org.davic` inheriting from `java.util.EventObject` is just a container for these fields and no validity checks are done for the parameters by this constructor. Instances of these classes are intended to be constructed by the platform implementation and not by applications. The platform implementation will only construct these events with the appropriate information passed in.

In `org.dvb` and `org.davic` all methods to add event listeners add each listener only once if the add method is called with the same parameters multiple times. This means that the same event is delivered only once to each listener even if it has been added twice.

11.2.8 Tuning as a side-effect

No MHP API shall cause tuning unless explicitly specified as such. For example, if a locator that requires tuning is received by the `DVBClassLoader` it shall behave as if the specified file is not available.

11.2.9 Intra application media resource management

Where an application makes conflicting requests for limited media decoding resources, the media decoding resources that are requested most recently are presumed to be the ones that are most wanted. This applies between MPEG-2 I-Frames, MPEG-2 Video "drips" and streaming video. Similarly, this applies between streaming audio and audio from memory.

When a non broadcast media presentation (audio or video from memory or still image) is interrupted by a resource loss within the same application, the first presentation is cancelled and will not be restored.

If a broadcast media presentation is interrupted by a resource loss within the same application, the broadcast presentation is restored when the interrupting presentation ends.

11.2.10 Application thread priority

The `ThreadGroup` of application threads shall have a `MaxPriority` of 5.

NOTE: As a consequence applications will not be able to create threads at priorities greater than 5 since they don't have `java.lang.RuntimePermission("modifyThread")`. Applications may perform compute intensive tasks within application created threads without being considered unresponsive.

11.3 Fundamental DVB-J APIs

11.3.1 Java platform APIs

The following packages are defined in [JAE 1.1.8 API \[31\]](#). See also 11.8.1.3, "Other classes" on page 125.

11.3.1.1 java.lang package

The java.lang package is supported with the following modifications.

- a) The following methods shall always throw a SecurityException when called by inter-operable applications:

```
Runtime.exec(),
Runtime.load(),
Runtime.loadLibrary(),
System.exit(),
System.load(),
System.loadLibrary(),
```

- b) MHP implementations are not required to include the following methods:

```
Runtime.runFinalizersOnExit(),
System.runFinalizersOnExit(),

Thread.destroy(),
Thread.stop(),
Thread.suspend(),
Thread.resume(),
Thread.countStackFrames(),
ThreadGroup.stop(),
ThreadGroup.suspend(),
ThreadGroup.resume(),
ThreadGroup.allowThreadSuspension()
```

- c) The following fields shall not be used by inter-operable applications:

```
System.in
```

- d) The following classes shall not be used by inter-operable applications:

```
java.lang.Process
```

- e) Applications shall be able to use:

```
System.out,
System.err,
Runtime.traceInstructions(),
Runtime.traceMethodCalls()
```

for debugging without any adverse effects to the application. The output shall not be visible to normal end users and shall not conflict with any other API.

- f) The `java.lang.Compiler` class and following methods shall be taken as hints from an application to the system however there is no guarantee of what happens:

```
Runtime.gc(),
System.gc()
```


g) Only the following properties are required to be supported for `System.getProperty()` and `System.getProperties()`:

`file.separator`,
`path.separator`,
`line.separator`,

`dvb.persistent.root` (see section 11.5.6, "Persistent Storage API" on page 115)

With the exception of `dvb.persistent.root` all of these properties are accessible to unauthorised applications. `dvb.persistent.root` is accessible only to authorised applications.

Property names beginning "dvb." are reserved for future use.

h) The `System.setProperties()` and `System.setSecurityManager()` methods will always throw an exception when called by downloaded DVB-J applications.

i) The class `SecurityManager` shall be as specified in [PersonalJAE \[36\]](#).

The call `System.currentTimeMillis()` shall feature a granularity of the returned time value of not more than 10 ms. With the call `Object.wait(long timeout)`, the timeout value is specified as a maximum time to wait. The MHP further guarantees that if not notified the object will wait for at least `timeout - 10` ms.

11.3.1.2 `java.lang.reflect` package

The `java.lang.reflect` package is supported.

11.3.1.3 `java.util`

The `java.util` package is supported. The constants in the `Locale` class do not imply support (or otherwise) for these Locales. Locales supported in the MHP are specified in profiles (see 15.4, "Locale support" on page 209).

11.3.1.4 `java.util.zip`

The `java.util.zip` package is supported with the exception of the following classes:

- `Deflater`
- `DeflaterOutputStream`
- `GZIPOutputStream`
- `ZipOutputStream`
- `Adler32`

11.3.1.5 `java.io`

The `java.io` package is supported.

11.3.1.6 `java.net`

From the `java.net` package, the `java.net.URL` and `java.net.InetAddress` classes and the exceptions `MalformedURLException` and `UnknownHostException` only are supported. Unless included in the platform as part of a specific profile, All the rest of this package is to be non-supported as defined in section 11.2.2, "Approach to Subsetting" on page 98. The signature dependencies from these to the rest of this package are severed as described in 11.2.2, "Approach to Subsetting" on page 98.

Support is required for at least one implementation dependant `java.net.URL` protocol. The `Class.getResource` method shall return instances of `java.net.URL` using such a protocol where no appropriate protocol is defined in this specification.

Support is required for the "file:" protocol. Applications shall be able to construct instances of `java.net.URL` using strings containing "file:" URLs as defined in [RFC 1738 \[67\]](#) where the `<host>` element is the empty string and the `<path>` element is an absolute filename.

The method `URL.getContent` shall work as specified in its specification even though the reference to the URL connection is not valid in all MHP profiles.

The return types of `URL.getContent()` are defined by the mappings from data type to java class name listed in table 41 "Return types of `URL.getContent()`".

Table 41 : Return types of `URL.getContent()`

Data type	Return type
Unknown or unsupported data types	<code>java.io.InputStream</code>
<code>text/plain</code>	<code>java.io.InputStream</code>
<code>text/dvb.utf8</code>	<code>java.io.InputStream</code>
<code>text/Generic</code>	<code>java.io.InputStream</code>
<code>image/png</code>	<code>java.awt.image.ImageProducer</code>
<code>image/jpeg</code>	<code>java.awt.image.ImageProducer</code>
<code>image/mpeg</code>	<code>org.havi.ui.HBackgroundImage</code>

The behaviour of `URL.getContent()` responds to data type using information with the following priority:

- a) Content type signalling such as:
 - the content type descriptor in the OC (see B.2.3.4, "Content type descriptor" on page 236).
 - the HTTP header (if supported in the profile) the Content-Type header field (if present)
- b) The filename extension (if known) (see table 4, "File type identification" on page 53)
- c) Open the file & study

`getContenttype` returns the value contained in the optional content type descriptor in the OC (see B.2.3.4, "Content type descriptor" on page 236) if present.

`getFileNameMap` returns information derived from table 4, "File type identification" on page 53.

11.3.1.7 `java.beans`

The `java.beans` package is supported.

11.3.1.8 `java.math`

From the `java.math` package `java.math.BigInteger` is supported.

11.3.2 MHP platform APIs

11.3.2.1 `org.dvb.lang`

The `org.dvb.lang` package is supported as defined in annex I, "(normative): DVB-J fundamental classes" on page 289.

The valid types of locator for use with `DVBClassLoader` shall include the following:

- `org.davic.net.dvb.DVBLocator`

That contains a valid reference to a component within a service and file path component referencing a directory within the carousel identified by the referenced component.

Where no parent is specified at creation, the delegation parent classloader of `DVBClassLoader` shall be the original classloader of the calling application.

ClassLoader delegation is defined in the specification for `java.lang.ClassLoader` in [PersonalJAE \[36\]](#).

11.3.2.2 org.dvb.event

The `org.dvb.event` package is supported as defined in annex J, "(normative): DVB-J event API" on page 293.

When sending events from a `org.dvb.event.EventManager` to listeners, the implementation shall ensure that any single listener shall only be sent one platform generated event instance at one time. If a new event is generated before the listener method has returned from processing a previous event, the MHP terminal shall not call that listener method until the call for processing the previous event returns.

The behaviour where applications have multiple such event listeners registered is implementation dependent. Implementations may use multiple threads to send the same event instance to any such multiple listeners. Implementations may ensure that at most one event listener in any one application for all these events is executing at any one time.

11.4 Presentation APIs

11.4.1 Graphical User Interface API

11.4.1.1 The Core GUI API

The following package is defined in [JAE 1.1.8 API \[31\]](#).

The following classes and interfaces from the `java.awt` package are included in the MHP specification:

- `Adjustable`
- `AWTError`
- `AWTEvent`
- `AWTEventMulticaster`
- `AWTException`
- `BorderLayout`
- `CardLayout`
- `Color`
- `Component`
- `Container`
- `Cursor`
- `Dimension`
- `EventQueue`
- `FlowLayout`
- `Font`
- `FontMetrics`
- `Graphics`
- `GridBagConstraints`
- `GridBagLayout`
- `GridLayout`
- `IllegalComponentStateException`
- `Image`
- `Insets`
- `ItemSelectable`
- `LayoutManager`
- `LayoutManager2`
- `MediaTracker`
- `MenuContainer`
- `Point`
- `Polygon`
- `Rectangle`
- `Shape`
- `Toolkit` (as detailed below)

The entire `java.awt.event` package is included.

Property names for use with the `getProperty` method on `java.awt.Image` and its sub classes beginning "dvb." are reserved for future use.

See also 11.8.1.3, "Other classes" on page 125.

The signature dependencies from `Component` to `PopupMenu` (the `add` method) and `MenuComponent` (the `remove` method) are severed as described in 11.2.2, "Approach to Subsetting" on page 98. The same applies for all references to the `java.awt.peer` package.

In the `Toolkit` class, the following methods are required:

- `getDefaultToolkit`,
- `getFontList`,
- `getFontMetrics`,
- `sync`,
- `getColorModel`,
- and all the methods relating to images.

The following two methods are added to the `Toolkit` class from [PersonalJAE \[36\]](#). These two methods shall not cache `java.awt.Image` objects.

- `public abstract Image createImage(String filename);`
- `public abstract Image createImage(URL url);`

The image caching behaviour of the following two methods is now observed as explicitly specified in [PersonalJAE \[36\]](#). These two methods cache `java.awt.Image` objects so that two calls with the same argument return the same object.

- `public abstract Image getImage(String filename);`
- `public abstract Image getImage(URL url);`

Applications shall be able to use `Toolkit.beep` without any adverse effects to the application. The output is not required to be audible to normal end users and shall not conflict with any other API.

The methods `getScreenResolution` and `getScreenSize` shall be supported with the additional semantics described in [HAVi \[50\]](#). The methods `getSystemEventQueue` and `getSystemEventQueueImpl` are supported however each Xlet will have a unique queue not shared with other Xlets or anything else in the system.

All of the `java.awt.image` package is required. The encoding of image content types for use by `java.awt.image` are defined in 7.1.1, "Bitmap image formats" on page 47. The set of formats supported is profile dependent.

When using the `java.awt.FontMetrics` class, the width of a set of characters or string returned by the `charsWidth` or `stringWidth` method shall be correct taking into account any kerning and sub-pixel positioning applied by the font renderer. Calculating the same number by adding the widths of the individual characters is not required or expected to return the same number since it will not take into account any kerning or sub-pixel positioning applied by the font renderer.

The downloading of fonts from the network (see D.2.2, "Downloaded fonts" on page 263) shall be supported using the methods concerned on `org.dvb.ui.FontFactory`. Failure to download a font shall be reported by these methods. The constructor for `java.awt.Font` shall only be aware of platform resident fonts.

11.4.1.2 TV user interface

The packages `org.havi.ui` and `org.havi.ui.event` defined in [HAVi \[50\]](#) shall be supported. Instances of `org.havi.ui.event.HRCEvent` are reported through the normal `java.awt` event mechanism due to the inheritance from `java.awt.event.KeyEvent`.

With the exception of the `HSound.load` method, no methods specified in [HAVi \[50\]](#) shall throw a security exception in the MHP context. The permissions for `HSound.load` are those defined for `java.io`.

The `DVBTextLayoutManager` specified in U, "(normative): Extended graphics APIs" on page 592 shall be supported.

The following semantics shall be used for the `getVideoController` method on `HVideoDevice`.

- It shall only return JMF players (see [Java Media Player Specification \[33\]](#)) which are in the Prefetched or Started states and which are using that `HVideoDevice` as one of their scarce resources. Otherwise null will be returned. It shall not return JMF players from other applications if those are using the video device underlying the `HVideoDevice`.
- Except as specified below, it shall only return JMF players which have been already created in response to the application calling `javax.media.Manager.createPlayer` or which have been returned by `javax.tv.service.selection.ServiceContext.getServiceContentHandlers` (see [Java TV \[51\]](#)).
- The only exception to the above is the situation where video is being played in the background as part of the context of an application but where `javax.tv.service.selection.ServiceContext.getServiceContentHandlers` has not yet been called. In this case, `getVideoController` shall return the same JMF player as would be returned by `getServiceContentHandlers` if it was to be called subsequently.

The signatures of the classes `HComponent` and `HContainer` shall be extended with `"implements org.dvb.ui.TestOpacity"`.

The methods `HGraphicsConfiguration.getPunchThroughToBackgroundColor` shall not be used by inter-operable applications.

The methods `fontAvailable()` and `downloadFont()` in the class `org.havi.ui.HFontCapabilities` shall not be used by inter-operable applications.

The package `javax.tv.graphics` defined in [Java TV \[51\]](#) shall be supported.

11.4.1.3 Extended graphics

See U, "(normative): [Extended graphics APIs](#)" on page 592.

11.4.1.4 Handling of input events

The MHP includes two ways for applications to receive input events: the normal AWT method in `java.awt.Component` and the `org.dvb.event` package (see 11.3.2.2, "[org.dvb.event](#)" on page 103). Via the normal AWT method, the application normally receives all input events when the component has the focus. The minimum set of input events that are supported is defined in G.5, "[Input events](#)" on page 286.

Often the resident Navigator software of the MHP terminal uses many of the keys on the remote control for its own navigation purposes. An MHP application having the AWT focus will consume the defined input events by itself which possibly may cause them not to be delivered to the resident Navigator.

To ensure consistent user experience, the following rules are defined:

- an application creating a `Scene` and placing components into it shall not by default get the input focus for these components
- the application may request to get the input focus by calling `Component.requestFocus()`. If this is granted and the focus moved to the requested component, this component shall receive input events as defined in J.1 on page 293.
- the application may request to receive a subset of input events via the `org.dvb.event` API even when not having the AWT focus.

For applications delivered within normal television services, it is recommended that the following items are taken into account:

- when the display is primarily showing the video of the television service and the user perception is that he is not actively interacting with an application but is just watching the television service (this state is later called 'television viewing mode'), the applications should not request the AWT focus but let most of the input events go to the resident Navigator (e.g. number keys, directional arrow keys and Enter may cause the normal actions the user expects from the Navigator)
- in the 'television viewing mode' the applications should request only the minimum required input events, e.g. only input events that cause some further action to happen and that may transition the user from the 'television viewing mode' into a state where the user more actively interacts with the applications.
- if the applications require some input events for the user to be able to activate the application when in the 'television viewing mode', it is recommended that the VK_COLOURED_KEY_(0...3) and VK_TELETEXT (see note below) input events are used for this purpose and the applications request them via the org.dvb.event API. In practice this means that the navigator can not map any essential function directly to the VK_COLOURED_KEY(0...3) events in television viewing mode.
- MHP applications wishing to leave "tv viewing mode" and receive events other than the VK_COLOURED_KEY_(0...3) and VK_TELETEXT are obliged to display a non-transparent graphics object on the screen that covers at least 3 % of the visible area on the screen (equivalent to 9852 pixels on a 634x518 visible screen in a 720x576 graphics mode) which clearly indicates to the user the "non-navigator" mode of the receiver with respect to input event handling.

NOTE 1: In television services where DVB Teletext is transmitted within the service, a typical Navigator action in the 'television viewing mode' can be to activate a teletext decoder, if supported by the terminal. The application requesting this input event may cause the DVB Teletext decoder not to be conveniently accessible to the end user. Therefore, within services that carry DVB Teletext it is recommended that the VK_TELETEXT input event is requested in the 'television viewing mode' only by such applications that provide a simulcast MHP application version of the teletext service, thus providing a replacement for the DVB Teletext information.

In environments where WST Teletext services are prevalent when there is no DVB Teletext service associated with the video service, the MHP application should display an information service of a similar nature to teletext. When receiving this event for the second time the information service should terminate and the user will return to normal viewing mode.

The VK_TELETEXT event should have no other purposes in MHP applications.

NOTE 2: The items above apply only to the 'television viewing mode' as explained above. In states where the user experience is that the user is clearly primarily interacting actively with an application the applications can naturally use the normal AWT input event mechanism and request the focus as well as use any of the supported input events via the org.dvb.event API.

NOTE 3: For data services, the first interaction state of an application that is automatically started after service selection should behave as television viewing mode. This is in order to allow users who are navigating with the navigator to seamlessly navigate through these services without getting confused.

11.4.2 Streamed Media API

11.4.2.1 Framework of solution

The `javax.media` and `javax.media.protocol` packages from Java Media Framework as defined in [Java Media Player Specification \[33\]](#) shall be implemented with the clarifications, extensions and restrictions as defined in the corresponding sections below.

11.4.2.2 Clarifications

The JMF "time base time" when playing MPEG content delivered in MPEG transport streams is used as a constantly progressing time whose rate may be synthesized from the Program Clock References / the System Time Clock in MPEG or by some other appropriate method. The value does not have any direct relation to the value of the MPEG System Time Clock in the receiver.

The media time of JMF when playing MPEG content delivered in MPEG transport streams is just a time value that progresses as the media stream is played, but whose actual value is implementation dependent.

NOTE: There is no implied or expected connection between the JMF media time and any time base(s) provided by the MPEG-2 / DSM-CC Normal Play Time.

When creating a JMF player, Locators and URLs which reference a DVB service, event or elementary stream will create a player which plays the content concerned direct from the network. Locators and URLs which reference files will create a player which will download the content concerned from the network during the Prefetching state of the player concerned. If the content cannot be downloaded then such players will never enter the Prefetched state.

Interoperable applications shall not call `javax.media.MediaHandler.setSource()`.

In the `javax.media.PackageManager`:

- a) The effect of the `set<xxx>PrefixList` methods is limited to the application calling the method.
- b) The `SecurityException` is always thrown in MHP.

`SubtitlingLanguageControl.isSubtitlingOn()` returns the current state of subtitle presentation and NOT the last value set with `setSubtitling`. In particular `setSubtitling` may be set to true but if there are no subtitles in the network or no subtitle service component selected then `isSubtitlingOn` shall return false.

Any elements in `DVBLocators` after and including the `event_id` element are ignored by JMF players.

11.4.2.3 Default media player behaviour

For a JMF player which is presenting a DVB service, the following rules will be followed in the order given to decide which service components will be presented when multiple audio, video or subtitle components are present in a service:

- a) For audio and subtitle streams in different languages, user preferences will be used to determine which streams are selected.
- b) The streams which are first in the network signalling information (i.e. in the appropriate SI table) will be presented.

If any of the media components comprising the service change then the implementation will as far as possible replace the changed components with suitable replacements in a user preference and implementation dependant manner.

11.4.2.4 Required controls for video drips

The following controls are supported for video drips (see 7.1.3, "MPEG-2 Video "drips"" on page 47):

- `javax.tv.media.AWTVideoSizeControl`
- `org.dvb.media.BackgroundVideoPresentationControl`

11.4.2.5 Extensions to the Framework

11.4.2.5.1 DVB specified extensions

The classes and interfaces defined in annex N, "(normative): Streamed Media API Extensions" on page 413 of this specification are included.

11.4.2.5.2 Extensions in org.davic

The following classes and interfaces will be included from the `org.davic.media` package, as defined in annex L of [DAVIC 1.4.1p9 \[3\]](#).

- `MediaPresentedEvent`
- `MediaLocator`
- `MediaTimePositionControl`
- `FreezeControl`
- `ResourceWithdrawnEvent`
- `ResourceReturnedEvent`
- `MediaTimePositionChangedEvent`
- `LanguageNotAvailableException`
- `NotAuthorizedException`
- `NotAuthorizedMediaException`
- `MediaFreezeException`
- `LanguageControl`
- `AudioLanguageControl`
- `SubtitlingLanguageControl`

The following classes will be included from the `org.davic.media` package as defined in annex L of [DAVIC 1.4.1p9 \[3\]](#) with the following semantic modification:

- The completion of the action started by calling `setMediaTimePosition()` on the `MediaTimePositionControl` will be signalled by a `org.davic.media.MediaTimePositionChangedEvent`.
- The `org.davic.media.MediaPresentedEvent` shall only be thrown following changes caused using controls in the `org.davic` package and as part of the transition of a JMF player into the Started state. In this second case, it augments the JMF state transition events and does not replace them.

NOTE: Changes effected using `javax.tv.media.MediaSelectControl` do not lead to the `org.davic.media.MediaPresentedEvent` being thrown.

11.4.2.5.3 Extensions in javax.tv

The package `javax.tv.media` defined in [Java TV \[51\]](#) shall be implemented.

In `javax.tv.media.MediaSelectControl` the `InsufficientResourcesException` is thrown by the `select()` method if selecting any service component fails due to a lack of system resources.

In `javax.tv.media.AWTVideoSize.equals()`, the "data members" shall be considered to be the "source" and "dest" parameters used to create the object.

11.4.2.5.4 Required controls for broadcast profiles

The following controls are supported for the broadcast streaming formats specified in 7.2, "Broadcast streaming formats" on page 49:

- org.davic.media.LanguageControl
- org.davic.media.AudioLanguageControl
- org.davic.media.SubtitlingLanguageControl
- org.davic.media.FreezeControl
- javax.tv.media.MediaSelectControl
- javax.tv.media.AWTVideoSizeControl
- org.dvb.media.VideoPresentationControl
- org.dvb.media.BackgroundVideoPresentationControl
- org.dvb.media.SubtitlingEventControl
- org.dvb.media.VideoFormatControl

The following controls are supported for media decoded from 7.1, "Static formats" on page 47:

- org.davic.media.MediaTimePositionControl

11.4.2.5.5 Clarifications

In SubtitlingLanguageControl, subtitling being presented shall be defined as the subtitle decoder running. It does not require subtitles to be visible on screen at that time. See 13.5, "Subtitles" on page 194.

When a PresentationChangedEvent is generated, the Player in question should re-evaluate the list of controls returned by the getControls() method for that player. Similarly, Players supporting the MediaSelectControl should re-evaluate the list of Controls returned by getControls() after calls to the MediaSelectControl.select() method is called.

Any controls referenced by an application after a PresentationChangedEvent or a MediaSelectSucceededEvent is generated may fail silently if they are no longer valid. Controls which are valid for the new content remain unaffected. Applications should re-acquire any controls they require after either of these events has been generated.

11.4.2.6 Restrictions on the Framework for Broadcast

Controls that are supported the MHP need not have an associated GUI component. Any calls to Control.getComponent() may return null.

Developers of MHP applications should not rely on the presence of the following classes or interfaces:

- javax.media.CachingControl (unless returned by a call to a JMF method)
- javax.media.CachingControlEvent
- javax.media.GainControl (unless returned by a call to a JMF method).

An MHP implementation need not return a CachingControl or GainControl from a call to Player.getControls() however this is not prohibited. If an MHP implementation does return a GainControl, then the volume that is set using this control may not be greater than the system volume level. I.e. the gain control may only change the volume between mute and the volume level at the time the application was started. This system volume level shall be represented as 1.0.

JMF Players are not required to return a `java.awt.Component` from their `getVisualComponent` method and may return null. Players which return null can only be used to present video in the background. Players which return a `java.awt.Component` must fully support the semantics for `java.awt.Component` concerning positioning and scaling.

Players start as background players. If a `getVisualComponent` returns a component then a player is also capable of performing as a component based player. Video shall continue running in the background until the first call to the `paint` method of the component returned `getVisualComponent`. When this transition happens the video is resized and repositioned as required by the `visualComponent`. Possible areas outside of the component are updated to follow the rules in 13.3, "Graphics" on page 183.

After this transition, applications shall re-acquire the list of JMF controls for the player. It is implementation dependent whether any previous JMF controls are re-used. Applications shall not use any previous JMF controls which are not in the new list of JMF controls. When a JMF player is performing as a component based player, the following JMF controls shall not be supported and video scaling & positioning shall be done by controlling the size & position of the component returned by the `getVisualComponent` method.

- `org.dvb.media.BackgroundVideoPresentationControl`
- `javax.tv.media.AWTVideoSizeControl`

Applications should not expect `PushDataSource` and `PullDataSource` to exist for broadcast MPEG content, and it is not required that functional implementations be provided for implementations of JMF in DVB. The `DataSource` used may be implementation-specific and non-specified apart from its inheritance from `javax.media.protocol.DataSource`.

The constructor for `URLDataSource` may always throw `IOException` for broadcast MPEG content.

For the purposes of integration with `javax.tv.media.MediaSelectControl` "resynchronization" is not considered to occur provided that the same `PCR_PID` is referenced between the new and existing service components.

Implementations of JMF shall not tune but shall allow selection of media components from transport streams which can be reached without tuning even where they are not part of a currently selected service.

11.4.2.7 Intersection Between `MediaSelectControl` and `SubtitlingLanguageControl` / `AudioLanguageControl`

The method `org.davic.media.LanguageControl.listAvailableLanguages()` shall list all available languages in the service concerned. This includes languages carried in service components which are not currently selected, either because the service component concerned has been de-selected using `MediaSelectControl` or because it was never selected initially because it was not carried in one of the components listed in the component tags of a locator which included component tags.

The method `org.davic.media.LanguageControl.selectLanguage()` shall over-ride any selection of service components made either by `javax.tv.media.MediaSelectControl` or by using a locator for a service which included component tags. If `selectLanguage()` has changed the set of service components selected, the methods on `javax.tv.media.MediaSelectControl` shall behave as if that change had been made through `MediaSelectControl` and return the correct set of service components taking into account the change made by `selectLanguage()`.

If the methods on `javax.tv.media.MediaSelectControl` are used to replace or remove the service component carrying the currently active audio or subtitles then the presentation of this service component shall stop. If the methods on `javax.media.MediaSelectControl` are used to add a service component carrying audio or subtitles when a service component of this media type is not already being presented then presentation of this service component shall be started. The language of the newly selected service component shall be returned by calls from the application to the method `getCurrentLanguage` on `AudioLanguageControl` or `SubtitlingLanguageControl` respectively. Attempting to select multiple service components of the same media type to be presented at the same time using methods on `MediaSelectControl` shall fail unless the MHP terminal concerned has sufficient resources to present them simultaneously. The failure mode shall be that as specified in `MediaSelectControl` for when insufficient resources are available.

Where methods on `MediaSelectControl` are used to modify the set of selected service components and this causes changes in the state of subtitles, the events `org.dvb.media.SubtitleSelectedEvent` and `SubtitleNotAvailableEvent` will be generated as appropriate

Control of the availability of subtitles using `MediaSelectControl` or the methods `selectLanguage` & `selectDefaultLanguage` (which `SubtitlingLanguageControl` inherits from `LanguageControl`) shall not impact the value of "Application Control" as mentioned in figure 34, "Determining subtitling language and presentation setting" on page 194 and vice versa.

11.4.2.8 Intersection between Streamed Media API and TV User Interface API

11.4.2.8.1 Basic Principles

Some of the decoder format controls pre-defined as part of `org.dvb.media.VideoFormatControl` may require control over the pixel aspect ratio of the final video output signal after video, graphics and backgrounds have been combined as shown in figure 17 on page 179. In order to enable this, a JMF player shall attempt to reserve the `HVideoDevice` instance on which its output is being displayed. Failure to reserve the `HVideoDevice` shall not be considered fatal to the JMF player but may result in an inferior TV video presentation.

NOTE: The actual configurations of the `HVideoDevice` used and available are dependent on the precise configuration of the MHP terminal. Differences will exist between set-top boxes, integrated digital TVs and PCs. The precise nature of any "inferior TV video presentation" is dependent on the configuration of the MHP terminal, on the input video and the characteristics of the final output device.

11.4.2.8.2 TV Behaviour Control

The "TV Behaviour Control" in figure 31, "Format control in the presence of a JMF player" on page 192, is the default video transformation behaviour for JMF players which have none other set. Setting the `VideoTransformation` to `DFC_PLATFORM` shall set the video format control to TV behaviour control mode.

NOTE 1: In this mode, any changes in the video input signal where "television behaviour control" which require changing the pixel aspect ratio of the final output signal (i.e. after the combination of video with graphics, subtitles & backgrounds) will also change the pixel aspect ratio of any graphics, subtitles & backgrounds combined into that one final output signal.

NOTE 2: For an example of "TV behaviour control" in set-top boxes and integrated digital TVs, see [E-Book \[I\]](#).

11.4.2.8.3 Application Behaviour Control

When an MHP application is controlling video presentation through `BackgroundVideoPresentationControl` (for video in the background) or `VideoPresentationControl` & methods on `java.awt.Component` (for video in a component), the application is responsible for monitoring the incoming video format & changing the video presentation if desired.

Instances of `VideoTransformation` constructed using the constructor of that class do not shall not impact the configuration of the `HVideoDevice`. Instances of `VideoTransformation` returned by `VideoFormatControl.getVideoTransformation` shall have the same impact on the `HVideoDevice` as the equivalent conversion applied in "TV behaviour control mode". These may not be fully achievable if the JMF player does not have the `HVideoDevice` reserved.

11.4.2.8.4 Dynamic Behaviour

A JMF player shall attempt to reserve the `HVideoDevice` instance on entry to the `Prefetched` state from any state except the `Started` state. A JMF player in the `prefetched` or `started` states which does not have the `HVideoDevice` reserved shall attempt to reserve it only when the application which created the JMF player calls the `setVideoTransformation` method of the control `org.dvb.media.BackgroundVideoPresentationControl`. A JMF player leaving the `Started` or `Prefetched` state for the `Realized` state shall release the `HVideoDevice` if it has it reserved.

A JMF player which has the `HVideoDevice` reserved and then loses the right to control that device shall post an instance of the event `org.davic.media.ResourceWithdrawnEvent` to all registered listeners for `ControllerEvents` on that `Player` instance. If the right to control that device is subsequently recovered when an attempt to reserve the device (as defined above) succeeds, then an `org.davic.media.ResourceReturnedEvent` shall be posted.

11.4.2.8.5 Resource Management Details

Inter-operable applications shall not call any of the methods on the instance of `ResourceClient` returned by `HVideoDevice.getClient` when a JMF player has reserved that `HVideoDevice` instance.

Inter-operable applications are allowed to call `HVideoDevice.release` or `HVideoDevice.setConfiguration` directly. JMF implementations shall tolerate this behaviour when it happens.

11.5 Data Access APIs

11.5.1 Broadcast Transport Protocol Access API

The broadcast transport protocol access API is defined in section P, "[\(normative\): Broadcast Transport Protocol Access](#)" on page 463.

Relative file names used to access objects in the carousel shall be taken as being relative to the base directory indicated in 10.9.2, "[DVB-J application location descriptor](#)" on page 92. Calling `new DSMCObject(".")` or `new java.io.File(".")` will instantiate the directory object that refers to the base directory as indicated in 10.9.2, "[DVB-J application location descriptor](#)" on page 92.

11.5.1.1 Constraints on the java.io.File methods for broadcast carousels

The application shall be able to use the standard java.io.File class for access to broadcast carousels (e.g. a carousel unaware application). In this case, the following definitions shall apply:

- the constructor of File only creates an instance of the abstract pathname and shall not cause synchronous access to the broadcast carousel that would block the thread
- after the constructor of the DVB-J File object has been run, the directory entry information relating to this object may be in an unloaded state. The information relating to this object (e.g. its length) comes from the parent directory which is not required to have been loaded at this point by the constructor. However, this information may be available if the implementation has the information in cache.
- if the directory entry information for a DVB-J File object is in the unloaded state, then this information shall be synchronously loaded when any of the following methods are called on the object: `canRead()`, `exists()`, `isDirectory()`, `isFile()`. If the loading fails, all these methods shall return false. The effect of the loading is equivalent to calling the `synchronousLoad` method on a File object corresponding to the parent directory.
- after the constructor has been run, the content of the object may be in unloaded state. However, it may also be loaded if the implementation has the information in cache.
- if the content is in unloaded state, it shall be synchronously loaded when the `list()` method is called for a directory. If this implicit load should result in a service transfer, it shall not be done implicitly and the `list()` shall return an empty list.
- the method `lastModified()` returns `moduleVersion` from the DII for the module that carries the file (treating the octet as an unsigned integer).
- any version changes in a file after the constructor for an `InputStream` is called will not be visible in the data read from that `InputStream`.
- list methods shall return null when called on a object that isn't a directory.
- the creation of a `FileInputStream` shall throw `FileNotFoundException` if the referenced object is not a file.
- Failure of a signed file to be authenticated shall be reported by the constructor for the `InputStream` throwing an `IOException`.
- Failure of a signed directory to be authenticated shall be reported by the list methods returning null when called on a file object representing the directory whose authentication failed.
- The value returned by `java.io.file.Length()` may not be accurate as it returns the value from the directory information rather than the actual size of the file

There are no guarantees that the most recent version of a file will be returned unless the network signalling specifies that the file concerned requires transparent access.

11.5.1.2 Methods dealing with write access

The `java.io.File` class also contains methods that assume write access to the file system. Due to its broadcast nature, the receiver naturally does not have write access to the carousel. It should be noted, however, that a broadcast carousel is not a read-only file system (which has the property of not changing). The carousel content can certainly be written and modified, but only by broadcaster - not the receiver. Therefore, the situation is equivalent to a Unix file system where the user has only read permissions, but not write permissions or ownership of the files.

The following `java.io.File` methods deal with write access to directories: `canWrite()`, `mkdir()`, `makedirs()`, `renameTo()`.

For abstract pathname entries in the broadcast carousel, the following behaviour shall apply:

- `canWrite()` returns false to indicate that the file can not be written to
- `mkdir()`, `makedirs()` and `renameTo()` return false to indicate that the request failed

11.5.1.3 Behaviour following loss of a broadcast file system

When a broadcast file system is lost to an application as described in 6.2.5.3, "Loss of Carousel Behaviour" on page 44, the following failure modes shall be followed for data which is unavailable.

- Attempting to load data from a file using a content format specific API shall fail as if the file itself never existed. This shall be done according to the specific API concerned.
- The classloader created by the platform when the application was first launched never attempts to automatically recover following loss of its initial broadcast file system.
- Attempting to load a class which is unavailable shall fail as if the class was never present.
- After the constructor for an `InputStream` has been successfully called, the data for that `InputStream` shall be maintained by the platform until the `InputStream` is closed. This is the same behaviour as specified for `InputStream` and file version changes in 11.5.1.1, "Constraints on the `java.io.File` methods for broadcast carousels" on page 113.
- Attempting to create a `FileInputStream` for a file whose data is unavailable shall fail with a `FileNotFoundException`.
- Attempting to create a `RandomAccessFile` for a file whose data is unavailable shall fail with an `IOException`.
- Attempting to use a `FileDescriptor` of a `FileInputStream` whose data is unavailable shall result in a `FileInputStream` or `InputStreamReader` where all methods shall throw an `IOException`.
- Attempting to call methods on a `File` object whose data is unavailable shall fail in the same way as if the `File` itself never existed.

11.5.2 Support for Multicast IP over the Broadcast Channel

Where support for IP over the broadcast channel is included, the following classes and packages shall be supported in addition to those listed above for the case where IP support is not included.

- The `javax.tv.net` package as defined in Java TV [51] is included.
- The methods listed below from `java.net.MulticastSocket` shall be supported for one way IP Multicast support. All other methods in the class shall either throw exceptions where possible or fail silently when called on receive only IP Multicast systems.

```
MulticastSocket()
MulticastSocket(int port)
InetAddress getInterface()
void joinGroup(InetAddress mcastaddr)
void leaveGroup(InetAddress mcastaddr)
void setInterface(InetAddress inf)
```

- The methods listed below from `java.net.DatagramSocket` shall be supported for one way IP Multicast support. These methods are inherited by `MulticastSocket`. All other methods in the class shall throw exceptions where possible or fail silently when only called on receive only IP Multicast systems.

```
DatagramSocket()
DatagramSocket(int port)
DatagramSocket(int port, InetAddress local)

void close()
int getSoTimeout()
void receive(DatagramPacket p)
void setSoTimeout(int timeout)
int getLocalPort()
InetAddress getLocalAddress()
```

d) The following classes from `java.net` shall be supported:-

- `DatagramPacket`
- `SocketException`
- `UnknownHostException`
- `ProtocolException`
- `BindException`

e) The class `org.dvb.net.DatagramSocketBufferControl` shall be supported see Q, "(normative): [Datagram Socket Buffer Control](#)" on page 524.

f) Behaviour if unsupported:

When the application tries to `joinGroup()` on a Multicast address, `ProtocolException` shall be thrown to indicate failure on joining the group.

11.5.3 Support for IP over the Return Channel

Where support for IP over the return channel is included, all of the `java.net` package shall be included. Platforms not implementing specific optional return channel protocols shall fail as defined in the specification of this API.

On devices whose return channel can be connected or disconnected, connecting a `java.net.Socket` or a `java.net.URLConnection` to a host addressed via the return channel shall automatically setup a connection to the default connection target subject to the application having return channel permission for the default ISP. Such connections shall be automatically disconnected after a time out period defined in the Navigator.

See 11.10, "[Java permissions](#)" on page 127.

See also 11.8.1.3, "[Other classes](#)" on page 125.

11.5.4 MPEG-2 Section Filter API

The MPEG-2 section filter API is defined in annex E of [DAVIC 1.4.1p9](#) [3].

11.5.5 Mid-Level Communications API

See Annex R, "(normative): [DVB-J Return Channel Connection Management API](#)" on page 527.

11.5.6 Persistent Storage API

The API to persistent storage shall be the `java.io` package and the extensions to it found in the `org.dvb.io.persistent` defined in annex K, "(normative): [DVB-J persistent storage API](#)" on page 309.

The "`dvb.persistent.root`" property which can be obtained from `java.lang.System.getProperty()` identifies the directory at the root of the file name space used for persistent storage. This value shall be the same for all applications. Accessing any files or directories in the parent directory of this root or directories above that shall throw a `SecurityException` as defined in the specification for the `java.io` package. Applications shall have read only access to this root directory. Applications shall have automatic read and write access to the sub-directories `<organisation_id>` and `<organisation_id> + <file.seperator> + <application_id>`. See 14.5, "[Text encoding of application identifiers](#)" on page 202. The fields `<organisation_id>` and `<application-id>` are hexadecimal text encodings (without leading zeros) of the fields in the 48 bit application identifier of the application concerned as defined in 10.5, "[Application identification](#)" on page 76. These directories must be automatically created by the platform. The owner of the organisation directory shall be the platform and it shall always have organisation read / write and world read access. The platform shall set the owner of the application directory to the application with read and write access for that application and no access for other applications.

All files in persistent storage shall store the 48 bit application identifier of their creator as the "owner" of the file. Only the owner of the file is entitled to change the file attributes and file access rights. The owner of a file cannot be changed once a file is created. Applications may only create files or directories in directories to which they have write access. The existing semantics for the `java.io` package are respected.

11.6 Service Information and Selection APIs

11.6.1 DVB Service Information API

The DVB specific SI API is defined in annex M, "(normative): SI Access API" on page 329.

11.6.2 Service Selection API

The service selection API is defined by the `javax.tv.service.selection` package from Java TV [51].

On the first occasion when the method `ServiceContext.getServiceContentHandlers` is called for a specific service, any JMF players returned shall always be in the started state and if they are presenting video, that video shall always be presenting on the background video device.

Applications shall re-acquire the list of service content handlers after a service selection completes. It is implementation dependent whether any previous handlers are re-used. JMF players which are not re-used are stopped and may be disposed by the platform. Where a JMF player is re-used, it shall be reset to a default condition as if it was not being re-used. In particular the implementation shall cancel all listeners previously defined and reset any previously defined characteristics such as video scaling or positioning.

The exception `javax.tv.services.selection.ServiceContextException` shall never be thrown by MHP terminals.

The default media player behaviour following service selection is defined under 11.4.2.3, "Default media player behaviour" on page 107.

The protected constructor of `ServiceContextFactory` is for implementation use. MHP applications shall not subclass `ServiceContextFactory`. Implementations are not required to behave correctly if they should do this.

Implementations of this API are required to perform tuning as part of implementing the `ServiceContext.select()` method where the new service to be selected is part of a transport stream known to the MHP terminal but not currently tuned to.

11.6.3 Tuning API

The tuning API is defined in annex H of DAVIC 1.4.1p9 [3] apart from section H.4, (the `Locator` and `DvbLocator` classes) which are found in section 11.7.6 "Content Referencing".

The following methods in this package shall throw `java.lang.SecurityException` where and only where the application does not have a `org.dvb.net.tuning.TunerPermission`:

- `NetworkInterfaceController.reserve`
- `NetworkInterfaceController.reserveFor`

The class `org.davic.net.tuning.dvb.DvbNetworkInterfaceSIUtil` is not required.

See also 11.8.3, "Additional permissions classes" on page 125.

11.6.4 Conditional Access API

The conditional access API is defined in annex I of [DAVIC 1.4.1p9 \[3\]](#).

The following classes are not supported as defined in section 11.2.2 "Approach to Subsetting" - CA1Module, CA0Module, CA1Message, CA0Message, CA1ModuleResponseEvent and CA0ModuleResponseEvent.

Physical CI modules or embedded systems following the CI protocol can produce MMI messages. The API implementation, subject to security model, passes those to be presented by the application if the application is interested. Otherwise CA dialogs are generated.

The following methods in this API may throw `java.lang.SecurityException`:-

- `CAModuleManager.addMMIListener`
- `CAModule.queryEntitlement`
- `CAModule.listEntitlements`
- `CAModule.buyEntitlement`
- `CAModule.openMessageSession`

The `sessionIDs` used in CI message passing are unique to a single application and access shall fail if shared between applications.

See also 11.8.3, "Additional permissions classes" on page 125.

11.6.5 Protocol Independent SI API

The protocol independent SI API is defined by the following packages from [Java TV \[51\]](#):

- `javax.tv.service`
- `javax.tv.service.guide`
- `javax.tv.service.navigation`
- `javax.tv.service.transport`

The mapping of this onto the DVB-SI protocol is specified in annex O, "(normative): Integration of the JavaTV SI API and DVB SI" on page 456.

Cancellation shall fail if the request is no longer pending. It is implementation dependent if cancellation fails under any other circumstances. Implementations are not required to support cancellation of requests between when the requested SI data has arrived in the device and when execution of the `notifySuccess` method starts.

The interface `javax.tv.service.ServiceMinorNumber` is not required to be implemented by any object defined in this specification.

11.7 Common Infrastructure APIs

11.7.1 APIs to support DVB-J application lifecycle

This API is formed of the Java classes and interfaces found in the `javax.tv.xlet` package specified in [Java TV \[51\]](#).

11.7.1.1 Xlet properties

The following named Xlet properties are introduced:

- `dvb.org.id`
- `dvb.app.id`
- `dvb.caller.parameters`

They can be retrieved from an Xlet's `XletContext` by calling `getXletProperty` with the string name defined above.

All keys for `XletContext.getXletProperty` beginning 'dvb.' are reserved for use in DVB project specifications.

The array of strings returned by `XletContext.getXletProperty(XletContext.ARGS)` shall be the array of strings defined in the [DVB-J application descriptor](#) (see [10.9.1 on page 91](#)) in the same order as specified in the signalling. Each entry in the loop of that descriptor shall be presented as one string in the array returned by this method, interpreted using the encoding as specified in [10.4.8, "Text encoding in AIT" on page 76](#). Zero-length strings in the signalling shall be represented as the empty string.

11.7.1.2 Actions for DVB-J applications to perform in their destroy method

Xlets shall perform at least the following in their `Xlet.destroyXlet` method and before calling `XletContext.notifyDestroyed`:

- cause any threads that they have created to exit voluntarily. See ["java.lang package" on page 100](#).
- stop, deallocate and close any JMF players that they have created.
- stop and destroy any JavaTV service selection `ServiceContext` objects that they created.
- release any other scarce resources that they created, e.g. `NetworkInterfaceControllers` if they do any tuning.
- flush any images using the `Image.flush()` method.
- Xlets shall not cause any unnecessary delay in their `Xlet.destroyXlet` method.
- de-register any event listeners

11.7.2 Application discovery and launching APIs

This API is formed of the `org.dvb.application` package defined in [S, "\(normative\): Application Listing and Launching" on page 550](#).

The following properties are defined for use with the method `AppAttributes.getProperty`:

Table 42 : Application attribute properties (Sheet 1 of 2)

Property name (note 1)	Return
<code>dvb.j.location.base</code>	Returns String containing <code>base_directory_bytes</code> from DVB-J application location descriptor.
<code>dvb.j.location.cpath.extension</code>	Returns <code>String[]</code> derived from <code>classpath_extension_bytes</code> of DVB-J application location descriptor with each array entry corresponding to a pathname entry as defined for <code>classpath_extension_bytes</code> .

Table 42 : Application attribute properties (Sheet 2 of 2)

Property name (note 1)	Return
dvb.transport.oc.component.tag	Returns Integer containing the component_tag from the selector bytes of the transport protocol descriptor
NOTE 1: Property names beginning "dvb." are reserved for future use.	

The following table defines the source of the information which shall be used for methods returning information from entries in the application database for an application signalled in an AIT. This version of this specification does not require support for applications signalled by any other means.

Table 43 : Information source for methods on AppAttributes

Method	Information source
getName()	One of the names that can be found in the application name descriptor.
getName(String ISO639code)	A name of the application from the application name descriptor corresponding to the specified language.
getNames()	All of the names for the application which can be found in the application name descriptor and their ISO 639 language code.
getProfiles()	The set of profiles signalled in the application profile field of the application descriptor.
getPriority()	The contents of the application_priority field of the application descriptor.
getVersions(String profile)	The values version.major, version.minor and version.micro for the specified profile from the application descriptor.
getIsServiceBound()	True if the service_bound field in the application descriptor is set to 1. Otherwise false.
isStartable()	An application shall be considered to be transmitted on a remote connection where the application control code in the signalling is REMOTE. An application shall be considered to be not available any more where the corresponding entry has been removed from the AIT and the implementation has detected this.
getIdentifier()	The contents of the application_identifier field of the application information section.
getServiceLocator()	An application shall be considered to be transmitted on a remote connection only where the application control code in the signalling is REMOTE. The locator for a remote application shall encapsulate the values found in the selector bytes of the transport protocol descriptor.

Table 44 : Information source for methods on Applcon

Method	Information source
getLocator()	The bytes carried in the application_locator_byte of the application icons descriptor appended to either the base directory of the application (where the application type from the application information section is zero, from the DVB-J application location descriptor) or the physical root (where the application type from the application information section is 1, from the DVB-HTML application location descriptor).
getIconFlags()	The icon_flags field of the application_icon_descriptor.

Applications signalled in an AIT shall be considered to be externally authorised where their only signalling in that AIT is by an [External application authorisation descriptor](#).

11.7.3 Inter-Application communication API

The javadoc for the `org.dvb.io.ixc` package is provided in annex Y, "(normative): [Inter-application communication API](#)" on page 1100. An example is provided in W.2, "[Example of exporting an object for inter-application communication](#)" on page 1090.

This API is formed of the interfaces `java.rmi.Remote` and `java.rmi.RemoteException`, and the classes `java.rmi.NotBoundException` and `java.rmi.AlreadyBoundException` as specified in JAE 1.1.8 API [31], plus the package `org.dvb.io.ixc`.

Two named Xlet properties are introduced: `dvb.org.id` and `dvb.app.id`. They can be retrieved from an Xlet's `XletContext` by calling `getXletProperty("dvb.org.id")` and `getXletProperty("dvb.app.id")`, respectively.

11.7.3.1 Remote Call Semantics

An object may be communicated to another Xlet in two ways:

- A reference to the remote object can be passed,
- or
- a copy of the remote object can be made.

These two techniques are called "pass by remote reference", and "pass by remote copy". When an object that has been bound to the IXC Registry via a method of `org.dvb.io.ixc.IxcRegistry` is imported by another, it shall be passed by remote reference.

11.7.3.1.1 Objects Passed by Remote Reference

An object that is passed by remote reference must implement a remote interface. A remote interface is an interface that implements the marker interface `java.rmi.Remote`. The declared type of a parameter or a return value for a remote method invocation must be a remote interface, or a class whose instances are serializable. If a remote interface that is application-defined, the interface definition must be included in both the sending and receiving Xlet. If the two xlets contain an identically named remote interfaces that contain different declarations, the result of attempting to use these interfaces for inter-Xlet communication is undefined, and possibly implementation dependent.

When an object is passed by remote reference to a different Xlet, the receiving Xlet does not receive a direct reference to the exported object; rather, it receives an instance of a stub class. This stub class will not be a subclass of the remote object's runtime type; rather, it will be a platform-generated class that implements the remote interface type that is the declared type of the argument or return value. It will include implementations of all methods declared in the remote interface, and will contain no other members accessible to the application. Remote methods invoked on this stub class instance will be forwarded to the object in the original Xlet, and executed in the context of that Xlet.

The definition of the stub class shall be automatically created by the platform.

NOTE: This differs from traditional network RMI, where the stub classes are created by the developer using a tool such as `rmic`. If stub classes produced by `rmic` or any other off-line tool are present, the platform shall silently ignore them for the purposes of inter-Xlet communication.

The stub class that is generated shall include a definition for all of the remote methods defined on the class of the original object. A remote method is a method declared in a remote interface that is implemented by the given class. A remote interface is an interface that extends `java.rmi.Remote`, either directly or indirectly. Methods declared in a remote interface must be defined as follows:

- Each method must declare `java.rmi.RemoteException` in its `throws` clause, in addition to any application-specific exceptions.
- A remote object passed by remote reference as an argument or return value must be declared as an interface that extends `java.rmi.Remote`, and not as an application class that implements this remote interface.
- The type of each method argument must either be a remote interface, a class or interface that implements `java.io.Serializable`, or a primitive type.
- Each return value must either be a remote interface, a class or interface that implements `java.io.Serializable`, a primitive type, or `void`.

If any remote method does not follow these rules, the platform cannot generate a stub class. When one is required, a `RemoteException` shall instead be thrown to the caller.

11.7.3.1.1.1 Lifecycle Considerations for Remote Objects

When an Xlet is destroyed, it is possible that other Xlets may have remote references to some of the Xlet's objects. If a method is invoked on one of these remote objects, the platform may fail to execute the method, and instead throw a `RemoteException`. If a remote method call is in progress when the Xlet receiving the call is destroyed, the calling Xlet may receive a `RemoteException` on the calling thread, and the remote method invocation may be abruptly terminated. If a remote method has started executing code in the implementation of the remote object when the Xlet making the call is destroyed, the call shall run to completion, unless the Xlet receiving the call is also destroyed.

11.7.3.1.1.2 Exceptions in Remote Method Calls

If an exception is thrown from a remote method, a remote copy of that exception shall be made in the context of the calling Xlet. This copy of the exception shall be thrown to the caller.

11.7.3.1.1.3 Re-exported Objects

It is possible that an object passed from one Xlet to another might be passed back to the original Xlet. This could happen through any number of intervening Xlets. If this happens, the original Xlet will receive the instance that it originally exported. If it compares the instance it receives with the original instance using the Java `==` operator, the result will be true. Because of this, there is no need to provide an override of `java.lang.Object.equals()` or `java.lang.Object.hashCode()` for remote objects.

NOTE: This behaviour is different than network RMI, as implemented in traditional Java implementations. In Sun's implementation of network RMI, a remote stub object is given to the original Xlet, but stubs and remote objects are required to have a special version of the `equals()` and `hashCode()` methods.

11.7.3.1.2 Objects Passed by Remote Copy

An object is passed by remote copy when a method argument or return value is passed, where the class of that object does not implement `java.rmi.Remote`. Additionally, a remote method call exception is communicated to the receiving Xlet by remote copy, as described in 11.7.3.1.1.2, "Exceptions in Remote Method Calls" on page 121.

When an object is passed by remote copy, it is serialized into a byte stream in the context of the exporting Xlet, and deserialized in the context of the importing Xlet. Serialization is performed as defined for `java.io.Serializable`. Application-defined classes may be serialized, but the definition of the application-defined class must be present in both Xlets, and the external forms of both versions of the class must be compatible. If any error in serialization or deserialization occurs, an instance of `java.rmi.RemoteException` shall be thrown.

11.7.3.1.2.1 Treatment of Primitive Types

Primitive types passed as method arguments or return values are copied.

11.7.3.1.3 Classloading Considerations

The presence of inter-xlet communication does not allow the loading of one Xlet's classes from another. No classloader that loads classes from a remote Xlet for remote method calls is created (unlike network RMI, which creates a special `RMIClassLoader` for remote objects). Rather, a copy of each application-defined remote interface and serializable object involved in a remote method invocation must be present in both Xlets. If this is not the case, the platform shall generate a `RemoteException` and throw it in the calling thread.

11.7.3.1.4 Thread Usage

A remote method may or may not execute in separate underlying thread. If an application makes a remote method invocation to a remote object in a different application, and that second application calls back to the first in the same "thread," then the first application might or might not observe that the original calling thread and the callback thread are the same instance of `java.lang.Thread`.

If an application makes simultaneous remote calls in separate threads, then the remote execution shall appear to be carried out in parallel.

NOTE: This is not meant to rule out thread-pooling techniques. Specifically, an implementation may choose to serialize such remote calls, as long as the first one completes within a reasonably short time, relative to the normal scheduling rules of Java threads.

11.7.3.1.5 Garbage Collection of Remote Objects

When a non-destroyed Xlet contains a reachable instance of a stub for a remote object, that remote object shall not be garbage collected, unless the remote Xlet is destroyed. When an exported object no longer has any remote stub objects that are reachable in other non-destroyed Xlets, and when that exported object is also not reachable locally within its Xlet, then that remote object shall be considered unreachable, and thus eligible for reclamation.

When an Xlet is destroyed, other Xlets may hold remote references to objects within the Xlet being destroyed. In this case, the referenced objects may be dereferenced and ultimately garbage collected. If this is done, then attempts to invoke remote methods on these objects shall result in a `RemoteException` to the caller.

11.7.4 Basic MPEG Concepts

This API is formed of the Java classes defined in annex G of [DAVIC 1.4.1p9 \[3\]](#):

- `ApplicationOrigin`,
- `ElementaryStream`,
- `Service`,
- `TransportStream`,
- `DvbElementaryStream`,
- `DvbService`,
- `DvbTransportStream`.

Methods returning instances of elementary stream, service or transport stream shall return instances of the dvb specific subclass (`DvbElementaryStream` etc.).

11.7.5 Resource Notification

The resource notification API is defined in annex F of [DAVIC 1.4.1p9 \[3\]](#).

- The `notifyRelease()` method shall be called for all `ResourceClients` where the corresponding resource has been removed without the application releasing it. The `release()` method shall be called for specific resources where time to cleanup is of practical use considering the specific resource in question. The only one of these in this specification is connection oriented return channels.
- The `requestData` parameter of the `requestRelease` method shall implement the `java.rmi.Remote` interface. In APIs using the `ResourceProxy` interface, where the method to reserve the resource has a parameter 'requestData', this parameter shall also implement the `java.rmi.Remote` interface or be `null`. Use of other values shall result in `null` being used when `requestRelease()` is called. Implementing the `Remote` interface does not force `java.rmi` to be used when the current owner of the resource is in the same application as code requesting ownership.
- The `resourceProxy.getClient()` method shall always return the `ResourceClient` provided to the platform by the application when that instance of a `ResourceProxy` was created or reserved. The `ResourceClient` for the current owner of a resource is only returned when this method is called on the `ResourceProxy` which currently holds the resource concerned.

This text clarifies the `DAVIC` javadoc with respect to multiple simultaneous applications. Interpretations of the `DAVIC` javadoc which are inconsistent with this are excluded.

11.7.6 Content Referencing

This API is formed of the classes found in section H.4 of annex H of [DAVIC 1.4.1p9 \[3\]](#) - the `Locator` and `DvbLocator` classes. It also includes the `javax.tv.locator` package as defined in [Java TV \[51\]](#).

The signature of the `org.davic.net.Locator` class will be extended with:

```
"implements javax.tv.locator.Locator"
```

The `createFactory()` method of `javax.tv.locator.LocatorFactory` shall always return `org.davic.net.Locator(s)` which implement the `javax.tv.locator.Locator` interface when provided with DVB URLs as input (as defined in 14.1, "Namespace mapping (DVB Locator)" on page 198).

In this specification, methods whose signature has a return type of `org.davic.net.Locator` or `javax.tv.locator.Locator` shall return an instance of `org.davic.net.dvb.DvbLocator` (or a platform defined subclass of that) where the locator returned can be represented by the DVB locator syntax described in [DAVIC 1.4.1p9 \[3\]](#). In this case, the `DvbLocator` returned shall contain the numeric identifiers of a DVB service (see 14.9, "Service identification" on page 204).

In `javax.tv.locator.Locator.toExternalForm()`, the canonical form of a DVB locator is defined as follows:

- For instances of `org.davic.net.dvb.DvbNetworkBoundLocator`, this should be the format defined in the MHP specification, including the transport stream id.
- For instances of `org.davic.net.dvb.DvbLocator` which are not instances of the above sub-class, this should be the format defined in the MHP specification, excluding the transport stream id.

Any optional extensions (for specifying components, events etc.) are considered in a comparison and if they are not equally present in both locators then the comparison shall fail.

For the above locators "best effort" comparison shall be exact.

The protected constructor of `LocatorFactory` is for implementation use. MHP applications shall not subclass `LocatorFactory`. Implementations are not required to behave correctly if they should do this.

11.7.7 Common Error Reporting

This API is formed of the interface and exceptions defined in annex G of [DAVIC 1.4.1p9 \[3\]](#):

- `NotAuthorizedInterface`,
- `NotAuthorizedException`,
- `ObjectUnavailableException`,
- `ResourceException`,
- `TuningException`.

11.8 Security

11.8.1 Basic Security

The following packages and classes as defined in [PersonalJAE \[36\]](#) are supported.

11.8.1.1 java.security

From the `java.security` package:

- `AccessControlContext`
- `AccessControlException`
- `AccessController`
- `AllPermission`
- `BasicPermission`
- `CodeSource`
- `GeneralSecurityException`
- `Guard`
- `InvalidKeyException`
- `Key`
- `KeyException`
- `NoSuchAlgorithmException`
- `NoSuchProviderException`
- `Permission`
- `PermissionCollection`
- `Permissions`
- `Policy`
- `Principal`
- `PrivilegedAction`
- `PrivilegedActionException`
- `PrivilegedExceptionAction`
- `ProtectionDomain`
- `PublicKey`
- `SignatureException`
- `SecurityPermission`
- `SecureClassLoader` (note 1)
- `UnresolvedPermission`

NOTE 1: The `java.security.SecureClassLoader` class extends the JDK 1.1.8 version of `java.lang.ClassLoader`, therefore the `java.security.SecureClassLoader` class is not required to support additional APIs from later versions of `java.lang.ClassLoader`.

The MHP platform shall always install a `SecurityManager` before starting any DVB-J applications.

The following classes shall be supported:

- `java.security.KeyFactory`

`KeyFactory.getInstance(String algorithm)` shall return a valid `KeyFactory` for algorithm "RSA".

NOTE: since `KeyFactorySpi` is not required, the protected constructor will be subset out via the subsetting rule

- `java.security.spec.KeySpec`
- `java.security.spec.EncodedKeySpec`

The `EncodedKeySpec` constructor is guaranteed to work for X.509 key encodings.

- `java.security.spec.X509EncodedKeySpec`

11.8.1.2 `java.security.cert`

- `Certificate`
- `CertificateEncodingException`
- `CertificateException`
- `X509Certificate`
- `CertificateExpiredException`
- `CertificateNotYetValidException`

11.8.1.3 Other classes

The following other classes are supported.

- `java.io.FilePermission`
- `java.io.SerializablePermission`
- `java.lang.RuntimePermission`
- `java.util.PropertyPermission`
- `java.net.SocketPermission`
- `java.awt.AWTPermission`

11.8.2 APIs to Support TLS / SSL Over the Return Channel

This API is defined in the following packages from JSSE [60]:

- `javax.net`
- `javax.net.ssl`
- `javax.security.cert`

Also see 12.10, "Security on the return channel" on page 167.

11.8.3 Additional permissions classes

See T, "(normative): Permissions" on page 585.

11.8.4 General security issues

Unless otherwise specified, sub-classes of `java.security.Permission` are not required to check the input parameters to their constructors. When an MHP platform constructs these, it is responsible for creating them with legal values. The behaviour of an MHP platform if an application creates such an instance with illegal values is intentionally not specified.

11.9 Other APIs

11.9.1 Timer Support

This API is formed of the Timer API defined in Java TV [51] in the `javax.tv.util` package.

Implementations are required to meet the following specifications:

- Minimum repeat interval less than or equal to 40 ms
- Granularity less than or equal to 10ms

The only condition defined in this specification where `TVTimer.scheduleTimerSpec` may throw `TVTimerScheduleFailedException` is if the MHP terminal is unable to provide any more timers. See table G.4, "Minimum requirements for other resources" on page 287.

11.9.2 User Settings and Preferences API

This API is defined in L "(normative): User Settings and Preferences API".

The preferences listed below shall be accessible to unauthorised applications.

- User Language
- Parental Rating
- Country Code
- Default Font Size

Other preferences shall not be accessible to unauthorised applications.

11.9.3 Profile and version properties

Applications can discover the supported profile and the version of the profile (and thus, what functionality is supported) by retrieving profile and version properties. If a particular profile is not supported then the related version properties shall return null.

More specifically, the properties listed in table 45 shall be included in the property set of the `java.lang.System` class. Thus these properties can be retrieved using `java.lang.System.getProperty()`. Since this API returns a string, numeric return values shall be encoded as defined by `java.lang.Integer.toString(int)`.

Table 45 : System properties for profile and version interrogation (Sheet 1 of 2)

Property	Semantics	Possible values	Example
<code>mhp.profile.enhanced_broadcast</code>	Indicates whether the enhanced broadcast profile is supported	"YES", "NO"	"YES"
<code>mhp.profile.interactive_broadcast</code>	Indicates whether the interactive broadcast profile is supported	"YES", "NO"	"NO"
<code>mhp.profile.internet_access</code>	Indicates whether the internet access profile is supported	"YES", "NO"	"NO"
<code>mhp.eb.version.major</code>	Major version number of the supported enhanced broadcast profile	Non-negative integer value	"1"
<code>mhp.eb.version.minor</code>	Minor version number of the supported enhanced broadcast profile	Non-negative integer value	"0"
<code>mhp.eb.version.micro</code>	Micro version number of the supported enhanced broadcast profile	Non-negative integer value	"0"
<code>mhp.ib.version.major</code>	Major version number of the supported interactive broadcast profile	Non-negative integer value	"1"
<code>mhp.ib.version.minor</code>	Minor version number of the supported interactive broadcast profile	Non-negative integer value	"0"
<code>mhp.ib.version.micro</code>	Micro version number of the supported interactive broadcast profile	Non-negative integer value	"0"
<code>mhp.ia.version.major</code>	Major version number of the supported internet access profile	Non-negative integer value	"1"

Table 45 : System properties for profile and version interrogation (Sheet 2 of 2)

Property	Semantics	Possible values	Example
mhp.ia.version.minor	Minor version number of the supported internet access profile	Non-negative integer value	"0"
mhp.ia.version.micro	Micro version number of the supported internet access profile	Non-negative integer value	"0"

The properties for querying the version of a profile which is not supported by the MHP terminal shall not be supported. Hence, calling `System.getProperty()` for these properties shall return null.

11.9.3.1 Information on options

Chapter 15 defines what is mandatory and optional for each profile. In order to give an application information about which options a particular MHP implementation supports, a property string is defined for each option (with the same granularity as in chapter 15).

An MHP implementation supports an option if and only if the corresponding property is known and its value is "SUPPORTED". The properties are part of the property set of the `java.lang.System` class.

The general syntax of the properties that indicate whether a certain feature is supported or not is:

```
mhp.option.<the optional feature>.
```

The table 46 lists the currently defined options.

Table 46 : System properties for optional feature interrogation

Option	Property
IP Multicast over Broadcast Channel	mhp.option.ip.multicast
DSMCC user-to-user over the interaction channel	mhp.option.dsmcc.uu
DVB-HTML	mhp.option.dvb.html

11.10 Java permissions

This section explains how the permissions that are defined to be included in the sandbox that is available to unsigned applications and the permissions that can be requested in the permission request file are mapped to the `Permission` objects in the Java platform.

11.10.1 Permissions for unsigned applications

The MHP security policy includes a set of resources that are always guaranteed to be granted to applications, if the application is executed. Unsigned applications have access to only these resources.

This section defines the mapping of those resources to the Java `Permission` objects. DVB-J applications shall always be granted these `Permissions`.

11.10.1.1 `java.awt.AWTPermission`

This control access to sensitive parts of AWT which is not needed for MHP applications. This shall be denied for both unsigned and signed applications.

11.10.1.2 `java.net.SocketPermission`:

Because access to return channel is not within the sandbox, this is not required for unsigned applications.

11.10.1.3 `java.util.PropertyPermission`

For unsigned applications, a read permission shall be granted for all properties defined in this chapter except for those explicitly identified as only available for signed applications. The permission shall be denied for the action string "write".

11.10.1.4 `java.lang.RuntimePermission`

This permission shall be denied for both unsigned and signed applications.

11.10.1.5 `java.io.SerializablePermission`

This permission shall be denied for both unsigned and signed applications.

11.10.1.6 `java.io.FilePermission`

A read permission shall be granted for the subtree under which the implementation mounts the object carousels.

11.10.1.7 `javax.tv.media.MediaSelectPermission`

The Media API (i.e. JMF) is within the sandbox, so all applications shall be granted a `javax.tv.media.MediaSelectPermission` with a locator string "*" that indicates access to all media streams.

11.10.1.8 `javax.tv.service.ReadPermission`

Access to Service Information is within the sandbox, so all applications shall be granted a `javax.tv.service.ReadPermission` with a locator string "**"

11.10.1.9 `javax.tv.service.selection.ServiceContextPermission`

All applications shall be granted a `javax.tv.service.selection.ServiceContextPermission` with a name string "getServiceContentHandlers" and action string "own". The name string "access" shall not be granted.

11.10.1.10 `java.util.Locale.setDefault`

This method shall throw a security exception.

11.10.2 Additional Permissions for signed applications

Signed applications can additionally request to get more permissions. These permissions are requested using the permission request file (12.6, "Security policy for applications" on page 147). This section defines the mapping from the items in the permission request file to the Java Permissions that may be granted by the MHP terminal in response to the request.

11.10.2.1 `java.util.PropertyPermission`

For signed applications, a read permission shall be granted for all properties for unsigned applications and `dvb.persistent.root`.

11.10.2.2 `java.io.FilePermission`

A read permission shall be granted for the subtree under which the implementation mounts the object carousels.

When the permission request file requests the permission to access persistent storage and this is granted, a `FilePermission` that permits access to the persistent storage directory subtree is created.

When there is a persistent file credential in the permission request file and this is granted, `FilePermissions` are created as follows:

- file path = value of `dvb.persistent.root` property + filename from the credential
- action = string containing "read" and/or "write" as indicated in the credential

11.10.2.3 `org.dvb.net.ca.CAPermission`

When the permission request file requests the permission to communicate with a CA system and this is granted, a `CAPermission` is created as follows:

The CA system ID string from the permission request file is directly used as the first part of the string used for the `CApermission` constructor, this is concatenated with a colon character and the list of the attribute strings based on the attributes listed as true in the permission request file.

11.10.2.4 `org.dvb.application.AppsControlPermission`

When the permission request file requests the permission to have additional permissions to control the lifecycle of applications and this is granted, an `AppsControlPermission` is created.

11.10.2.5 `org.dvb.net.rc.RCPermission`

When the permission request file requests the permission to communicate through the return channel and this is granted, an `RCPermission` is created as follows:

- for the default ISP item, the `RCPermission` is created with "target:default" string.
- for items with phone numbers in them, the string is "target:" + the phone number prefix in the permission request file + "**"

On `org.dvb.net.rc.ConnectionRCInterface`, the method `getCurrentTarget` shall always throw a `SecurityException`. The method `setTarget` shall throw a security exception where the application doesn't have the permission to use the target specified. The method `setTargetToDefault` shall throw a security exception where the application doesn't have either "target:default" or "target:*" permissions.

11.10.2.6 `org.dvb.net.tuning.TunerPermission`

When the permission request file requests the permission to access the Tuning API and this is granted, an `TunerPermission` is created.

11.10.2.7 `javax.tv.service.selection.SelectPermission`

When the permission request file requests the permission to perform service selection and this is granted, a `SelectPermission` is created with a locator "*" and action string "own" and a `ServiceContextPermission` is created with a name "*" and action string "own".

11.10.2.8 `org.dvb.user.UserPreferencePermission`

When the permission request file requests the permission to read and/or write user preferences and this is granted, a `UserPreferencePermission` is created as follows:

- when the permission request file includes "true" for the "read" attribute and this is granted, a `UserPreferencePermission` is created with the string "read"
- when the permission request file includes "true" for the "write" attribute and this is granted, a `UserPreferencePermission` is created with the string "write"

11.10.2.9 `java.net.SocketPermission`

When the permission request file requests the permission to communicate with remote hosts and this is granted, `SocketPermissions` are created with the host and action as indicated in the permission request file.

These permissions shall not be granted in MHP terminals where all return channels are represented by instances of `org.dvb.net.rc.ConnectionRCInterface` (i.e. where all return channels are connection oriented) unless an instance of `org.dvb.net.rc.RCPermission` is also granted.

11.10.2.10 `org.dvb.media.DripFeedPermission`

When the permission request file requests the permission to use the drip feed feature and this is granted, a `DripFeedPermission` shall be created.

11.11 Content referencing

The following mapping shall be used between the types of locator defined in table 63, "Addressable entities, locators and their text representation" on page 203 and the DVB-J methods defined in this chapter. It lists the Java methods & constructors which accept or return (as defined by their method signature) instances of `org.davic.net.Locator`, `javax.tv.locator.Locator`, `javax.media.MediaLocator` or their sub-classes. The external form of these locators shall be the text representation defined in the table 63, "Addressable entities, locators and their text representation" on page 203 for the corresponding entity being referenced. Where the same method is listed as accepting multiple forms of locator, then it is required to accept all forms listed in this section.

Where a method listed below is defined (in its specification) to check its input then it shall only accept the forms of locator listed below as being valid for that method from among those defined in this specification. Other forms of locator from among those defined in this specification shall be rejected as specified for the method concerned. If a method does not specify a means of rejecting inappropriate locators then it shall fail silently apart from Exceptions and Events which do not check their input and where it is the responsibility of the platform to use correct locators when constructing them. This specification does not prevent methods accepting other forms of locator which are not defined in this specification.

11.11.1 Transport stream

The following methods used in this specification shall accept or return instances of Objects which describe an MPEG transport stream. Methods which accept a locator for a transport stream as an input parameter shall also accept all other DVB locators which include the information to identify a transport stream. Any excess information shall be silently discarded by such methods.

- `javax.tv.service.transport.TransportStream.getLocator()`
- `javax.tv.service.transport.TransportStreamCollection.retrieveTransportStream()`
- `org.davic.net.tuning.StreamTable.getTransportStreams()`
- `org.davic.net.tuning.NetworkInterfaceController.tune()`
- `org.davic.net.tuning.NetworkInterface.getLocator()`
- `org.davic.net.tuning.NetworkInterfaceController.reserveFor()`
- `org.davic.net.tuning.StreamTable.listTransportStreams()`
- `org.dvb.si.SITransportStream.getDvbLocator()`

11.11.2 Network

The following methods used in this specification shall accept or return instances of Objects which describe a DVB network.

- `javax.tv.service.transport.NetworkCollection.retrieveNetwork()`
- `javax.tv.service.transport.Network.getLocator()`

11.11.3 Bouquet

The following methods used in this specification shall accept or return instances of Objects which describe a DVB bouquet.

- `javax.tv.service.transport.BouquetCollection.retrieveBouquet()`
- `javax.tv.service.transport.Bouquet.getLocator()`

11.11.4 Service

11.11.4.1 MPEG/DVB specific service

The following methods used in this specification shall accept or return instances of Objects which describe a DVB service. Methods which accept a locator for a MPEG/DVB service as an input parameter shall also accept all other DVB locators which include the information to identify a service. Any excess information shall be silently discarded by such methods.

- `org.davic.net.ca.CAModule.buyEntitlement()`
- `org.davic.net.ca.CAModule.queryEntitlement()`
- `org.dvb.si.SIDatabase.retrieveSIService()`
- `org.dvb.si.SIDatabase.retrievePMTService()`
- `org.dvb.dsmcc.DSMCCStream.getStreamLocator` where the method `isMPEGProgram` returns `true`
- `org.dvb.dsmcc.ServiceDomain.attach()`
- `org.dvb.dsmcc.ServiceDomain.getLocator()`
- `org.dvb.si.PMTService.getDvbLocator()`
- `org.dvb.si.SIBouquet.getSIServiceLocators()`
- `org.dvb.si.SIService.getDvbLocator()`
- `org.davic.net.ca.TuneRequestEvent` - constructor
- `org.davic.net.ca.TuneRequestEvent.getLocator()`
- `org.dvb.application.AppAttributes.getServiceLocator()` where the service is a MPEG / DVB service
- `org.dvb.dsmcc.ServiceXFRReference` - constructor where the service is a MPEG / DVB service
- `org.dvb.dsmcc.ServiceXFRReference.getLocator()` - where the service is a MPEG / DVB service

11.11.4.2 Generic Service

The following methods used in this specification shall accept or return instances of Objects which reference generic services. These methods are also required to accept or return the same locators as in the previous section.

- `javax.tv.service.navigation.LocatorFilter` - constructor
- `javax.tv.service.navigation.LocatorFilter.getFilterValue()`
- `javax.tv.service.SIManager.getService()`
- `javax.tv.service.navigation.ServiceDetails.getLocator()`
- `javax.tv.service.Service.getLocator()`
- `javax.tv.service.SIManager.retrieveServiceDetails()`
- `javax.tv.service.navigation.ServiceList.findService()`
- `org.dvb.application.AppAttributes.getServiceLocator()` - where the service is not a MPEG / DVB specific one
- `org.dvb.dsmcc.ServiceXFRReference` - constructor where the service is not a MPEG / DVB specific one
- `org.dvb.dsmcc.ServiceXFRReference.getLocator()` where the service is not a MPEG / DVB specific one
- `org.dvb.dsmcc.ServiceXFRException` - constructor
- `org.davic.media.MediaLocator` - constructor
- `javax.media.MediaLocator` - constructor
- `javax.media.Manager.createPlayer(MediaLocator)`
- `javax.media.Manager.createDataSource(MediaLocator)`
- Constructor of various JMF events consumes JMF MediaLocators:
`org.dvb.media.CAStopEvent, org.dvb.media.PresentationChangedEvent, org.dvb.media.ServiceRemovedEvent, org.dvb.media.NoComponentSelectedEvent`
- Various JMF events return JMF MediaLocators which were passed into their constructors:
`org.dvb.media.CAStopEvent, org.dvb.media.PresentationChangedEvent, org.dvb.media.ServiceRemovedEvent, org.dvb.media.NoComponentSelectedEvent`

11.11.5 DVB Event

The following methods used in this specification shall accept or return instances of Objects which describe a DVB event.

- `javax.tv.service.guide.ProgramEvent.getLocator()`
- `javax.tv.service.SIManager.retrieveProgramEvent()`
- `org.davic.net.ca.CAModule.buyEntitlement()`
- `org.davic.net.ca.CAModule.queryEntitlement()`
- `javax.tv.service.guide.ProgramSchedule.retrieveProgramEvent()`
- `org.dvb.si.SIEvent.getDvbLocator()`

11.11.6 MPEG elementary stream

The following methods used in this specification shall accept or return instances of Objects which describe a MPEG elementary stream. Methods below which accept as an input parameter an array of locators shall also accept DVB locators including multiple component tags.

- `javax.tv.net.InterfaceMap.getLocalAddress()`
- `javax.tv.service.selection.InvalidServiceComponentException` - constructor
- `javax.tv.media.MediaSelectControl` - all methods accepting or returning instances of `javax.tv.locator.Locator`
- `javax.tv.media.MediaSelectEvent` & subclasses - constructor
- `javax.tv.media.MediaSelectPermission` - constructor
- `javax.tv.service.selection.ServiceContext.select()`
- `org.dvb.si.SIDatabase.retrievePMTElementaryStreams()`
- `org.dvb.si.PMTElementaryStream.getDvbLocator()`
- `org.dvb.dsmcc.ServiceDomain.attach()`
- `org.dvb.dsmcc.ServiceDomain.getLocator()`
- `javax.tv.media.MediaSelectControl.getCurrentSelection()`
- `javax.tv.service.navigation.ServiceComponent.getLocator()`
- `javax.tv.media.MediaSelectEvent.getSelection()` (also subclasses)
- `org.davic.net.ca.DescramblingStoppedEvent.getServiceLocator()`
- `org.davic.net.ca.DescramblingStartedEvent.getServiceLocator()`
- `org.davic.media.MediaLocator` - constructor - shall also accept multiple component tag "dvb:" locator
- `javax.media.MediaLocator` - constructor - shall also accept multiple component tag "dvb:" locator
- `javax.media.manager.createPlayer(MediaLocator)` - shall also accept multiple component tag "dvb:" locator
- `javax.tv.service.selection.InvalidServiceComponentException.getInvalidServiceComponent()`
- `javax.tv.service.selection.ServiceContentHandler.getServiceContentLocators()`

11.11.7 File

The following methods used in this specification shall accept or return locators which reference files.

- `org.davic.media.MediaLocator` -constructor - for audio files intended to be played from memory
- `javax.media.MediaLocator` - constructor - for audio files intended to be played from memory
- `javax.media.Manager.createPlayer(MediaLocator)` - for audio files intended to be played from memory
- `javax.media.Manager.createDataSource(MediaLocator)` - for audio files intended to be played from memory
- `org.dvb.dsmcc.ServiceDomain.getURL(Locator)` - instances of "dvb:" locator including `dvb_abs_path`

Apart from the above, all file references shall be encapsulated in instances of `java.net.URL`.

11.11.8 Directory

The following method shall return an instance of the "dvb:" locator referencing a directory.

- `org.dvb.application.AppIcon.getLocator()`

11.11.9 Drip feed decoder

The following methods used in this specification shall accept or return locators which reference the "drip feed" decoder.

- `javax.media.MediaLocator` - constructor
- `javax.media.Manager.createDataSource(MediaLocator)`

11.11.10 Irrelevant

The following methods used in this specification which accept Locators according to their signature have no requirement to have locator types specified for them in this specification:

- `javax.tv.service.ReadPermission`, all applications shall have this permission with "*", see 11.10.1.8, "`javax.tv.service.ReadPermission`" on page 128.
- `javax.tv.service.selection.SelectPermission`, applications shall either have this permission with "*" or not to have it at all, see 11.10.2.7, "`javax.tv.service.selection.SelectPermission`" on page 129.

11.11.11 Methods working on many Locator types

The following methods used in this specification work on many locator types. The locator types which each method is required to support are listed for each of the methods concerned.

- `javax.tv.locator.LocatorFactory.transformLocator` - transforms a transport independent locator into a transport independent one
 required to accept instances of `org.davic.net.dvb.DvbLocator`
 required to return instances of `org.davic.net.dvb.DvbNetworkBoundLocator`
- `javax.tv.locator.LocatorFactory.createLocator` - creates a locator from a string
 required to accept valid 'dvb' URLs (see 14.1, "`Namespace mapping (DVB Locator)`" on page 198) and return corresponding instances of `org.davic.net.dvb.DVBLocator`
- `javax.tv.service.SIManager.registerInterest` - accepts a locator referencing one or more SIElements as input
- `javax.tv.service.SIManager.retrieveSIElement` - accepts a locator referencing one or more SIElements as input
 Both these methods are required to accept locators referencing: -Bouquet, Network, Event, ElementaryStream, Service, TransportStream
- `javax.tv.service.SIElement.getLocator`
 returns a locator for "this SIElement" as specified by the JavaTV specified sub-interfaces, no other SIElements exist

11.11.12 Support for the HTTP protocol in DVB-J

Where the HTTP (see 6.3.7.1, "HTTP 1.1" on page 46) protocol is supported, the following classes and methods shall support HTTP URLs as described below.

- The constructor for `javax.media.MediaLocator` - for referencing audio files intended to be played from memory
- methods on `javax.media.Manager` accepting `javax.media.MediaLocator` as input parameters - for constructing JMF players for audio files intended to be played from memory
- The classes & methods in the "java.net" package
- Methods in this specification which accept instances of `java.net.URL` are required to accept instances which encapsulate an "http" URL and behave according to their specification. - e.g. `Toolkit.getImage(java.net.URL)`

When HTTP URLs are used with instances of `DVBClassLoader` to load DVB-J classes over the interaction channel in a signed application, the requirements of the MHP security model shall be complied with before a class is allowed to be successfully loaded from such a URL.

12 Security

12.1 Introduction

This section covers the following areas of security:

- Authentication of applications
- Security policies for applications
- Authentication and privacy of the return channel communications
- Certificate management

12.1.1 Overview of the security framework for applications

The security framework enables a receiver to authenticate the source of application code or other files. In the case of application code files, the authentication advises the receiver what access rights should be granted to an application for sensitive resources, see 12.6, "Security policy for applications" on page 147 for more detail.

The system uses 3 different security messages:

- Cryptographic hash codes

This provides a summary of a quantity of data - typically a subset of the total set of data under consideration.

- Signatures

These deliver a master hash code (computed over all of the appropriate data) that has been "signed" by an authorising organisation. The signing process securely associates the master hash code with the signatory. The hash code process shows that the data has not been tampered with since it was signed by the signatory.

- Certificates

These provide a "chain of trust" from the authorising organisation up to some trusted third party (the root certificate authority) that is well known to the receiver.

The messages are delivered within files of the file system so this authentication scheme is applicable to any hierarchical file system whether operating over the broadcast or return channels.

Applications that are signed shall be identified with an [application_id](#) from the signed applications range (see table 11, "Value ranges for application_id" on page 77). Applications that are unsigned shall be identified with an [application_id](#) from the unsigned applications range. An application with an [application_id](#) from the signed applications range but that is not signed is considered to have failed authentication. An application with an [application_id](#) from the unsigned applications range is treated as unsigned even if the files might be transmitted with signatures.

12.1.2 Overview of return channel security

In this version of the specification general purpose protocols and a standard cryptographic suite derived from internet standards are used.

12.2 Authentication of applications

12.2.1 Overview of authentication messages

Three different message types are used: "Hash codes", "Signatures" & "Certificates". Each message is placed in a file. The placement of the files depends on their function and is specified under the appropriate headings under 12.4, "Detail of application authentication messages" on page 139.

12.2.1.1 Hash codes

This specification describes application of hash codes to the following types of information:

- Files
- Directories

The hash computation considers the content and attributes of the objects rather than transport specific information. As a result, the authentication is independent of the underlying transport protocol.

In the case of a directory the hash value depends on the hash values of the objects bound to it, and so provides a hash of all of the objects to be authenticated in the "tree" below it.

12.2.1.2 Signatures

The data authenticated is a hierarchical file system (for example DSM-CC OC). The root of an authenticated "tree" carries one or more signatures. This allows one or more organisations to sign a set of information.

The root of the authenticated "tree" can be the root directory of the file system or the "top" directory of a "subtree".

The signature:

- references a certificate containing the public key required to decode the signature
- identifies the hash algorithm used
- and the value of the signature

12.2.1.3 Certificates

The certificate provides a public key that can be used to decode a hash code contained in a signature and so enable a tree/subtree to be verified. The certificate itself is signed by a higher certification authority.

To correctly authenticate a subtree there must be a valid "chain" of certificates from the signature to a root certificate as is illustrated in figure 14.



Figure 14 : Certificate chain illustrated

12.2.1.4 Authentication of hierarchical file systems

The solution here is based on authentication of a hierarchical structure of objects. Hashcodes are computed systematically and accumulatively across some or all of the objects in the hierarchy. A signature at the top of the hierarchy identifies the source of the objects.

The framework provides a flexible and non-time consuming method enabling the authentication of subtrees of a file system with a single signature. Since checking signature is far more time-consuming than checking hashcode values, this mechanism is more efficient than signing each object of a subtree.

Further, only the objects that are loaded need real-time hashcode checking.

This mechanism does NOT mandate that the whole subtree is authenticated.

NOTE: The broadcaster can choose which files in the file system are authenticated. For example code files might be authenticated and asset files might be left without authentication.

Finally, this framework embraces key distribution by specifying a certificate mechanism, the aim of this is to certify that the key used to compute the signature is valid and used by a certified service provider. See 12.8, "Procedures for application certificates and signatures" on page 161.

12.3 Message transport

The security messages are transported in files.

In no cases shall a service transfer be required to access the file content. In the case that the file system is an object carousel this means that the IOR for the security files shall always use a BIOP profile body and never a Lite options profile body.

12.4 Detail of application authentication messages

Three data structures are defined for communicating authentication information:

- "HashFile" on page 139
- "SignatureFile" on page 141
- "CertificateFile" on page 142

These are placed in files in the file system. The location of the file depends on its function.

12.4.1 HashFile

12.4.1.1 Description

The [HashFile](#) lists all of the elements of the current directory except itself and the possible signature files. Those elements to be authenticated are associated with hashcodes. The syntax of the [HashFile](#) is shown in table 47.

Table 47 : Syntax of the Hashfile

Syntax	Num. Bits	Format
<pre> Hashfile () { digest_count for(i=0; i<digest_count; i++) { digest_type name_count for(j=0; j<name_count; j++) { name_length for(k=0; k<name_length; k++) name_byte } } for(j=0; j<digest_length; j++) { digest_byte } } </pre>	<p>16</p> <p>8</p> <p>16</p> <p>8</p> <p>8</p> <p>8</p>	<p>uimsbf</p> <p>uimsbf</p> <p>uimsbf</p> <p>uimsbf</p> <p>bslbf</p> <p>bslbf</p>
Other data may follow but can be ignored by implementations conforming to this profile.		

digest_count: This 16 bit value identifies the number of digest values in this hash file.

digest_type: This 8 bit value identifies the digest algorithm, if any, used for the associated objects. Table 48 lists the allowed values for this field.

Table 48 : Values of digest_type

value	digest len.	algorithm
0	0	Non authenticated
1	16	MD-5 as defined in RFC 1321 [38]
2	20	SHA-1 as defined in FIPS-180-1 [62]
Other values		Reserved

name_count: This 16 bit value identifies the number of object names associated with the digest value. The value of this field shall be greater than zero.

name_length: This 8 bit value identifies the number of bytes in the object name.

name_byte: This 8 bit value holds one byte of the object name.

Each name shall be the name of an object in the directory that contains the [HashFile](#). So, file names are the names of files in the directory and directory names are the names of direct sub-directories of the directory. No path information shall be included in the name.

The names carried by this field are binary identical to the payload part of names in the file system. So, any name matching process can be binary and ignorant of character encoding, letter case etc. Also, terminating null characters are not considered to be part of the file name.

digest_length: This integer value gives the number of bytes in each digest value. It depends upon the digest type as tabulated in table 48.

NOTE: Non-authenticated objects have a zero length digest.

digest_byte: This 8 bit value holds one byte of the digest value. See 12.4.1.3, "Digest value computation rules" on page 140.

12.4.1.2 HashFile location and naming conventions

An application comprises files containing data that can be spread across various directories and is contained within a subtree of the file hierarchy. A [HashFile](#) will be put in each directory containing objects that need to be authenticated.

The name of the [HashFile](#) shall be:

"dwb.hashfile"

There shall only be one instance of [HashFile](#) per directory that contains authenticated resources.

See 12.7, "Example of creating an application that can be authenticated" on page 158.

12.4.1.3 Digest value computation rules

The digest value is computed over the objects named in the [HashFile](#) in the order listed in the [HashFile](#). The length of the list of objects associated with each digest value may be one or more.

Each list of objects may contain an arbitrary mix of different object types (e.g. a mixture of file and directory names). The digest value is computed by first initialising the digest algorithm in an algorithm specific way and then applying the relevant data for each object to the algorithm in order. The relevant data for each object depends on its type and is specified in table 49.

Table 49 : Data required for digest value computation

Object type	Relevant data
File	The entire content of the file
Directory	The content of the HashFile of the named directory

12.4.1.4 Special authentication rules

- a) For objects which are directories, if the [digest_type](#) is non-zero there shall be a [HashFile](#) in the sub-directory listed. If the [HashFile](#) is absent then the authentication fails.
- b) Each [HashFile](#) shall provide a complete list of all the objects named in the directory except itself and any possible signature files mentioning each name exactly one time. The behaviour varies depending on the ability of the transport protocol to support directory listing.
 - On transport protocols supporting the listing of files in a directory (e.g. Object Carousel), the authentication shall fail if the set of objects listed in the [HashFile](#) is different to the set of objects in the directory.
 - On transport protocols that don't support the listing of files in a directory (e.g. HTTP), the set of names in the [HashFile](#) acts as a filter for the set of objects that can be accessed. Attempts to access a file not named in the [HashFile](#) shall fail (that is behave as if the file is not available).

These rules apply regardless of the value of [digest_type](#) associated with the object.

- c) If the `digest_count` is equal to 0, the file hashfile shall be ignored. Every entry in the directory will be non authenticated.
- d) If a `name_length` is equal to zero (or if a name is not found in the directory containing the `HashFile`), all the names associated with the current digest value shall be considered as incorrectly authenticated. It means the authentication checking will fail for these entries.
- e) If the object is a Stream or StreamEvent then the `digest_type` shall be zero.
- f) Objects associated with a `digest_type` that the receiver does not support shall be treated by that receiver as if the value of `digest_type` was zero (not authenticated).
- g) There is no requirement for certificates files to have a `digest_type` other than zero (not authenticated). However, if they do have a non-zero `digest_type` they don't receive exceptional treatment.

12.4.2 SignatureFile

12.4.2.1 Description

The `SignatureFile` is a File containing one digital signature. It contains the following ASN.1 DER structure:

```
Signature ::= SEQUENCE {
    certificateIdentifier           AuthorityKeyIdentifier,
    hashSignatureAlgorithm        HashAlgorithmIdentifier,
    signatureValue                 BIT STRING }
```

certificateIdentifier : As defined in the ITU-T X.509 [54] extension for the AuthorityKeyIdentifier field. It identifies the certificate that carries the certified public key that is used to check the signature.

```
AuthorityKeyIdentifier ::= SEQUENCE {
    keyIdentifier                 [0] KeyIdentifier OPTIONAL,
    authorityCertIssuer           [1] GeneralNames OPTIONAL,
    authorityCertSerialNumber     [2] CertificateSerialNumber OPTIONAL }
```

Implementations are not required to use the possibly present `keyIdentifier` element of the `AuthorityKeyIdentifier`. The `AuthorityKeyIdentifier` structure shall contain both the `authorityCertIssuer` and `authorityCertSerialNumber` elements.

The `authorityCertIssuer` shall contain the field "directoryName", this field shall be equal to the `issuerName` of the certificate that carries the public key used to check the signature.

hashSignatureAlgorithm: this field identifies the hash algorithm that is used. Note that the encryption algorithm used to compute the signature is already described in the `SubjectKeyInfo` field of the certificate that certifies this key, and thus that only the identification of the hash algorithm is needed. The supported algorithms are MD5 and SHA-1.

```
md5 OBJECT IDENTIFIER ::=
{ iso(1) member-body(2) US(840) rsadsi(113549)
  digestAlgorithm(2) 5 }
```

```
sha-1 OBJECT IDENTIFIER ::=
{ iso(1) identified-organization(3) oiw(14) secsig(3)
  algorithm(2) 26 }
```

signatureValue: See "signatureValue" on page 170.

12.4.2.2 SignatureFile location and naming conventions

The `SignatureFile` is located in the root directory of the subtree that it signs. There can be several `SignatureFiles`, as there can be several entities that sign the structure. See 12.4.4, "Integration" on page 143.

By convention, the name of a `SignatureFile` is:

```
"dvb.signaturefile."<x>
```

where the <x> is a textual representation of an integer decimal number without leading zeroes. The range of values represented in any single directory shall start with 1 and increment in steps of 1. The first unused integer value in the ascending sequence indicates the end of the range.

The purpose of this x is to allow the hash file of an authenticated subtree to be signed by more than one entity. It is equal to the x value in the file name of the corresponding certificate file. See 12.4.3.5, "CertificateFile location and naming conventions" on page 143 and 12.4.4, "Integration" on page 143.

12.4.2.3 Supported algorithms

Signing data is a two-step process:

- first a hash is computed over the data.
- the resulting hashvalue is then encrypted using an encryption algorithm.

As indicated in 12.4.1 "HashFile" this specification defines two possible hash algorithms: MD5 and SHA-1.

The encryption algorithm used to compute the signature is indicated in the certificate that carries this key.

12.4.2.4 Signature computation rules.

The hash is computed over the content of the HashFile contained in this root directory.

NOTE: This is the same principle as for the classical hash computation described in "Digest value computation rules" on page 140.

12.4.2.5 Authentication rules

See signatureValue on page 141.

12.4.3 CertificateFile

12.4.3.1 Description

The CertificateFile contains all of the certificates in the certificate chain up to, and including, the root certificate. The leaf certificate is placed first in the file. The last certificate in the file is the root certificate. The root certificate is included in this file only for consistency. How the MHP terminal determines its policy related to this root CA is implementation dependent. The encoding of the certificate is defined in ITU-T X.509 [54]. Below is defined the profile of ITU-T X.509 [54] for use in authenticating MHP applications. This profile is based on RFC 2459 [58].

The syntax of the CertificateFile is shown in table 50.

Table 50 : Syntax of the CertificateFile

Syntax	Num. Bits	Format
<pre>Certificatefile () { certificate_count for(i=0; i<certificate_count; i++) { certificate_length certificate() } }</pre>	16	uimsbf
	24	uimsbf

certificate_count: This 16-bit integer carries the number of certificates in the certificate file.

certificate_length: This 24-bit integer specifies the number of bytes in the certificate.

certificate(): This field carries a single "Certificate" data structure as defined by ITU-T X.509 [54]. See 12.11.1, "Main part of the certificate" on page 169.

12.4.3.2 ASN.1 encoding

The basic specification of the ASN.1 DER encoding used in RFC 2459 [58] is given in ASN.1 [57]. However, RFC 2459 [58] defines some extensions which are required to implement this specification.

12.4.3.3 Supported algorithms

There are various algorithm identifiers in the certificate structure. The OID of the algorithm used in the `SubjectPublicKeyInfo` structure shall be RSA.

The values for `AlgorithmIdentifier` used both in the certificate structure and in the `TBSCertificate` structure that are supported in this specification are listed under "`signatureAlgorithm`" on page 144.

12.4.3.4 Name matching

The only allowed encoding of attributes of distinguished names shall be UTF8String.

NOTE: The use of this encoding allows name matching to be a binary comparison.

12.4.3.5 CertificateFile location and naming conventions

As described in 12.2.1.3, "`Certificates`" on page 137, a key can be authenticated through a "certificate chain".

A certificate chain is a hierarchy of certificates that enable the implementation to verify the validity of the key used to check a signature. In the MHP environment, the root certificate is embedded in the MHP. Hence, the file structure shall carry all of the certificate chain apart from the root certificate.

The certificate file that leads to the public key of a signature shall be placed in the same directory as that signature file.

The name of a `CertificateFile` is:

```
"dvb.certificates.x"
```

where the <x> corresponds to the x value in the file name of the signature file verified by this certificate. Hence in the root directory of an authenticated subtree there shall be one certificate file for each signature file. See 12.4.2.2, "`SignatureFile location and naming conventions`" on page 141 and 12.4.4 "`Integration`".

12.4.3.6 Authentication rules

Certificates are considered to be the same if they have bitwise identical contents.

12.4.4 Integration

Logically a file is authenticated as follows:

- a) Confirm that the file is listed in the hash file located in the same directory as the file to be authenticated.
- b) Verify that the file contents and the corresponding digest value are consistent.
- c) Recursively ascend the directory hierarchy checking that each directory is authenticated by its parent directory until a directory is found that contains one or more signature files.

Such a directory is termed the root directory of an authenticated subtree.

NOTE 1: This means that there is no requirement to progress above the root of the authenticated subtree to examine further hash files. If a such a directory has a digest type other than "Non authenticated" in its parent directory, this is only significant when verifying the hash file of the parent directory.

NOTE 2: Presence of more than one signature file enables more than one set of organisations to authenticate a subtree. The application of this is outside the scope of this specification.

- d) For a signature file locate the corresponding certificate file (where the x portion of the signature file's file name identifies the certificate file to be used).

- e) Follow the certificate chain contained within the certificate file verifying each link in the chain until the link to the root certificate is found.
- f) If the identified root certificate and all the intermediate certificates leading to it are "satisfactory", accept the files as being authenticated.

"satisfactory" depends on the policies implemented in the receiver and other constraints expressed in this specification. In particular the requirements in 11.2.3, "Class Loading" on page 98 for using the "same" leaf certificate to authenticate DVB-J class files shall be observed.

- g) Dependant on receiver policy return to step (c) and repeat for other signature files.

NOTE: The above is a logical description of the process and does not constrain implementations to perform these steps in this exact order. E.g. hash files may be verified when descending an directory hierarchy rather than ascending one.

A file system may contain several independent authenticated subtrees, each tree with its own subtree root directory.

12.5 Profile of X.509 certificates for authentication of applications

This section identifies how ITU-T X.509 [54] is profiled when used for authentication of broadcast MHP applications. This profile is a variation (in general a sub-set) of the internet profile defined in RFC 2459 [58]. This section identifies the differences from the profile in RFC 2459 [58]. Section 12.11, "The internet profile of X.509 (informative)" on page 169 summarises the profile in RFC 2459 [58].

12.5.1 signatureAlgorithm

This specification supports 2 signature algorithms: MD5 with RSA and SHA-1 with RSA.

12.5.1.1 MD5 with RSA

The signature algorithm with MD5 and the RSA encryption algorithm is defined in RFC 2313 [56]. As defined in RFC 2313 [56], the ASN.1 OID used to identify this signature algorithm is:

```
md5WithRSAEncryption OBJECT IDENTIFIER ::= {
  iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-1(1) 4 }
```

12.5.1.2 SHA-1 with RSA

The signature algorithm with SHA-1 and the RSA encryption algorithm is implemented using the padding and encoding conventions described in RFC 2313 [56]. The message digest is computed using the SHA-1 hash algorithm. The ASN.1 object identifier used to identify this signature algorithm is:

```
sha-1WithRSAEncryption OBJECT IDENTIFIER ::= {
  iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-1(1) 5 }
```

12.5.1.3 parameters

For both of the 2 supported algorithms the parameters component shall be the ASN.1 type NULL.

12.5.2 signatureValue

The RSA signature generation process and the encoding of the result is described in detail in RFC 2313 [56].

12.5.3 version

The version field of the certificate shall signal v3. All implementations shall support the v3 extensions as required by 12.5.9, "Extensions" on page 146.

12.5.4 issuer

12.5.4.1 minimum requirement

For this specification at least a Common Name attribute shall be provided. The text value of the attribute shall be non-empty. It shall be suitable for direct presentation to the user.

12.5.4.2 certificate authority responsibility

The senior certificate authority who signs a certificate shall oversee the attribute information to ensure that the information is suitable.

12.5.5 validity

The only allowed format for encoding time in the `validity` field is `GeneralizedTime`.

12.5.6 subject

The subject field is a "distinguished name". The following requirements are specified by this specification:

- The only allowed encoding attributes of the subject is `UTF8String` (see 12.4.3.4, "Name matching" on page 143)
- The minimum set of attributes that shall be present in the subject are:
 - `commonName`
 - `countryName`
- If the certificate is a "leaf certificate" (see figure 14, "Certificate chain illustrated" on page 138) then the subject shall also contain an `organizationName`.
- When encoded the `organizationName` carries organisation specific text post fixed by the `organisation_id` of the authenticated files. This integer value is represented as a fixed length 8 character hexadecimal string (with leading zeros where required). So the `organizationName` takes the form:

```
text + "." + organisation_id
```

See 14.5, "Text encoding of application identifiers" on page 202.

This field reproduces the `organisation_id` value from the application's application identifier see 10.5.1, "Encoding" on page 76. If the values of the `organisation_ids` don't match then the application is considered to have failed authentication. Applications which fail authentication at this point shall not be started on MHP terminals.

12.5.7 SubjectPublic Key Info

This specification supports a single public key algorithm (RSA) for the subject public key.

The key lengths that implementation are required to support are addressed in G, "(normative): Minimum Platform Capabilities" on page 282.

12.5.7.1 rsaEncryption

The OID `rsaEncryption` identifies RSA public keys:

```
rsaEncryption OBJECT IDENTIFIER ::= { pkcs-1 1 }
pkcs-1 OBJECT IDENTIFIER ::= { iso(1) member-body(2) us(840)
                                     rsadsi(113549) pkcs(1) 1 }
```

The parameters field shall have ASN.1 type `NULL`.

12.5.7.2 subjectPublicKey

The RS `subjectPublicKey` BIT STRING shall be encoded using the ASN.1 type `RSAPublicKey`:

```

RSAPublicKey ::= SEQUENCE {
    modulus          INTEGER, -- n
    publicExponent  INTEGER -- e -- }

```

The semantics of the modulus (n) and the public exponent (e) are defined in [RFC 2313 \[56\]](#).

12.5.8 Unique Identifiers

X.509 defines the issuerUniqueID and subjectUniqueID extensions.

CAs conforming to this profile shall not generate certificates with unique identifiers.

MHP terminals conforming to this profile are not required to be capable of parsing unique identifiers and making comparisons.

12.5.9 Extensions

The following restrictions and semantics are placed on the use of certificate extensions when used to authenticate applications.

Table 51 : Profile for standard certificate extensions

Extension	In broadcasts	In implementations	Semantic
Authority key identifier	Opt.	Opt.	Shall not be marked critical
Subject key identifier	Opt.	Opt.	Shall not be marked critical
Key usage	Mand.	Mand.	If the keyUsage extension is marked critical, for the leaf certificate the bit digitalSignature shall be set, for other certificates the bit keyCertSign shall be set. If these bits are not set then the certificate shall be ignored by the implementation.
Private key usage period	Opt.	Opt.	Shall not be marked critical
Certificate policies	Opt.	Opt.	Shall not be marked critical
Policy mappings	Opt.	Opt.	Shall not be marked critical
Subject Alternative Name	Mand.	Opt.	Shall not be marked critical The subject name unambiguously identifies the subject. It is recommended that DVB MHP implementations can read rfc822Name (email address)
Issuer Alternative Name	Mand.	Opt.	Shall not be marked critical The issuer name unambiguously identifies the issuer. It is recommended that DVB MHP implementations can read rfc822Name (email address).
Subject Directory attributes	Opt.	Opt.	Shall not be marked critical
Basic Constraints	Opt.	Mand.	May be marked critical
Name Constraints	Opt.	Mand.	May be marked critical. DVB MHP decoders shall be able to recognise name constraints when GeneralName are either directoryName or rfc822 names.
Policy Constraints	Opt.	Opt.	Shall not be marked critical
Extended key usage field	Opt.	Opt.	Shall not be marked critical
CRL Distribution points	Opt.	Opt.	Shall not be marked critical

Table 52 : Key for table 51

Keyword	When applied to ...	
	broadcasts	receivers
Mandatory	Certificates shall include these extensions.	Receivers shall observe the semantic for this information when provided.
Optional	Certificates may or may be not include these extensions. The MHP specification does not define the use of these extensions and hence broadcasters should not use them.	Receivers can ignore these extensions if present.
Critical / not-critical	Broadcasters should not mark the receiver optional extensions as critical.	Certificates containing unrecognised critical extensions shall be considered as invalid. Receivers should recognise all the extensions that can be critical.

12.6 Security policy for applications

12.6.1 General principles

This section specifies the resource access policy for the downloaded applications. The resource access policy depends on two factors

- The access rights requested by the broadcaster through the signalling
- The access rights granted by the user.

The ultimate access rights that are granted to the applications are the intersection of the access rights requested by the broadcaster and the access rights granted by the user.

Unsigned applications have limited access to platform resources.

Unless specified elsewhere in this specification, signed applications have the same access rights as unsigned applications. An application broadcaster can request additional permissions to access specific resources by providing a signed "Permission Request File" along with the application. The syntax and semantics of the Permission Request File are defined in the following sections. The permission request file may also contain a credential that indicates that a persistent file owned by another organisation may be accessed. If the "Permission Request File" is not correctly authenticated the application is not granted any additional permissions but is not prevented from starting for this reason.

The way the user grants rights to the downloaded applications is implementation dependant and is not addressed by this specification.

For DVB-J applications, accessing a resource consists of method calls. Each method call that results in accessing the resource shall throw a security exception as defined in 11.10, "Java permissions" on page 127 and the specifications of the java APIs concerned. For each resource subject to access restriction, the application can test whether it has been granted permissions to access it by using the corresponding java Permission class (See 11.8, "Security" on page 124).

For a DVB-J application to be correctly authenticated, all the class files that the application consists of need to be signed. If, during the execution of the application the MHP detects an unsigned File containing a class or a class file that failed to pass the authentication process (i.e. because its actual hash value does not match the expected hash value), then the class shall be considered as not available.

When an application first requests to retrieve data from a file that is signalled as being signed, but for which the MHP failed to match the computed hash value and the expected hash value, then the API concerned shall fail in a manner consistent with the defined behaviour of that API when the file exists but has no content in it.

NOTE: In order to be efficient, if a directory D contains objects that are likely to frequently change, it is advised to put a signature file in this directory D and to mark the directory D as non authenticated in the hashfile located in the parent directory of D. By doing so, it will limit the propagation of modifications to just one directory.

The authentication of a file is evaluated each time that the file is loaded from a transport connection. File version information in the transport system cannot be assumed to be secure.

Applications authors should be aware that deciding whether to grant a permission or not may, depending on the implementation, involve prompting and asking the end user. The latest point in time when the implementation must decide if an application has a permission or not is when the application either queries the presence of this permission for the first time or when it invokes an action that requires the permission for the first time. Application authors should be aware that in these situations, an implementation may prompt and ask the user. Depending on the implementation, this prompting (if necessary) can also happen at any point in time prior to this (e.g. at the application start up time).

An MHP terminal is required to be able to operate in a mode where it grants permission to provide access to all of the functionality required by the profiles and options that it supports when appropriately requested (e.g. via the permission request file). The mechanism for causing the terminal to operate in this mode is implementation-dependent. The granting of permissions for accessing functionality outside of the claimed MHP profile and options is not required.

NOTE: In the case of permissions represented by a Java class in DVB-J, this means that it will be possible to have such a permission granted if the corresponding class is required in the given profile, and it can be requested in the permission request file.

NOTE: This means that, for example, it must be possible to grant the permission associated with dialling a phone number on a terminal that supports the interactive broadcast profile, even if the terminal implements the interaction channel using a cable modem. In this case, the dialling APIs will fail in a manner consistent with this specification.

12.6.2 Permission request file

12.6.2.1 File encoding

The Permission Request File is an XML File. Its syntax is defined by the following DTD. The Name used in the document type declaration shall be "permissionrequestfile".

The `PublicLiteral` to be used for specifying this DTD in document type declarations of the XML files is:

```
"-//DVB//DTD Permission Request File 1.0//EN"
```

and the URL for the `SystemLiteral` is:

```
"http://www.dvb.org/mhp/dtd/permissionrequestfile-1-0.dtd".
```

The DTD is:

```
<!ELEMENT permissionrequestfile
  (file?, capermission?, applifecyclecontrol?, returnchannel?, tuning?,
  servicesel?, userpreferences?, network?, dripfeed?, persistentfilecredential?)>
<!ATTLIST permissionrequestfile
  orgid CDATA #REQUIRED
  appid CDATA #REQUIRED
  >

<!ELEMENT file EMPTY>
<!ATTLIST file
  value          (true|false) "true"
  >

<!ELEMENT capermission (casystemid)+>
<!ELEMENT casystemid EMPTY>
<!ATTLIST casystemid
  entitlementquery (true|false) "false"
  id               CDATA #REQUIRED
  mmi             (true|false) "false"
```



```

    messagepassing      (true|false) "false"
    buy                  (true|false) "false"
>

<!ELEMENT applifecyclecontrol EMPTY>
<!ATTLIST applifecyclecontrol
    value                (true|false) "true"
>

<!ELEMENT returnchannel (defaultisp?,phonenumber*)>
<!ELEMENT defaultisp EMPTY>
<!ELEMENT phonenumber (#PCDATA)>

<!ELEMENT tuning EMPTY>
<!ATTLIST tuning
    value                (true|false) "true"
>

<!ELEMENT servicesel EMPTY>
<!ATTLIST servicesel
    value                (true|false) "true"
>

<!ELEMENT userpreferences EMPTY>
<!ATTLIST userpreferences
    write                (true|false) "false"
    read                 (true|false) "true"
>

<!ELEMENT network (host)+>
<!ELEMENT host (#PCDATA)>
<!ATTLIST host
    action                CDATA #REQUIRED
>

<!ELEMENT dripfeed EMPTY>
<!ATTLIST dripfeed
    value                (true|false) "true"
>

<!ELEMENT persistentfilecredential (grantoridentifier,expirationdate,filename+,signature,
certchainfileid)>
<!ELEMENT grantoridentifier EMPTY>
<!ATTLIST grantoridentifier
    id                    CDATA #REQUIRED
>
<!ELEMENT expirationdate EMPTY>
<!ATTLIST expirationdate
    date                  CDATA #REQUIRED
>
<!ELEMENT filename (#PCDATA)>
<!ATTLIST filename
    write                (true|false) "true"
    read                 (true|false) "true"
>
<!ELEMENT signature (#PCDATA)>
<!ELEMENT certchainfileid (#PCDATA)>

```

12.6.2.1.1 Number representation

12.6.2.1.1.1 Hex

Unless stated otherwise each hexadecimal value has the following form "0x" N*hex where "N" specifies the fixed number of significant digits in the value and hex is specified by the following BNF:

```

hex = digit | "A" | "B" | "C" | "D" | "E" | "F" | "a" | "b" | "c" | "d" | "e" | "f"
digit = "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

```

12.6.2.2 File integrity

If the permission file is not parsable as defined by the XML parsing rules (see 14.3, "XML notation" on page 200) it shall be ignored and hence no additional permissions are granted.

12.6.2.3 Example

```
<?xml version="1.0"?>
<!DOCTYPE permissionrequestfile PUBLIC "-//DVB//DTD Permission Request File 1.0//EN"
"http://www.dvb.org/mhp/dtd/permissionrequestfile-1-0.dtd">
<permissionrequestfile orgid="0x000023d2" appid="0x0020">

  <file value="true"></file>

  <capermission>
    <casystemid
      id="0x1111" messagepassing="true"
      entitlementquery="true" mmi="false">
    </casystemid>
  </capermission>

  <applifecyclecontrol value="true"></applifecyclecontrol>

  <returnchannel>
    <defaultisp></defaultisp>
    <phonenumber>+3583111111</phonenumber>
    <phonenumber>+3583111112</phonenumber>
    <phonenumber></phonenumber>
  </returnchannel>

  <tuning value="false"></tuning>

  <servicesel value="true"></servicesel>

  <userpreferences read="true" write="false"></userpreferences>

  <network>
    <host action="connect">hostname</host>
  </network>

  <persistentfilecredential>
    <grantoridentifier id="0x0202030"></grantoridentifier>
    <expirationdate date="24/12/2032"></expirationdate>
    <filename read="true" write="false">5/15/dirl/scores</filename>
    <filename read="true" write="false">5/15/dirl/names</filename>
    <signature>023203293292932921493143929423943294239432
    </signature>
    <certchainfileid>3</certchainfileid>
  </persistentfilecredential>

</permissionrequestfile>
```

12.6.2.4 Permission request file name and location

The format for the permission request file name is:

```
"dvb.<application name>.perm"
```

The prefix "dvb" identifies this as a well known file specified by this specification. The portion "application name" carries the file name of the initial file of the application. The initial file depends on the application type as is shown in table 53 for the types defined in this specification.

Table 53 : Application name for different application types

Application type		File identified for application name
Value	Meaning	
0x0001	DVB-J	The name <i>initial_class_byte</i> , see table 34 on page 92
0x0002	DVB-HTML	The name <i>initial_path_bytes</i> , see table 36 on page 93

This file shall be located in the same directory as the initial file.

12.6.2.5 Permission request file

12.6.2.5.1 Minimum permissions

If the permission file does not contain a valid `permissionrequestfile` element it shall be ignored and hence no additional permissions are granted.

12.6.2.5.2 Syntax and semantics

```
<!ATTLIST permissionrequestfile
  orgid CDATA #REQUIRED
  appid CDATA #REQUIRED
>
```

orgid: This attribute is a hexadecimal string (`hex_string`) that conveys the organisation id of the associated application. The encoding of this value is specified in 12.6.2.1.1.1, "Hex" on page 149.

appid: This attribute is a hexadecimal string (`hex_string`) that conveys the application id of the associated application. The encoding of this value is specified in 12.6.2.1.1.1, "Hex" on page 149.

12.6.2.6 Credentials

A credential contains a resource description and is used to allow the owner of this resource (the grantor) to grant to the permission request file's application to access it. In this specification, the only resource that can be contained in a credential is a file (or a set of files of a directory). This type of credential is named `persistentfilecredential` in the XML DTD. The credential contains an expiration date that allow the grantor to grant access to its resource for a limited duration. The credential is signed by the grantor. The signature checking is done by the implementation by getting the certificate of the grantor. The certificate can be found thanks to the information contained in the `certchainfileid` element.

The certificate that leads to the public key of the signature shall be placed either in the same directory as the permission request file containing the credential or in one of its parent directories.

The `grantoridentifier` in the `persistentfilecredential` shall match the `organization_id` contained in the `Subject organizationName` field of the leaf certificate. Likewise, the `grantoridentifier` shall match the owner of the file to which access is granted by this `persistentfilecredential`. If either of these matches is not successful then the file access shall not be granted.

The persistent file credential is transmitted using the following XML DTD syntax:

```
<!ELEMENT persistentfilecredential (grantoridentifier,expirationdate,filename+,signature,
certchainfileid)>
<!ELEMENT grantoridentifier EMPTY>
<!ATTLIST grantoridentifier
  id CDATA #REQUIRED
>
<!ELEMENT expirationdate EMPTY>
<!ATTLIST expirationdate
  date CDATA #REQUIRED
>
<!ELEMENT filename (#PCDATA)>
<!ATTLIST filename
  write (true|false) "true"
  read (true|false) "true"
>
<!ELEMENT signature (#PCDATA)>
<!ELEMENT certchainfileid (#PCDATA)>
```

The following table provide more information about the different elements:

Table 54 :

Elements	Comments
grantoridentifier	<p>This element contains the 32 bit organization id identifying the grantor organization. The CDATA attribute <code>id</code> of this element shall have the following BNF syntax: <code>"0x" 0*8hex ; e.g. 0x34243</code></p> <p>See 12.6.2.1.1.1, "Hex" on page 149.</p>
expirationdate	<p>This element contains the expiration date of this credential. The implementation should ignore the certificate if the date has expired. The CDATA attribute <code>date</code> shall follow the following BNF syntax: <code>2dec "/" 2dec "/" 4dec ; e.g. "01/12/2001"</code></p> <p>Where the first 2 digits are the day number in the month, the second two digits are the month number in the year and the last 4 digits are the year. All values are in accordance with the Gregorian calendar.</p>
filename	<p>This element contains the filename path and the read/write access rights that are granted on the file. The element consists of a CDATA string following the following BNF syntax: <code>1*(alphanum "/" "*" "." "-" "_" "?")</code></p> <p>"*" can be used as a wildcard to replace any number of character in a file or directory name. "?" can be used to represent one wildcarded character "/" is the file separator "-" used at the end of a pathname indicates (recursively) all files and subdirectories contained in that directory</p> <p>The file path shall not start with a "/". It is relative to the path obtained from the <code>dvb.persistent.root</code> property. The element has two attributes <code>read</code> and <code>write</code> that can take the value "true" or "false".</p>
signature	<p>This element contains a signature from the grantor. Signature structure is as defined section 12.4.2, "SignatureFile" on page 141. The signature follows the following BNF syntax: <code>1*dec</code></p>
certchainfileid	<p>This element contains the identifier of the leaf certificate, i.e. the "x" in the file name "dvb.certificate.x".</p>

The signature is computed on the binary concatenation of the following fields in the following order with identically the same encoding as in the permission request file:

Table 55 :

Fields	Binary content
grantee_identifier.organization_id	32 bits
grantee_identifier.application_id	16 bits
grantor_identifier (organization_id)	32 bits
expiration_date	10 characters (e.g. "10/12/2001") in ASCII
filenames & actions (in the order they appear in the XML document) i.e.:	
<pre> for (i=0;i<filenumber;i++) { read write filepath } </pre>	<pre> 4 or 5 char ("true" or "false") 4 or 5 char ("true" or "false") string in ASCII (without any string termination character) </pre>

The implementation will check the validity of the credential by checking the signature with the grantor's public key that can be found in the grantor's certificate. Certificates are carried by the grantee in the file format defined section 12.4.3, "CertificateFile" on page 142. Certification chain authenticates grantor's certificate. This chain shall derive from one of the root authorities embedded in the MHP.

12.6.2.7 File Access

12.6.2.7.1 Unsigned applications

Have no access to the persistent storage

12.6.2.7.2 Default policy for signed applications

No access to the persistent storage, unless otherwise indicated in the Permission File.

When an application is granted access to the File system, the file access policy is derived from the policy used in the Unix world:

An application owns the files it has created. The root directory of the persistent file namespace is defined by the 'dvb.persistent.root' property as described in 11.5.6, "Persistent Storage API" on page 115. The files owned by an application shall be located in sub-directories below this directory, specifically one of the following two choices:

- a) the sub-directory whose name is the **organisation_id** of the application concerned.
- b) a sub-directory of the immediately previously defined directory whose name is the **application_id** of the application concerned.

The encodings of the organisation identifier and application identifier are as defined in 14.5, "Text encoding of application identifiers" on page 202. By default, applications cannot access any file outside the second of the two directories defined immediately above.

An Application can modify the access rights to a file it owns as follows:

- it can grant a read-only access, a write-only access or a read-write access to all applications having the same organisationId value.
- it can grant a read-only access, a write-only access or a read-write access to all applications.
- write access to a directory is required to add or remove an entry in a directory.
- read access to a directory is required to list the contents of a directory or access any of the files contained within in it.
- to read the contents of a file permission to read that file and all directories on the path to the root of the persistent file system is required

An application shall be granted access to a file if it qualifies for such access by application, organisation or world access permissions.

An application's right to access a file is the union of the rights granted by the credential mechanism and the right granted by the file permission mechanism.

See org.dvb.io.persistent see K, "(normative): DVB-J persistent storage API" on page 309.

12.6.2.7.3 Permission request syntax

```
<!ELEMENT file EMPTY>
<!ATTLIST file
  value (true|false) "true"
>
```

12.6.2.8 CA API

12.6.2.8.1 Unsigned applications

An unsigned application cannot access the following methods:

- CAModule.buyEntitlements
- CAModule.openMessageSession
- CAModuleManager.addMMILListener
- CAModule.queryEntitlements
- CAModule.listEntitlements.

12.6.2.8.2 Signed applications

By default, an application has limited access to the CA API functions (same default rights as an unsigned application)

In particular, the following method calls are not accessible to an unsigned application:

- CAModule.buyEntitlements
- CAModule.openMessageSession
- CAModuleManager.addMMILListener
- CAModule.queryEntitlements
- CAModule.listEntitlements.

The permission request file requests the MHP to grant additional rights to the application with the ConditionalAccess Permission described below.

12.6.2.8.3 Conditional Access Permission syntax

The ConditionalAccess Permission is optional. When not present, the application has the default access rights. When present, the permission request file overrides the default rights for this application.

```
<!ELEMENT capermission (casystemid)+>
<!ELEMENT casystemid EMPTY>
<!ATTLIST casystemid
  entitlementquery      (true|false) "false"
  id                    CDATA #REQUIRED
  mmi                   (true|false) "false"
  messagepassing       (true|false) "false"
  buy                   (true|false) "false"
>
```

The string specifying the CA system IDs has the following syntax:

```
CAIds          = 1*CASystemId | "[" CASystemId "-" CASystemId "]" | "*"
CASystemId     = "0x" 4*hex
```

See 12.6.2.1.1.1, "Hex" on page 149.

12.6.2.9 Application lifecycle control policy

Applications shall not launch broadcast applications that are not signalled in the AIT of the same service.

12.6.2.9.1 Unsigned applications

An unsigned broadcast application can launch any application visible in the listing API that is signalled in the same service.

An unsigned application can control (pause, stop, resume) the lifecycle of an application it has launched.

An unsigned application cannot control the lifecycle of an application it has not launched.

12.6.2.9.2 Default policy for Signed applications

By default, a signed application has the same rights as an unsigned application as concerns the application lifecycle control policy.

These default rights can be overridden by the permission request file as described below.

12.6.2.9.3 Syntax

```
<!ELEMENT applifecyclecontrol EMPTY>
<!ATTLIST applifecyclecontrol
  value (true|false) "true"
>
```

value: When the boolean value is set to `true`, this means that the application can control the lifecycle of all the applications signalled in the same service. When set to `false` the policy is as in 12.6.2.9.2, "Default policy for Signed applications" on page 155.

12.6.2.10 Return channel access policy

12.6.2.10.1 Unsigned applications

An unsigned application may not use the return channel.

12.6.2.10.2 Signed applications

By default, a signed application may not access the return channel, unless otherwise specified by the permission request file. The syntax of the return channel permission is so that it describes the phone numbers that the application may try to dial.

12.6.2.10.3 Return channel permission syntax

```
<!ELEMENT returnchannel (defaultisp?,phonenumber*)>
<!ELEMENT phonenumber (#PCDATA)>
<!ELEMENT defaultisp EMPTY>
```

The syntax of the phone number string is as defined below.

```
phonenumber = "+" digit digits | digits
digits      = "" | digit digits
digit       = "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
```

If default ISP is not present, then the net API shall not use the default ISPnumber.

The presence of the `defaultisp` tag indicates that the application is allowed to use the default ISP connection. If this tag is not present, the application is not allowed to use the default ISP connection.

When a phone number is given, this number defines a prefix of the allowed phone numbers and applications are allowed to call to all numbers that start with one of the prefixes defined in the permission request file, subject to the MHP terminal granting this right.

NOTE: By defining an empty phone number tag (i.e. empty string as the prefix), the application could try to call to any phone number.

12.6.2.11 Tuning access policy

12.6.2.11.1 Unsigned applications

An unsigned application may not tune using the Tuning API.

12.6.2.11.2 Signed applications

By default, a signed application may not tune using the Tuning API. However, the right to tune can be requested with the Tuning permission that can be put in the permission request file.

12.6.2.11.3 Tuner Permission syntax

The syntax of this permission is as follows:

```
<!ELEMENT tuning EMPTY><
<!ATTLIST tuning
  value (true|false) "true"
>
```

The value `true` requests the permission to tune using the Tuning API.

12.6.2.12 Service selection policy

12.6.2.12.1 Unsigned applications

Unsigned applications may not select a new service.

12.6.2.12.2 Signed applications

By default, signed applications can select any new service, unless otherwise specified in the permission request file.

12.6.2.12.3 Service Selection Permission

The syntax of the service selection permission is as follows:

```
<!ELEMENT servicesel EMPTY>
<!ATTLIST servicesel
  value (true|false) "true"
>
```


If no service selection permission is present in the permission request file, the application has the default right, i.e. it can select any service.

The value "false" in this item in the permission request file, denies the right to select a new service.

12.6.2.13 Media API access policy

The media API is inside the sandbox.

12.6.2.14 Inter-application communication policy

12.6.2.14.1 Unsigned applications

Unsigned applications are allowed to communicate with each other through the inter-application communication API. However, an unsigned application is not allowed to communicate with a signed application through the inter-application communication API.

12.6.2.14.2 Signed applications

Signed applications signalled in the same service are allowed to communicate with each other through the inter-application communication API.

No special Permission need be defined.

12.6.2.15 User Setting and Preferences access policy

12.6.2.15.1 Unsigned applications

Read access to:

- User Language
- Parental Rating
- DefaultFontSize
- Country Code

An unsigned application cannot access (neither read nor write) to other preferences

12.6.2.15.2 Signed applications

By default, same as unsigned applications. The permission request file may include items that request read access to all user preferences and/or write access to all user preferences.

12.6.2.15.3 Permission syntax

```
<!ELEMENT userpreferences EMPTY>

<!ATTLIST userpreferences
  write (true|false) "false"
  read (true|false) "true"
>
```

True value in the write and read attribute means that the permission for writing and reading, respectively, is requested.

12.6.2.16 Network permissions

12.6.2.16.1 Unsigned applications

Unsigned applications can not have access to the return channel and therefore do can not access remote network hosts,

12.6.2.16.2 Signed applications

For signed applications, the permission request file can contain a set of permissions that specify the hosts and actions for which permissions are requested.

12.6.2.16.3 Permission syntax

```
<!ELEMENT network (host)+>
<!ELEMENT host (#PCDATA)>
<!ATTLIST host
  action CDATA #REQUIRED
>
```

The two strings that specify the host and the action shall be formatted as specified in the `java.net.SocketPermission` class as defined in 11.8, "Security" on page 124.

12.6.2.17 Dripfeed permissions

12.6.2.17.1 Unsigned applications

Has no access to drip feed mode.

12.6.2.17.2 Default policy for signed applications

No access to drip feed mode unless otherwise indicated in the Permission file. When an application is granted access to the drip feed mode, it is able to instantiate a `DripFeedDataSource`.

12.6.2.17.3 Permission request syntax

```
<!ELEMENT dripfeed EMPTY>
<!ATTLIST dripfeed
  value (true|false) "true"
>
```

12.7 Example of creating an application that can be authenticated

12.7.1 Scenario Example

This section is informative and gives an example of how a file system carrying two applications can be organised.

In this example, the file system carries single signed application `Xlet1`.

The main class of the application is the file `root/Xlet1/classes/Xlet1.class`, other files comprising the application are the following classes:

- `root/Xlet1/classes/foo1.class`
- `root/Xlet1/classes/subclasses/sub1.class`
- `root/Xlet1/classes/subclasses/sub2.class`

`Xlet1` consumes data located in the file `root/Xlet1/data/Xlet1.dat`. This file is not authenticated.

Each subdirectory that contains signed files contains a hashfile.

Assumptions in this example:

- All the `*.class` files are signed
- The file `root/Xlet1/data/Xlet1.dat` is not signed
- The only digest algorithm used is MD5

The file structure is shown below:

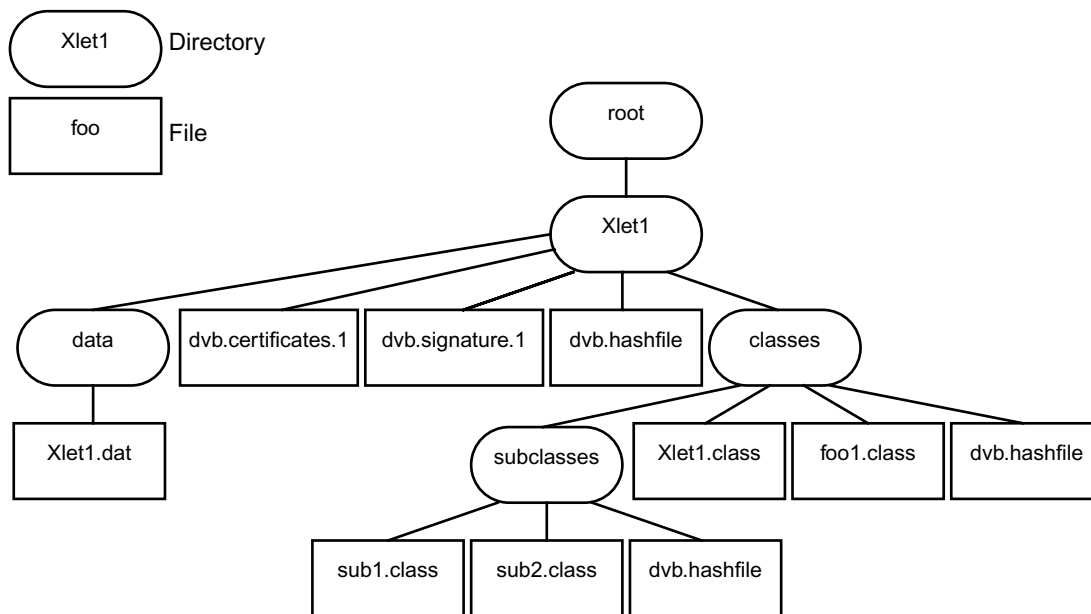


Figure 15 : Example of an authenticated file tree

12.7.2 Hashes and signature computations:

12.7.2.1 Computation of the hashes of the root/Xlet1/classes/subclasses directory

- a) initialise the MD5 algorithm
- b) apply the contents of the file `root/Xlet1/classes/subclasses/sub1.class` to the MD5 algorithm then apply the contents of the file `root/Xlet1/classes/subclasses/sub2.class` to the MD5 algorithm. The cumulative result from these two files is the result `H0`
- c) construct the contents of the hash file for the directory `root/Xlet1/classes/subclasses/` as follows:

Table 56 : root/Xlet1/classes/subclasses/dvb.hashfile

Field	Comment
1	One digest
1	Type of digest algorithm = MD5
2	Number of entries over which a MD5 hash has been computed
sub1.class	List of names of entries
sub2.class	
H0	MD5 hash of files <code>sub1.class</code> and <code>sub2.class</code>

NOTE: In this example we have chosen that the digests for this directory result from processing the concatenation of the contents of the files in the directory.

- d) create the hash file `root/Xlet1/classes/subclasses/dvb.hashfile` with the above contents

12.7.2.2 Computation of the hashes of the of root/Xlet1/classes directory

- e) initialise the MD5 algorithm, compute the MD5 hash `H2` using the contents of the file `root/Xlet1/classes/subclasses/dvb.hashfile`
- f) initialise the MD5 algorithm, compute the MD5 hash `H3` using the contents of the file `root/Xlet1/classes/Xlet1.class`
- g) initialise the MD5 algorithm, compute the MD5 hash `H4` using the contents of the file `root/Xlet1/classes/foo1.class`

h) construct the contents of the hash file for the directory `root/Xlet1/classes/` as follows:

Table 57 : root/Xlet1/classes/dvb.hashfile

Field	Comment
3	Three digests
1	Type of digest algorithm = MD5
1	Number of entries over which a MD5 hash has been computed
subclasses	List of names of entries
H2	MD5 hash of subclasses directory
1	Type of digest algorithm = MD5
1	Number of entries over which a MD5 hash has been computed
Xlet1.class	List of names of entries
H3	MD5 hash of file Xlet1.class
1	Type of digest algorithm = MD5
1	Number of entries over which a MD5 hash has been computed
foo1.class	List of names of entries
H4	MD5 hash of file foo1.class

NOTE: In this example we have chosen to individually hash each object in this directory.

i) create the hash file `root/Xlet1/classes/dvb.hashfile` with the above contents

12.7.2.3 Computation of the hashes of the of root/Xlet1 directory

j) initialise the MD5 algorithm, compute the MD5 hash H5 using the contents of the file `root/Xlet1/classes/dvb.hashfile`

k) construct the contents of the hash file for the directory `root/Xlet1/classes/` as follows:

Table 58 : root/Xlet1/dvb.hashfile

Field	Comment
2	Two digests
1	Type of digest algorithm = MD5
1	Number of entries over which a MD5 hash has been computed
classes	List of names of entries
H5	MD5 hash of the classes directory
0	Type of digest algorithm = non authenticated data
1	Number of entries over which a MD5 hash has been computed
data	List of names of entries
<no digest in this case>	

NOTE: the `root/Xlet1/classes` entry is the only authenticated entry of the `root/Xlet1` directory

l) create the hash file `root/Xlet1/dvb.hashfile` with the above contents

12.7.2.4 Computation of the signature

m) initialise the MD5 algorithm, compute the MD5 hash H6 using the contents of the file `root/Xlet1/dvb.hashfile`

n) RSA-encrypt H6 with the private key corresponding to the public key that can be found in the leaf certificate in the file `root/Xlet1/dvb.certificates.1`. In this example this has serial number 0123456.

o) ASN.1 encode the following structure:

- AuthorityCertIssuerName: Name of the CA
- AuthorityCertSerialNumber: 0123456
- HashSignatureAlgorithm: MD5
- SignatureValue: result of step (n).

p) put this structure into the signature file `root/Xlet1/dvb.signature.1`

NOTE: The file system could contain other Xlets in their own authenticated sub-trees. If these use the same certificate chain as Xlet1 (above) then logically the certificates file is replicated at the root of each of the authenticated sub-trees. Some file systems support symbolic links. These may in some cases improve the efficiency of the broadcast.

12.8 Procedures for application certificates and signatures

See 12.12, "MHP certification procedures" on page 177.

12.9 Certificate management

12.9.1 Certificate Revocation Lists

12.9.1.1 Introduction (informative)

Certificates may be revoked prior to their expiration time, e.g. if the broadcaster's private key is assumed to be compromised, or the broadcaster is no longer to be certified by the CA. Each CA publishes a list of revoked certificates, called a CRL (Certificate Revocation List). This contains the list of the serial number of revoked certificates.

During the validation process of a certificate chain, the CRL of each certification authority on the certification path is checked.

12.9.1.2 Distribution of CRLs (informative)

Two routes from the broadcaster to the MHP terminal can be envisaged:

- via the return channel
- in the broadcast MPEG stream

12.9.1.2.1 Distribution via return channel

In the certificate extension fields, there is an optional field called "CRL Distribution points". This field can hold a URL pointing to a `crFile` which can be downloaded.

This approach is suitable for obtaining CRLs relating to TLS authentication of return channel exchanges. It is not suitable for delivering CRLs for broadcast application authentication as:

- not all MHP profiles require return channel support
- MHP terminals may be able to receive broadcast applications when not connected to a return channel
- it would not be acceptable to require a return channel session to authenticate each broadcast application

12.9.1.2.2 Distribution via MPEG stream

For an MHP terminal without a working return channel, the only way to deliver CRLs is via the broadcast MPEG Transport Stream.

12.9.1.3 CRL retention

12.9.1.3.1 Requirement

MHP terminals shall retain CRLs in persistent storage because:

- this enhances security as it defends against attacks with signals that filter out the CRL and use a revoked certificate
- it is more efficient to cache CRLs rather than downloading the CRLs for authentication of each application

12.9.1.3.2 Storage requirement

The minimum amount of persistent memory required to store CRLs is addressed in [12.12, "MHP certification procedures" on page 177](#).

12.9.1.3.3 Storage management

The broadcast CRL and RCMM signalling (see [12.9.2, "Root certificate management" on page 165](#)) manages the use of the persistent storage.

If the CRL of a non-root certificate CA become's too large the CA's certificate itself can be revoked by its parent CA who adds it to their CRL. For root certificates, the RCMM mechanism can be used.

The broadcaster policy in this area is addressed in [12.12, "MHP certification procedures" on page 177](#).

12.9.1.4 CRL file location and naming convention

For CRLs that are authenticated by a broadcast certificate the format of the name of files carrying CRLs shall be:

```
"dvb.crl.x"
```

In this case the "x" portion of the filename corresponds to the "x" portion of a certificate filename for the certificate file that authenticates the CRL.

For CRLs that are authenticated by a root certificate the format of the name of files carrying CRLs shall be:

```
"dvb.crl.root.x"
```

In this case the "x" portion of the filename is just a discriminator to ensure non-collision of CRL file names in the event that there is more than one in this directory.

The CRL filename may not be constant through time or across broadcasts. So, implementations shall not rely on this filename when caching the CRL.

All CRL files shall be located in a subdirectory of the root of the file system called "dvb.crl". The location of certificate files authenticating the CRL files shall follow the same rules as for the location of certificates relative to a signature file. That is the certificate files shall either be in the dvb.crl directory or in the root directory. See [12.4.3.5, "CertificateFile location and naming conventions" on page 143](#).

12.9.1.5 Operational model

Receivers are expected to inspect the set of CRL files periodically and cache the revocation information for future use. This inspection process can assume that a file system will not normally carry certificates revoked by CRL files carried in the same file system. So, inspection of the CRL set in a file system is not a precondition to authenticating other files in that file system.

This specification does not address the reliability with which implementations are required to consider certificate revocations when authenticating files.

12.9.1.6 Examples

12.9.1.6.1 Revocation of a broadcaster's certificate

If the broadcaster B's certificate is compromised:

- a) the certification authority CA01 adds the serial number of broadcaster B's certificate to its CRL
- b) CA01 then sends the new CRL file to the broadcasters that use CA01
- c) these broadcasters (broadcaster A for instance) broadcast the new CRL file

As soon as an MHP terminal has downloaded the new CRL file (after selecting one of broadcaster A's channel), the MHP terminal's CRL cache in persistent storage is updated. The MHP terminal is then protected against any malicious usage of the compromised certificate.

To continue authenticating applications broadcast "B" will require a new certificate.

12.9.1.6.2 Revocation of a CA's certificate.

If the CRL of CA01 becomes too big, CA01's certificate could be revoked:

- a) the root certification authority RCA0 adds the serial number of CA01's certificate to its CRL
- b) RCA0 sends the new CRL file to the broadcasters that use RCA0
- c) these broadcasters broadcast the new CRL file

As soon as an MHP terminal has downloaded the new CRL file, its CRL cache in persistent storage for RCA0 is updated and CA01's CRL is removed from the cache (as CA01 has been revoked).

12.9.1.7 CRL format

Each CRL file contains the CRL of one certification authority.

The encoding of the CRL is defined in the [ITU-T X.509 \[54\]](#) is reproduced below for information. The fields Version, Time, CertificateSerialNumber correspond to fields with the same names in the certificate see [12.11, "The internet profile of X.509 \(informative\)" on page 169](#):

```

CertificateList ::= SEQUENCE {
    tbsCertList                TBSCertList,
    signatureAlgorithm         AlgorithmIdentifier,
    signatureValue BIT STRING }

TBSCertList ::= SEQUENCE {
    version                    Version OPTIONAL,
                                -- if present, shall be v2
    signature                  AlgorithmIdentifier,
    issuer                     Name,
    thisUpdate                 Time,
    nextUpdate                 Time OPTIONAL,
    revokedCertificates        SEQUENCE OF SEQUENCE {
    userCertificate            CertificateSerialNumber,
    revocationDate            Time,
    crlEntryExtensions        Extensions OPTIONAL
                                -- if present, shall be v2
    } OPTIONAL,
    crlExtensions              [0] EXPLICIT Extensions OPTIONAL
                                -- if present, shall be v2
}

```

12.9.1.8 Profile of CRL

The profile of fields that correspond to fields in the certificate follow the profile in 12.5, "Profile of X.509 certificates for authentication of applications" on page 144. This applies to the following fields:

signatureAlgorithm : follows "signatureAlgorithm" on page 144.

signatureValue: follows "signatureValue" on page 144.

version: follows "version" on page 144.

signature: follows "signatureAlgorithm" on page 144.

issuer: follows "issuer" on page 145.

thisUpdate: Publication date of this CRL. Follows the encoding of Time used for **validity**. See "validity" on page 145.

nextUpdate: Publication date of the next version of the CRL. Follows the encoding of Time used for **validity**. See "validity" on page 145.

userCertificate: SerialNumber of the revoked certificate. It is used to identify the revoked certificate.

The serial number shall be unique for a given CA. So, the pair [issuerName, serialNumber] shall be unique.

revocationDate: Date of revocation for a given certificate. Follows the encoding of Time used for **validity**. See "validity" on page 145.

crlExtensions: The syntax of the **Extensions** element is reproduced on "Extensions" on page 173. This element allows multiple extension elements to be carried. The set of extensions defined for certificates and CRLs is reproduced at 12.11.2, "Standard certificate extensions" on page 174.

The following crlExtension shall be supported:

- AuthorityKeyIdentifier as defined in section 12.4.2.1 on page 141.

This extension identifies the certificate that is needed to check the signature of the CRL.

Other crlExtensions are optional.

12.9.1.9 CRL Processing

List of revoked serial numbers shall be kept in persistent storage in set top box.

When an MHP terminal finds a file with the file name format given in 12.4.3.5, "CertificateFile location and naming conventions" on page 143, it shall do the following sequence:

- a) Get the field thisUpdate and compare it with the last update for the CRL. If thisUpdate is not after the last update, ignore the CRL.
- b) Check the signature of the CRL. If it is invalid, ignore the message.
- c) Process the content of the CRL message:
 - store the list of serial numbers of revoked certificates in persistent storage.
 - update the stored value of thisUpdate with the value from the CRL.
- d) If a CA's certificate has been revoked, remove its CRL if it was stored in the MHP terminal.

During the validation process of a certificate chain, the CRL of each certification authority on the certification path is checked.

12.9.2 Root certificate management

12.9.2.1 Introduction

Every compliant MHP terminal will have to maintain a set of X.509 root certificates in persistent storage. These root certificates will be placed in the MHP terminal by its manufacturer during the manufacturing process.

It could be necessary to update the set of root certificates for MHP terminals that are already deployed. Possible reasons that could require such an update include:

- a root certificate becoming compromised
- technical developments (such as the emergence of factorisation algorithms) that require the use of greater key lengths in root certificates to provide adequate security
- retirement of a certificate due to its age

So, It is necessary to have a standard mechanism to update this set.

NOTE: A manufacturer specific mechanism could require a different message for each manufacturer and so would be more expensive in terms of broadcast bandwidth.

The mechanism specified here uses messages called RCMM (Root Certificate Management Messages). These messages contain a set of new root certificates to add and a reference to the root certificates to remove.

12.9.2.2 Security of RCMM

RCMM are authenticated by multiple signatures. An RCMM message will be accepted by an MHP terminal if and only if it has at least N signatures.

The initial value of N and the maximum value of N that MHP terminals will ever be asked to support are specified in 12.12, "MHP certification procedures" on page 177.

NOTE: The initial value of N is expected to be 2

The use of multiple signatures guarantees that the set of root certificates can be updated securely even if one of the root certificates has been compromised.

RCMM can update the number of signatures required for future RCMM using the nextNbOfSignature field.

The RCMM message shall be signed with the key of the certificates to be removed.

12.9.2.3 Format of RCMM

The encoding of RCMM is ASN.1 DER (see [ASN.1 \[57\]](#)):

```
URCMM ::= SEQUENCE {
    issuer                Name,
    thisUpdate            Time,
    nextNbOfSignatures   INTEGER OPTIONAL,
    addedCertificates     SET OF Certificate
    removedCertificates  SET OF CertificatesReference }
```

```
CertificatesReference ::= SEQUENCE {
    issuerName           Name,
    serialNumber         CertificateSerialNumber }
```

issuer: Identification of the certification authority which has issued the message.

thisUpdate: Date of the issue of the message.

nextNbOfSignatures: This field could be used to change the minimum number of valid signatures required for an RCMM message. This value will be applied to the next RCMMs not to itself!

addedCertificates: List of root certificates to be added in persistent storage

removedCertificates: Reference of the root certificates to be removed from persistent storage

```
RCMM ::= SEQUENCE {
    uRcmm                URCMM,
    signatures            SET OF SignatureInfo }

SignatureInfo ::= SEQUENCE {
    signerName           Name,
    signatureAlgorithm   AlgorithmIdentifier,
    signatureValue       BIT STRING }
```

NB: The signatures are computed on the whole content of uRCMM.

issuerName: Name of the issuer of the root certificate to remove (for a self signed root certificate this field is equal to the subject name).

serialNumber: Serial number of the root certificate to remove.

12.9.2.4 Distribution of RCMM

RCMM are distributed to the MHP terminals in the broadcast MPEG Transport Stream. The RCMM from a particular CA are supplied to at least the broadcasters that use that CA.

The RCMM shall be placed in a file named:

```
"dwb.rcmm"
```

The RCMM files are inserted on a sample basis specified by the CA. This file shall be located in root directories of the object carousels broadcast.

12.9.2.5 RCMM Processing

When an MHP terminal finds RCMM in a root directory, it shall perform the following sequence of operations:

- a) Get the field `thisUpdate` and compare it with the last update. If `thisUpdate` is not after the last update, ignore the message.
- b) If there is a `nextNbOfSignatures` in the RCMM, and if `nextNbOfSignatures` will be greater than the number of remaining root CAs (i.e. the number of root CA that would remain if the RCMM was processed), ignore the RCMM.
- c) Get the number signatures from the RCMM, if this number is lower than the minimum required, ignore the message.
- d) If the RCMM contains references to root certificates to remove, check this RCMM is signed with the keys belonging to the certificates to be removed. If at least one of these signatures is missing, ignore the RCMM message.
- e) Check all the signatures of the RCMM. If any of the signatures is invalid, ignore the message.
- f) Process the content of the RCMM message, add and remove root certificates according to the RCMM message.
- g) Store in persistent storage the date of `thisUpdate` as the date of the last update.
- h) If a root certificate is removed, the CRLs associated are also removed.
- i) If there is a `nextNbOfSignatures` in the RCMM, replace the minimum number of signature required by the `nextNbOfSignatures`.
- j) Since this process will permanently modify the terminal behaviour and is highly sensitive for security, this is allowed to have an implementation dependent enabling / confirmation step prior to performing the action (e.g. it may prompt the end user for verification). Such an enabling / confirmation step is allowed to reject this RCMM action.

The implementation shall ensure the following:

- The integrity of the persistent storage shall be kept if the power supply fails for any reason during the processing of the RCMM message.
 - i.e. If the power is switched off during the processing of the RCMM message, the set of root certificates shall remain as if processing of the RCMM message had not started.
- The minimum amount of memory reserved to store the list of root certificate is specified in [12.12, "MHP certification procedures" on page 177](#). If there is not enough persistent storage available to process an RCMM message, it shall be ignored (to prevent inconsistencies).

12.9.2.6 Example: Renewal of a root certificate

Let's assume the root certification authority RCA has two certificates in each MHP terminal: RC0 and RC1. If RC0 is compromised, RCA may wish to renew this certificate using the following steps:

- a) RCA generates a new key pair and a new self signed certificate RC2.
- b) RCA provides new certificates signed by RC1 to all the entities authenticated by RCA.
- c) Wait until all entities authenticated by RCA have switched to the new certificates and have stopped using RC0.
- d) RCA generates an RCMM message to add RC2 and to remove RC0. This RCMM will be double signed by RC0 and RC1 keys.
- e) RCA will deliver this RCMM message to the broadcasters to update the MHP terminals.
 - (The broadcasting period should be long enough to update almost all of the MHP terminals in the field).
- f) RCA will provide RC1 and RC2 to set top box manufacturers as the new list of root certificates to put in set top boxes.

12.10 Security on the return channel

General purpose security for the return channel is provided by the TLS (Transport Layer Security) protocol as described in [RFC 2246 \[63\]](#).

12.10.1 MHP functionality

When implementing return channel security the MHP shall:

- implement the cipher suites identified in section [12.10.2](#)

The MHP is not required to implement the following:

- the server part of the TLS protocol
- compliance with SSL 3.0
- TLS client authentication

12.10.2 TLS cipher suites

The minimum set of cipher tools that implementations of the MHP profile of TLS shall implement are:

- RSA ()
- MD5
- SHA-1
- DES

More detail of this requirement is given in table 59 (see RFC 2246 [63] for definition of the terms) which identifies which methods are required in an MHP.

Table 59 : Profile of cipher suites that implementations are required to support

CipherSuite	Key Exchange	Cipher	Hash	Value (hex)	MHP status
TLS_NULL_WITH_NULL_NULL	NULL	NULL	NULL	00, 00	Required
TLS_RSA_WITH_NULL_MD5	RSA	NULL	MD5	00, 01	Required
TLS_RSA_WITH_NULL_SHA	RSA	NULL	SHA-1	00, 02	Required
TLS_RSA_EXPORT_WITH_DES40_CBC_SHA	RSA_EXPORT	DES40_CBC	SHA-1	00, 08	Required
TLS_RSA_WITH_DES_CBC_SHA	RSA	DES_CBC	SHA-1	00, 09	Required
TLS_RSA_WITH_3DES_EDE_CBC_SHA	RSA	3DES_EDE_CBC	SHA-1	00, 0A	Required
DVB_RSA_WITH_3DES_EDE112_SHA	RSA	3DES_EDE112_CBC	SHA-1	FF, 01	Required

12.10.3 The EDE112 cipher

The DVB_RSA_WITH_3DES_EDE112_SHA cipher suite is introduced by this specification. It is the following triple encryption using 2 different DES keys:

$$C = E_{K1}(D_{K2}(E_{K1}(P)))$$

$$P = D_{K1}(E_{K2}(D_{K1}(C)))$$

This algorithm is a variant of TLS_RSA_WITH_3DES_EDE_CBC_SHA where the keys that are used in first and third stage of the encryption process are identical (i.e. $k1 = k3$).

12.10.4 Downloading of certificates for TLS

12.10.4.1 Introduction

Before the TLS connection can be established, the MHP has to ensure that the certificate list sent by a server contains at least one trusted certificate. In computer environment, this is simply done by checking the list of certificates against one certificate that is resident in the computer.

In the MHP environment, a downloadable application can establish a TLS session. This can be used for e.g. sensitive transactions. In such a scenario, the application knows which server to connect to, and also knows one certificate against which it can check that a given certificate chain contains the expected certificate that it knows and trusts.

The API that is used by a downloadable application is described in section 11.8.2, "APIs to Support TLS / SSL Over the Return Channel" on page 125. The process of server authentication involves the checking of the certificate chain sent by the TLS server. As described above, the application may trust a certificate that the MHP does not know about. This certificate needs then to be downloaded by the MHP before the TLS session can be established.

This section specifies how the MHP terminal identifies and manages the TLS certificates that are downloaded along with the application and how verification (or otherwise) is presented to the application).

12.10.4.2 Usage of certificate in TLS

12.10.4.2.1 When certificates are delivered with the application

One or several TLS root certificates can be optionally broadcast along with the application.

When the certificate chain sent by the TLS server is not compatible with any of the TLS root certificates sent with the application an `IOException` will be thrown.

12.10.4.2.1.1 Certificate file naming and location

To facilitate certificate chain checking the name of the certificate file shall be:

```
dvb.tls.organisation_id.application_id.x
```

where:

- "x" is an optional string discriminating certificates where necessary.
- the encoding of `organisation_id` and `application_id` are specified in 14.5, "Text encoding of application identifiers" on page 202.

Location of the TLS certificates is application type dependant. See table 60.

Table 60 : TLS certificate locator semantics

application_type	description
0x0000	reserved
0x0001	For DVB-J the TLS certificate(s) are placed in the base directory of the application as defined in 10.9.2, "DVB-J application location descriptor" on page 92.
0x0002	For DVB-HTML the TLS certificate(s) are placed at the physical root of the application as defined in 10.10.2, "DVB-HTML application location descriptor" on page 93.
0x0003...0xFFFF	

12.10.4.2.1.2 Certificate authentication

To be considered valid TLS certificates the certificate files shall be authenticated members of the same authenticated subtree as the application.

12.10.4.2.2 When no certificates are provided

When there are no TLS certificates sent with the application then the implementation will allow connection to be established to any server. The application can then use the JSSE API (see 11.8.2 on page 125) to retrieve the certificate chain and check that it contains what the application requires. In such a case both name and public keys need to be checked by the application if the application wants to be sure of the remote server.

12.11 The internet profile of X.509 (informative)

The text that follows summarises the technical features of RFC 2459 [58] and references the different profile decisions made for the different MHP application areas.

12.11.1 Main part of the certificate

12.11.1.1 Certificate

```
Certificate ::= SEQUENCE {
    tbsCertificate      TBSCertificate,
    signatureAlgorithm  AlgorithmIdentifier,
    signatureValue      BIT STRING }
```

12.11.1.2 signatureAlgorithm

The signatureAlgorithm field contains the identifier for the cryptographic algorithm used by the CA to sign this certificate.

An algorithm identifier is defined by the following ASN.1 structure:

```
AlgorithmIdentifier ::= SEQUENCE {
    algorithm          OBJECT IDENTIFIER,
    parameters        ANY DEFINED BY algorithm OPTIONAL }
```

The algorithm identifier is used to identify a cryptographic algorithm. The OBJECT IDENTIFIER component identifies the algorithm. The contents of the optional parameters field will vary according to the algorithm identified.

This field MUST contain the same algorithm identifier as the signature field in the sequence `TBSCertificate`.

See 12.5.1, "signatureAlgorithm" on page 144.

NOTE: RFC 2459 [58] section 7.2 lists the signature algorithms supported by that profile.

For all of the currently specified algorithms possible non-NULL parameters shall be ignored.

12.11.1.3 signatureValue

The signatureValue field contains a digital signature computed upon the ASN.1 DER encoded `tbsCertificate`. The ASN.1 DER encoded `tbsCertificate` is used as the input to the signature function. This signature value is then ASN.1 encoded as a BIT STRING and included in the Certificate's signature field.

NOTE: RFC 2459 [58] section 7.2 describes in detail this process for the algorithms supported by that profile.

By generating this signature, a CA certifies the validity of the information in the `tbsCertificate` field. In particular, the CA certifies the binding between the public key material and the subject of the certificate.

See 12.5.2, "signatureValue" on page 144.

12.11.1.4 tbsCertificate

The field contains the names of the subject and issuer, a public key associated with the subject, a validity period, and other associated information. The `tbscertificate` may also include extensions.

The pair `issuer / serialNumber` uniquely identifies the certificate.

```
TBSCertificate ::= SEQUENCE {
    version          [0] EXPLICIT Version DEFAULT v1,
    serialNumber     CertificateSerialNumber,
    signature        AlgorithmIdentifier,
    issuer           Name,
    validity         Validity,
    subject          Name,
    subjectPublicKeyInfo SubjectPublicKeyInfo,
    issuerUniqueID  [1] IMPLICIT UniqueIdentifier OPTIONAL,
                  -- If present, version shall be v2 or v3
    subjectUniqueID [2] IMPLICIT UniqueIdentifier OPTIONAL,
                  -- If present, version shall be v2 or v3
    extensions      [3] EXPLICIT Extensions OPTIONAL
                  -- If present, version shall be v3 }
```

12.11.1.5 version

This field describes the version of the encoded certificate. When extensions are used, as expected in this profile, use X.509 version 3 (value is 2). If no extensions are present, but a UniqueIdentifier is present, use version 2 (value is 1). If only basic fields are present, use version 1 (the value is omitted from the certificate as the default value).

Implementations SHOULD be prepared to accept any version certificate. At a minimum, conforming implementations MUST recognize version 3 certificates.

```
Version ::= INTEGER { v1(0), v2(1), v3(2) }
```

Generation of version 2 certificates is not expected by implementations based on this profile.

See 12.5.3, "version" on page 144.

12.11.1.6 serialNumber

The serial number is an integer assigned by the CA to each certificate. It MUST be unique for each certificate issued by a given CA (i.e., the issuer name and serial number identify a unique certificate).

CertificateSerialNumber ::= INTEGER

12.11.1.7 signature

This field contains the algorithm identifier for the algorithm used by the CA to sign the certificate.

This field MUST contain the same algorithm identifier as the `signatureAlgorithm` field in the sequence `Certificate`. The contents of the optional parameters field will vary according to the algorithm identified.

If the `signatureAlgorithm` is different from the algorithm identifier in the signature field, the signature shall be rejected as being inconsistent.

See 12.5.1, "signatureAlgorithm" on page 144.

NOTE: RFC 2459 [58] section 7.2 lists the supported signature algorithms for that profile.

12.11.1.8 issuer

The issuer field identifies the entity who has signed and issued the certificate. The issuer field MUST contain a non-empty distinguished name (DN). The issuer field is defined as the X.501 type Name. ITU-T X.501 [53] Name is defined by the following ASN.1 structures:

Name::= CHOICE {
 RDNSequence }

RDNSequence::= SEQUENCE OF RelativeDistinguishedName

RelativeDistinguishedName::=
 SET OF AttributeTypeAndValue

AttributeTypeAndValue::= SEQUENCE {
 type AttributeType,
 value AttributeValue }

AttributeType::= OBJECT IDENTIFIER

AttributeValue::= ANY DEFINED BY AttributeType

DirectoryString::= CHOICE {
 teletexString TeletexString (SIZE (1..MAX)),
 printableString PrintableString (SIZE (1..MAX)),
 universalString UniversalString (SIZE (1..MAX)),
 utf8String UTF8String (SIZE (1..MAX)),
 bmpString BMPString (SIZE (1..MAX)) }

The Name describes a hierarchical name composed of attributes, such as country name, and corresponding values, such as US. The type of the component AttributeValue is determined by the AttributeType; in general it will be a DirectoryString.

See 12.5.4, "issuer" on page 145.

12.11.1.9 validity

The certificate validity period is the time interval during which the CA warrants that it will maintain information about the status of the certificate. The field is represented as a SEQUENCE of two dates: the date on which the certificate validity period begins (notBefore) and the date on which the certificate validity period ends (notAfter). Both notBefore and notAfter may be encoded as UTCTime or GeneralizedTime.

CAs conforming to this profile MUST always encode certificate validity dates through the year 2049 as UTCTime; certificate validity dates in 2050 or later MUST be encoded as GeneralizedTime.

```

Validity::= SEQUENCE {
    notBefore      Time,
    notAfter       Time }

Time::= CHOICE {
    utcTime        UTCTime,
    generalTime    GeneralizedTime }

```

12.11.1.9.1 UTCTime

The universal time type, UTCTime, is a standard [ASN.1](#) type intended for representation of dates and time. UTCTime specifies the year through the two low order digits and time is specified to the precision of one minute or one second. UTCTime includes either Z (for Zulu, or Greenwich Mean Time) or a time differential.

For the purposes of this profile, UTCTime values MUST be expressed Greenwich Mean Time (Zulu) and MUST include seconds (i.e., times are YYMMDDHHMMSSZ), even where the number of seconds is zero. Conforming systems MUST interpret the year field (YY) as follows:

- Where YY is greater than or equal to 50, the year shall be interpreted as 19YY; and
- Where YY is less than 50, the year shall be interpreted as 20YY.

12.11.1.9.2 GeneralizedTime

The generalized time type, GeneralizedTime, is a standard [ASN.1](#) type for variable precision representation of time. Optionally, the GeneralizedTime field can include a representation of the time differential between local and Greenwich Mean Time.

For the purposes of this profile, GeneralizedTime values MUST be expressed Greenwich Mean Time (Zulu) and MUST include seconds (i.e., times are YYYYMMDDHHMMSSZ), even where the number of seconds is zero. GeneralizedTime values MUST NOT include fractional seconds.

See 12.5.5, "validity" on page 145.

12.11.1.10 subject

The subject field identifies the entity associated with the public key stored in the [SubjectPublicKeyInfo](#) field. It thus represents the entity whose public key is certified. It is encoded as a Distinguished Name (see "[issuer](#)" on [page 171](#)). This name must be unique for each subject entity certified by one CA as defined by the [issuer](#) field.

12.11.1.10.1 issuerUniqueID

This field is optional and appears in X.509 v2 or v3 only. It enables to reuse the IssuerName over time. It is redundant with the [issuer](#) Name, and it is proposed here that this field be not parsed by the client.

12.11.1.10.2 subjectUniqueID

This field is optional and appears in X.509 v2 or v3 only. It enables to reuse the subjectName over time. It is redundant with the [subject](#) Name, and it is proposed here not to use this field.

The subject name may be carried in the subject field and/or the subjectAltName extension. If the subject is a CA (e.g., the basic constraints extension, as discussed in [RFC 2459 \[58\]](#) section 4.2.1.10, is present and the value of cA is TRUE,) then the subject field MUST be populated with a non-empty distinguished name matching the contents of the issuer field (see [RFC 2459 \[58\]](#) section 4.1.2.4) in all certificates issued by the subject CA. If subject naming information is present only in the subjectAltName extension (e.g., a key bound only to an email address or URI), then the subject name MUST be an empty sequence and the subjectAltName extension MUST be critical.

Where it is non-empty, the subject field MUST contain an X.500 distinguished name (DN). The DN MUST be unique for each subject entity certified by the one CA as defined by the issuer name field. A CA may issue more than one certificate with the same DN to the same subject entity.

The subject name field is defined as the X.501 type Name. Implementation requirements for this field are those defined for the issuer field (see [RFC 2459 \[58\]](#) section 4.1.2.4). When encoding attribute values of type DirectoryString, the encoding rules for the issuer field MUST be implemented. Implementations of this specification MUST be prepared to receive subject names containing the attribute types required for the issuer field. Implementations of this specification SHOULD be prepared to receive subject names containing the recommended attribute types for the issuer field. The syntax and associated object identifiers (OIDs) for these attribute types are provided in the [ASN.1](#) modules in [RFC 2459 \[58\]](#) Appendices A and B. Implementations of this specification MAY use these comparison rules to process unfamiliar attribute types (i.e., for name chaining). This allows implementations to process certificates with unfamiliar attributes in the subject name.

In addition, legacy implementations exist where an RFC 822 name is embedded in the subject distinguished name as an EmailAddress attribute. The attribute value for EmailAddress is of type IA5String to permit inclusion of the character '@', which is not part of the PrintableString character set. EmailAddress attribute values are not case sensitive (e.g., "fanfeedback@redsox.com" is the same as "FANFEEDBACK@REDSOX.COM").

Conforming implementations generating new certificates with electronic mail addresses MUST use the rfc822Name in the subject alternative name field (see [RFC 2459 \[58\]](#) section 4.2.1.7) to describe such identities. Simultaneous inclusion of the EmailAddress attribute in the subject distinguished name to support legacy implementations is deprecated but permitted.

12.11.1.11 SubjectPublic Key Info

This field is used to carry the public key which is certified and identifies the algorithm with which the key is used. The algorithm is identified using the [AlgorithmIdentifier](#) structure (see "[signatureAlgorithm](#)" on page 169) and the public key is represented as a bitstring.

```
SubjectPublicKeyInfo ::= SEQUENCE {
    algorithm           AlgorithmIdentifier,
    subjectPublicKey    BIT STRING }
```

See [12.5.7, "SubjectPublic Key Info" on page 145.](#)

NOTE: [RFC 2459 \[58\]](#) section 7.3 lists the supported algorithms for that profile.

12.11.1.12 Unique Identifiers

These fields may only appear if the version is 2 or 3. The subject and issuer unique identifiers are present in the certificate to handle the possibility of reuse of subject and/or issuer names over time. This profile recommends that names not be reused for different entities and that Internet certificates not make use of unique identifiers. CAs conforming to this profile SHOULD NOT generate certificates with unique identifiers. Applications conforming to this profile SHOULD be capable of parsing unique identifiers and making comparisons.

```
UniqueIdentifier ::= BIT STRING
```

See [12.5.8, "Unique Identifiers" on page 146.](#)

12.11.1.13 Extensions

This field may only appear if the version is 3 and is optional. If present, this field is a SEQUENCE of one or more certificate extensions.

```
Extensions ::= SEQUENCE SIZE (1..MAX) OF Extension
```

```
Extension ::= SEQUENCE {
    extnID      OBJECT IDENTIFIER,
    critical    BOOLEAN DEFAULT FALSE,
    extnValue   OCTET STRING }
```

The extensions are defined in [ITU-T X.509 \[54\]](#).

See [12.5.9, "Extensions" on page 146.](#)

12.11.2 Standard certificate extensions

See table 51, "Profile for standard certificate extensions" on page 146.

12.11.2.1 Authority key identifier

This extension is used where an issuer has multiple signing keys. It provides a means of finding the public key that can be used to check the signature of the certificate.

The identification can be based on either the keyIdentifier or the on the pair (authorityCertIssuer, AuthorityCertSerialNumber). It is recommended to use the pair (authorityCertIssuer, AuthorityCertSerialNumber) instead of the keyIdentifier because there is no common agreement on the way to compute a unique KeyIdentifier.

```
AuthorityKeyIdentifier ::= SEQUENCE {
    keyIdentifier          [0] KeyIdentifier          OPTIONAL,
    authorityCertIssuer    [1] GeneralNames          OPTIONAL,
    authorityCertSerialNumber [2] CertificateSerialNumber OPTIONAL }
```

12.11.2.2 Subject key identifier

This extension provides of identifying certificates that contain a particular public key.

```
SubjectKeyIdentifier ::= KeyIdentifier
```

12.11.2.3 Key usage

The key usage extension defines the purpose of the key contained in the certificate.

```
keyUsage ::= BIT STRING {
    digitalSignature      (0),
    nonRepudiation       (1),
    keyEncipherment      (2),
    dataEncipherment     (3),
    keyAgreement         (4),
    keyCertSign          (5),
    cRLSign              (6),
    encipherOnly         (7),
    decipherOnly         (8)
}
```

12.11.2.4 Private key usage period

This field is used to defined a period of validity for the private key which is different from the period of validity of the certificate. This is only meaningful for digital signature keys.

```
privateKeyUsagePeriod EXTENSION ::= {
    SYNTAX          PrivateKeyUsagePeriod
    IDENTIFIED BY id-ce-privateKeyUsagePeriod }
```

```
PrivateKeyUsagePeriod ::= SEQUENCE {
    notBefore      [0] GeneralizedTime OPTIONAL,
    notAfter      [1] GeneralizedTime OPTIONAL }
( WITH COMPONENTS {..., notBefore PRESENT} |
  WITH COMPONENTS {..., notAfter PRESENT} )
```

12.11.2.5 Certificate policies

This field is used to define a policy defining the purpose for which the certificate may be used.

Applications may have a list of specific policies they will accept, the certificate validation software must be able to compare the policy OIDs found in the certificate to that list.

```
certificatePolicies EXTENSION ::= {
    SYNTAX          CertificatePoliciesSyntax
    IDENTIFIED BY id-ce-certificatePolicies }
```

```
CertificatePoliciesSyntax ::= SEQUENCE SIZE (1..MAX) OF PolicyInformation
```

```
PolicyInformation ::= SEQUENCE {
  policyIdentifier    CertPolicyId,
  policyQualifiers    SEQUENCE SIZE (1..MAX) OF
                      PolicyQualifierInfo OPTIONAL }
```

```
CertPolicyId ::= OBJECT IDENTIFIER
```

```
PolicyQualifierInfo ::= SEQUENCE {
  policyQualifierId    CERT-POLICY-QUALIFIER.&id
                      ({SupportedPolicyQualifiers}),
  qualifier            CERT-POLICY-QUALIFIER.&Qualifier
                      ({SupportedPolicyQualifiers}@policyQualifierId)
                      OPTIONAL }
```

```
SupportedPolicyQualifiers CERT-POLICY-QUALIFIER ::= { ... }
```

12.11.2.6 Policy mappings

This field is used to define equivalence between policies from different CA's policy Domain.

```
policyMappings EXTENSION ::= {
  SYNTAX      PolicyMappingsSyntax
  IDENTIFIED BY id-ce-policyMappings }
```

```
PolicyMappingsSyntax ::= SEQUENCE SIZE (1..MAX) OF SEQUENCE {
  issuerDomainPolicy    CertPolicyId,
  subjectDomainPolicy   CertPolicyId }
```

12.11.2.7 Subject Alternative Name

This field is used to define additional identities for the subject name of the certificate (such as an internet email address).

```
subjectAltName EXTENSION ::= {
  SYNTAX      GeneralNames
  IDENTIFIED BY id-ce-subjectAltName }
```

```
GeneralNames ::= SEQUENCE SIZE (1..MAX) OF GeneralName
```

```
GeneralName ::= CHOICE {
  otherName          [0]  INSTANCE OF OTHER-NAME,
  rfc822Name         [1]  IA5String,
  dNSName            [2]  IA5String,
  x400Address        [3]  ORAddress,
  directoryName      [4]  Name,
  ediPartyName       [5]  EDIPartyName,
  uniformResourceIdentifier [6] IA5String,
  iPAddress          [7]  OCTET STRING,
  registeredID       [8]  OBJECT IDENTIFIER }
```

12.11.2.8 Issuer Alternative Name

This field is similar to the previous one for the issuer identity.

```
issuerAltName EXTENSION ::= {
  SYNTAX      GeneralNames
  IDENTIFIED BY id-ce-issuerAltName }
```

12.11.2.9 Subject Directory attributes

This field is used to carry optional directory attributes associated with the subject.

```
subjectDirectoryAttributes EXTENSION ::= {
  SYNTAX      AttributesSyntax
  IDENTIFIED BY id-ce-subjectDirectoryAttributes }
```

```
AttributesSyntax ::= SEQUENCE SIZE (1..MAX) OF Attribute
```

12.11.2.10 Basic Constraints

This field indicates if the subject of the certificate is a certification authority and how deep a certification path may exist through that path.

This extension shall appear in every CA Certificates. It will be used to prevent unauthorised entities to act as a CA.

```
basicConstraints EXTENSION ::= {
  SYNTAX      BasicConstraintsSyntax
  IDENTIFIED BY id-ce-basicConstraints }

BasicConstraintsSyntax ::= SEQUENCE {
  ca                      BOOLEAN DEFAULT FALSE,
  pathLenConstraint      INTEGER (0..MAX) OPTIONAL }
```

12.11.2.11 Name Constraints

This field indicates a namespace within which all subject names in subsequent certificates in a certification path shall be located.

```
nameConstraints EXTENSION ::= {
  SYNTAX      NameConstraintsSyntax
  IDENTIFIED BY id-ce-nameConstraints }

NameConstraintsSyntax ::= SEQUENCE {
  permittedSubtrees      [0] GeneralSubtrees OPTIONAL,
  excludedSubtrees      [1] GeneralSubtrees OPTIONAL }

GeneralSubtrees ::= SEQUENCE SIZE (1..MAX) OF GeneralSubtree

GeneralSubtree ::= SEQUENCE {
  base                  GeneralName,
  minimum              [0] BaseDistance DEFAULT 0,
  maximum              [1] BaseDistance OPTIONAL }

BaseDistance ::= INTEGER (0..MAX)
```

12.11.2.12 Policy Constraints

This field is only used in CA's certificate (i.e. not in end entity certificate). It is used to prohibit policy mapping or to require that each certificate in a path contain an acceptable policy identifier.

```
policyConstraints EXTENSION ::= {
  SYNTAX      PolicyConstraintsSyntax
  IDENTIFIED BY id-ce-policyConstraints }

PolicyConstraintsSyntax ::= SEQUENCE {
  requireExplicitPolicy [0] SkipCerts OPTIONAL,
  inhibitPolicyMapping  [1] SkipCerts OPTIONAL }

SkipCerts ::= INTEGER (0..MAX)
```

12.11.2.13 Extended key usage field

This field is an extensions of the previous field keyUsage. It is used to define more purposes for which the certified public key may be used.

```
extKeyUsage EXTENSION ::= {
  SYNTAX      SEQUENCE SIZE (1..MAX) OF KeyPurposeId
  IDENTIFIED BY id-ce-extKeyUsage }

KeyPurposeId ::= OBJECT IDENTIFIER
```

12.11.2.14 CRL Distribution points

This field defines how CRL (Certificate revocation list) information can be obtained.

```
cRLDistributionPoints EXTENSION ::= {
```

```
SYNTAX          CRLDistPointsSyntax
IDENTIFIED BY  id-ce-cRLDistributionPoints }
```

```
CRLDistPointsSyntax ::= SEQUENCE SIZE (1..MAX) OF DistributionPoint
```

```
DistributionPoint ::= SEQUENCE {
  distributionPoint [0] DistributionPointName OPTIONAL,
  reasons          [1] ReasonFlags OPTIONAL,
  cRLIssuer        [2] GeneralNames OPTIONAL }
```

```
DistributionPointName ::= CHOICE {
  fullName          [0] GeneralNames,
  nameRelativeToCRLIssuer [1] RelativeDistinguishedName }
```

```
ReasonFlags ::= BIT STRING {
  unused           (0),
  keyCompromise   (1),
  cACompromise    (2),
  affiliationChanged (3),
  superseded      (4),
  cessationOfOperation (5),
  certificateHold  (6) }
```

12.12 MHP certification procedures

This MHP certification procedures reference is a place holder for a document that will have to be written and agreed with the root CA that describe the administration of certificates.

As defined in section 12.5.6 on page 145, each leaf certificate shall contain the organisationId in the organisation name attribute. In case there are several root certificate entities, the certificate procedure shall ensure that the leaf certificate contain the organisationId defined in ETR 162 [10] which is owned by this organisation.

13 Graphics reference model

13.1 Introduction

The MHP provides tools to control the positioning of: video on an output device, interface components such as buttons and lists, as well as raw graphical primitives.

Each screen connected to an MHP has three planes which are, from back to front, a background plane, a video plane and a graphics plane.

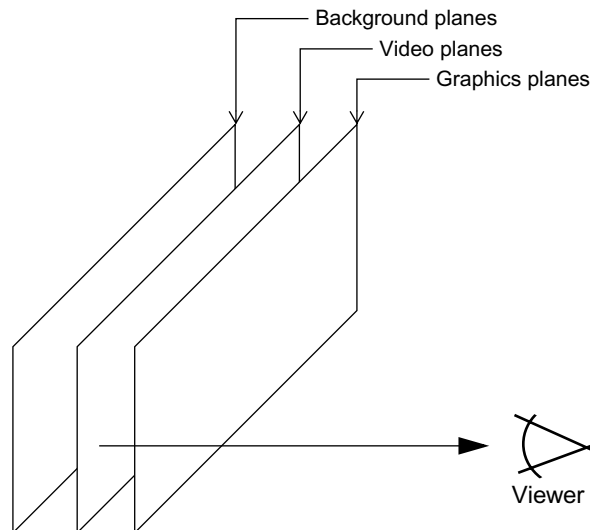


Figure 16 : Illustration of the different types of display planes

The behaviour of the subtitle plane varies between implementations. API facilities are provided to allow applications to make the behaviour predictable. See 13.5, "Subtitles" on page 194.

An application is provided with a contiguous rectangular region of the graphics plane in which it can draw (see 13.3.3, "HAVi devices and AWT components" on page 186). An application can place video, interface elements and graphics inside its rectangle on the graphic plane.

An application can also control video outside of the AWT hierarchy on the video plane, and place still images or solid colour in the background plane.

The MHP specification enables terminals to support multiple applications at any one time, each of which can have a sub area of the screen to which it can draw. The specification enables the areas to overlap. However, the minimum required support for these features is profile specific. See annex G, "(normative): Minimum Platform Capabilities" on page 282.

13.1.1 Interapplication interaction

If the presentations of different applications overlap, the areas obscured by other applications are clipped. Therefore where an application is translucent it will be blended with the video or background image behind it rather than being blended with another application.

13.2 General Issues

13.2.1 Coordinate Spaces

The MHP includes a number of coordinate systems for different purposes and includes the means to transform between these as needed:

- Input video space

This considers post upsampling MPEG pixels.

- Device space

Logical pixels in the various display devices. There may be different device spaces for the various device types (e.g. video and graphics).

- Normalised screen space

Normalised coordinates relative to the output (HScreen).

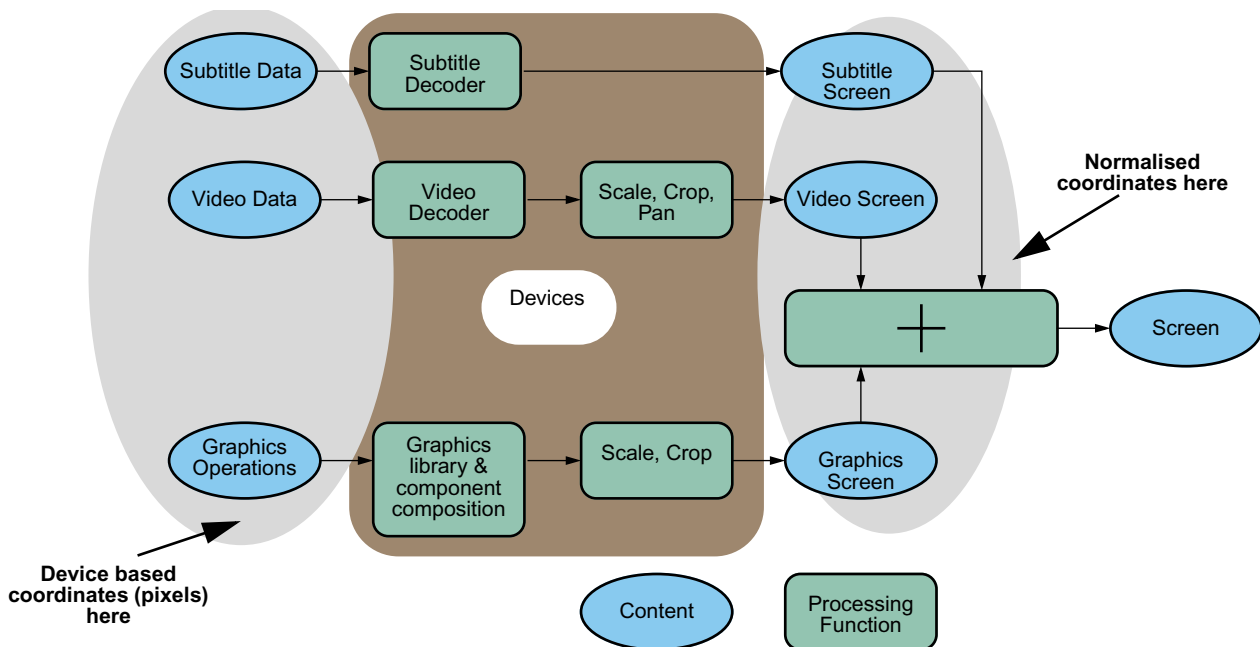


Figure 17 :

Various different interfaces provide access to different parts of the graphics and video systems using these coordinate spaces.

13.2.1.1 Normalised screen space

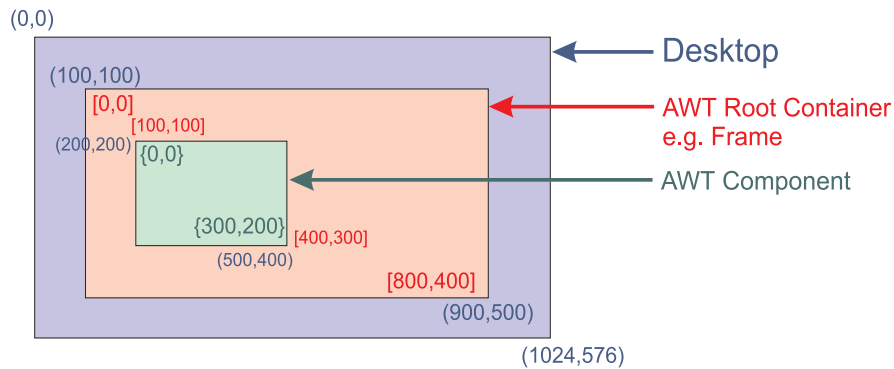
A normalised screen coordinate system supports references to positions and sizes in the video output from an MHP device without reference to any form of pixels.

This coordinate system describes the top left corner of the screen as $\{0, 0\}$ and the bottom right corner of the screen as $\{1, 1\}$. This coordinate system is used in the positioning of graphics and video on the screen through a number of classes in the `org.havi.ui` package and the JMF control `org.dvb.media.VideoPresentationControl`.

The normalized coordinate system is given through the `HScreen`.

13.2.1.2 User space

The coordinate space for graphics used in java.awt is defined by applications through the creation of an `HGraphicsDevice`. The root container, an instance of the class `org.havi.ui.HScene` can be placed within the normalised coordinate system. The `HSceneTemplate` class allows applications to express requirements for their top level container. Instances of this class are used by `HSceneFactory` to return instances of an `HScene`.



Coordinate Systems

- (x,y) coordinate system of the Desktop
- $[x,y]$ coordinate system of the root container
- $\{x,y\}$ coordinate system of the component

Figure 18 : AWT Coordinate system in a computer environment

Figure 18 shows the AWT coordinate system in a normal computer environment. In an MHP device the `HGraphicsDevice` can be thought of being the desktop and the `HScene` as being the AWT RootContainer. Thus an `HScene` is placed within the coordinate system of the `HGraphicsDevice`. An `HScene` itself defines a new coordinate system which pixels are aligned to those of the `HGraphicsDevice` but the origin is translated (see figure 18).

The mapping between the user space and the normalised coordinate system is done given the size and location of the `HGraphicsDevice` in the normalised coordinate system and the resolution of the `HGraphicsDevice` in pixel.

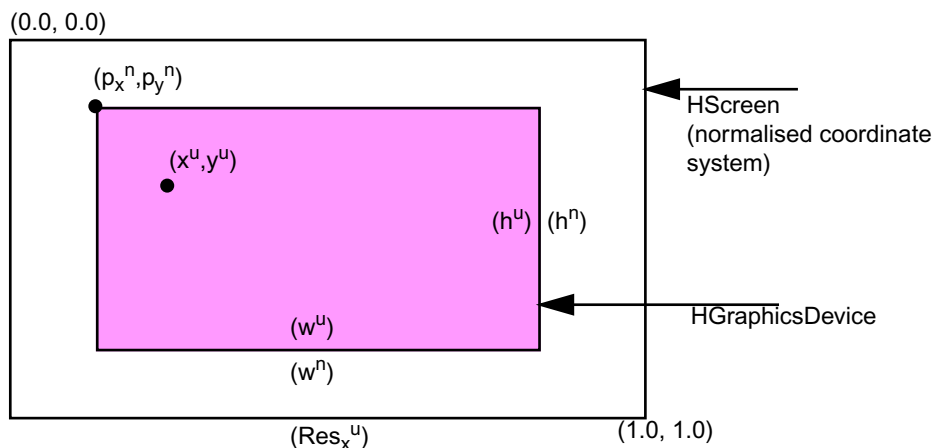


Figure 19 : Conversion between normalised and user coordinate systems

(x^n, y^n) = normalised coordinate system of `HScreen`

(x^u, y^u) = coordinate system of the `HGraphicsDevice` in pixels

x^{vu} = "virtual" user coordinate system in pixels relative to the `HScreen`

Assume the `HGraphicsDevice` has the origin of (p_x^n, p_y^n) with a dimension of (w^n, h^n) and has a pixel resolution of $w^u \times h^u$ then the point (x^u, y^u) in normalised coordinates is given by

$$x^n = \frac{x^{vu}}{Res_x^{vu}} \quad y^n = \frac{y^{vu}}{Res_y^{vu}}$$

where

$$Res_x^{vu} = \frac{w^u}{w^n} \quad Res_y^{vu} = \frac{h^u}{h^n}$$

is the virtual resolution of the HScreen in (sub)pixel and

$$x^{vu} = p_x^{vu} + x^u \quad y^{vu} = p_y^{vu} + y^u$$

is the point (x,y) in the virtual coordinate space with

$$p_x^{vu} = p_x^n \cdot Res_x^{vu} \quad p_y^{vu} = p_y^n \cdot Res_y^{vu}$$

being the location of the HGraphicsDevice in the virtual coordinate system.

Given the Point (xⁿ,yⁿ) the point (x^u,y^u) is given by

$$x^u = \text{floor}[(x^n - p_x^n) \cdot Res_x^{vu} + 0.5]$$

and

$$y^u = \text{floor}[(y^n - p_y^n) \cdot Res_y^{vu} + 0.5]$$

Given a HGraphicsDevice which is full screen this simplifies to

Res_x^{vu}=w^u and Res_y^{vu}=h^u, x^{vu}=x^u and y^{vu}=y^u thus

$$x^n = \frac{x^u}{w^u} \quad y^n = \frac{y^u}{h^u}$$

and

$$x^u = x^n \cdot w^u \quad y^u = y^n \cdot h^u$$

Within the above calculations precision equivalent to a float shall be used. Conversion to integer shall only be used when the result is a point in a pixel oriented co-ordinate space (e.g. user space).

The resolution of an HGraphicsDevice is specified using the constant HScreenConfigTemplate.PIXEL_RESOLUTION with a Dimension on the setPreference(int, Object, int) method.

The constant HSceneTemplate.SCENE_PIXEL_RESOLUTION allows applications to define the dimension of an HScene in pixel of the HGraphicsDevice. The constant SCENE_SCREEN_RECTANGLE allows applications to define the position and size which the HScene should occupy on the screen in normalised coordinates.

The combination of these defines the transformation between graphics pixels and the video output from the MHP device concerned. Only a limited set of transformations are required to be supported. The `HGraphicsConfiguration` class contains methods to transform in both directions between graphics pixels and normalised coordinates.

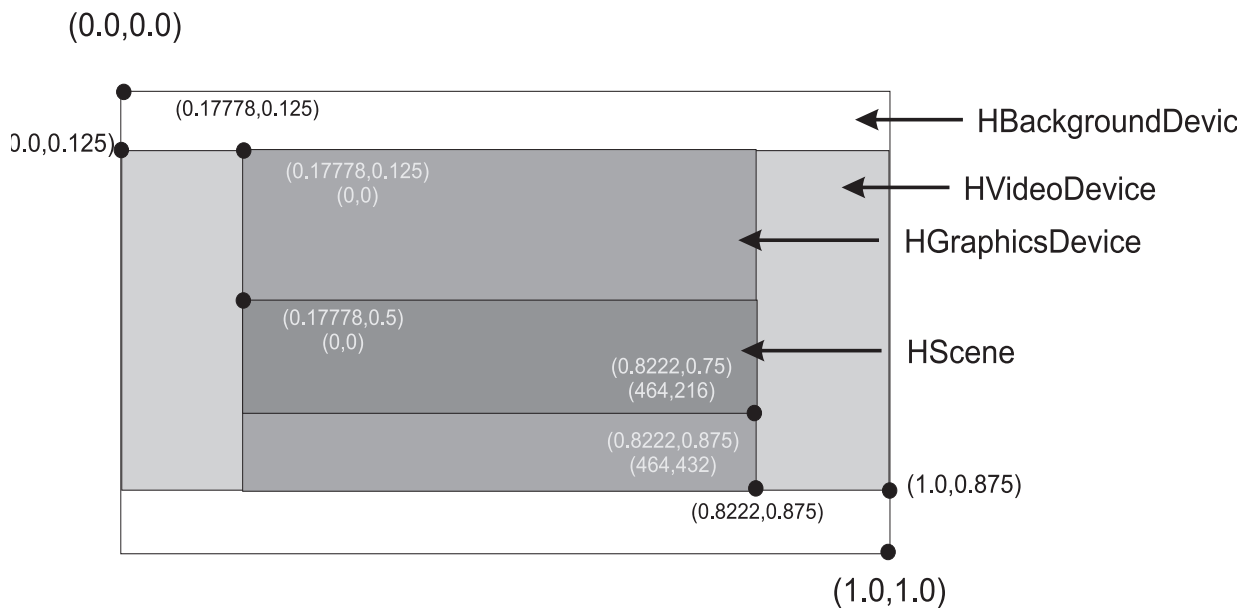


Figure 20 : Possible configuration of HAVi Devices

Figure 20 shows a possible configuration of HAVi Devices. The `HBackgroundDevice` is configured to be full screen, the `HVideoDevice` to cover the area of (0.0, 0.125) to (1.0, 0.875).

When positioning video implementations may snap the video position to an adjacent line vertically (for example, to accommodate video and display field order) or an adjacent pixel horizontally (for example, to accommodate display chroma structure). The direction of "snapping" shall always be to minimise the error relative to the requested coordinate.

In figure 20 the `HGraphicsDevice` is configured to cover the area (0.17, 0.125) to (0.82, 0.875) with a pixel resolution of 464x432.

The `HScene` can be configured by setting the preference `HSceneTemplate.SCENE_PIXEL_RECTANGLE` with a `Rectangle` of (0, 216, 464, 261) or by setting the preference `HSceneTemplate.SCENE_SCREEN_RECTANGLE` with a `HScreenRectangle` of (0.17, 0.5, 0.64, 0.75).

In some implementations and/or configurations pixels in the `HGraphicsDevice` may not correspond to discrete physical pixels in the actual display device. For example, this may be the case when the `HGraphicsDevice` is emulated.

13.2.1.3 Pixel Aspect Ratio

A pixel orientated coordinate system does not say anything about the pixel aspect ratio. The pixel aspect ratio ($AR_x^{pixel} / AR_y^{pixel}$) is defined by the aspect ratio of the display ($AR_x^{display} / AR_y^{display}$, 4:3 or 16:9), the area that is covered by the `HGraphicsDevice` (w^n, h^n) and the pixel resolution of the `HGraphicsDevice` (w^u, h^u). See figure 21

$$AR^{pixel} = \frac{AR_x^{pixel}}{AR_y^{pixel}} = \frac{AR_x^{display} \cdot w^n}{AR_y^{display} \cdot h^n} \cdot \frac{h^u}{w^u}$$

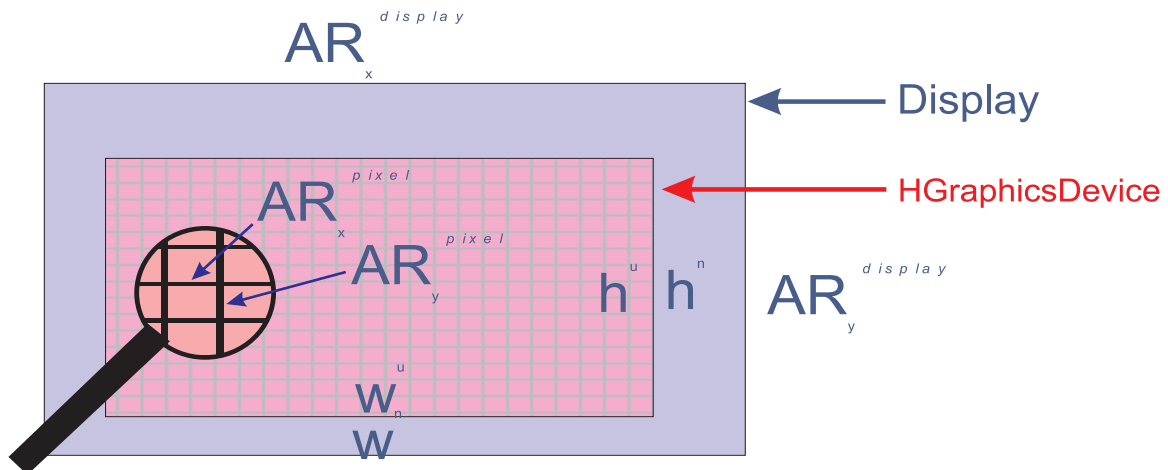


Figure 21 : Calculating the Pixel Aspect Ratio

Table 61 shows typical resolutions of a full screen HGraphicsDevice and the corresponding pixel aspect ratios for different display aspect ratios. The supported resolutions are defined in G, "(normative): Minimum Platform Capabilities" on page 282.

Table 61 : Typical Resolutions and their pixel aspect ratio

	4:3 Display	16:9 Display
Resolution for full screen HGraphicsDevice	Pixel Aspect Ratio	Pixel Aspect Ratio
720x576	16:15	64:45
768x576	1:1	48:36
1024x576	36:48	1:1

13.2.1.4 Video space

The coordinate space for video is that defined by the input video signal after any scaling required by the platform (e.g. that required by ETR154). Scaling and clipping of video can be achieved using the JMF control `org.dvb.media.VideoPresentationControl`. The JMF control `VideoFormatControl` allows applications to query the various transformations being performed on video as part of its decoding and presentation.

13.3 Graphics

13.3.1 Modelling of the MHP display stack composition

The following sections describes the theoretical model of the MHP display stack. Unfortunately, certain real world constraints may apply see section 13.6, "Approximations" on page 195. The "Graphics, Video and Subtitle pipeline" is illustrated in figure 22.

Figure 22 shows the conceptual model of the "graphical content" pipelines from an applications point of view. There are four sources of graphical content: subtitles, background, video and application graphics, and these four sources are mapped in a controllable way onto single screen. The figure shows the conceptual processing functions, the content stages, and application control points inside the content pipelines.

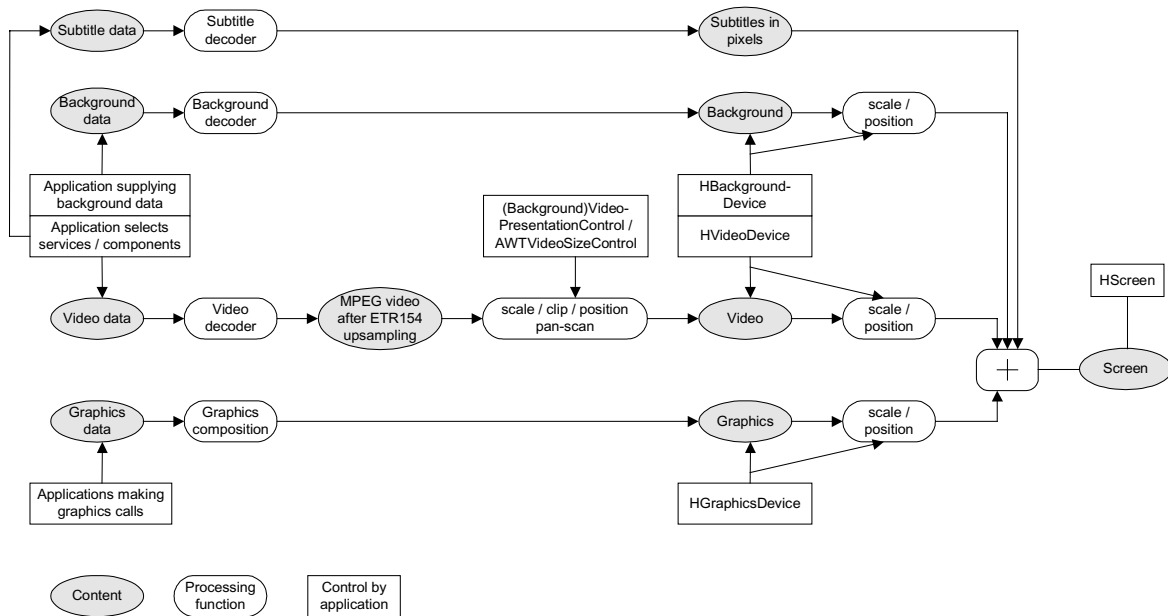


Figure 22 : Graphics, Video and Subtitle pipeline

The figure shows that applications have full control over the source of the content that enters the different pipelines. Furthermore the application may control clipping, scaling and positioning of the content at different stages in the different pipelines. Of course an application can only apply operations that are supported by the underlying system.

The clipping and positioning of subtitles follows the video. Behaviour of subtitles when video is scaled is platform dependent.

From the application author's point of view the behaviour of the graphics composition process has 3 elements:

- The AWT elements are composed following the traditional graphics model using Porter-Duff rules (see Porter-Duff [D]). The default rule used is the SRC rule.
- The background and video planes are composed using the Porter-Duff rule SRC_OVER (Note that only alpha of 0 and 1 is used in the Video planes).
- The results are composed together using the SRC_OVER rule (with the AWT results as the source and the HAVi results as the destination).

This is illustrated in figure 23.

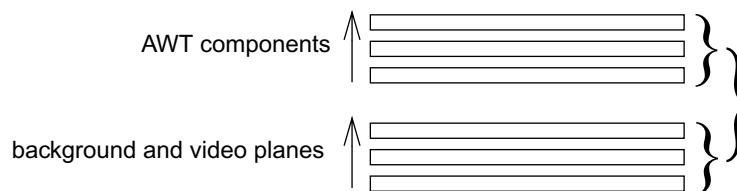


Figure 23 : Overview of AWT / HAVi plane composition

The HAVi stack has a single full screen `HBackgroundDevice` at the back. In front of this are an ordered set of zero or more `HVideoDevices`. Each of the video devices can occupy the full screen area or part of it. Any area that is not occupied behaves as transparent. The occupied areas (video pixels) are considered to be opaque and will be obscured by any video devices in front of them. Non active video devices are invisible.

Systems that support only a single video device that can display full screen (and possibly other partial screen video devices) should report the full screen capable device as the first (back most) of the video devices.

The composition rules in each group follow the traditional "painter's" algorithm i.e. composing the layers from back to front.

The Xlet AWT Root Component is transparent (as shown in figure 24) so by default the result of the HAVi video and background device composition is the background to any application graphics.

Video already running in the `HVideoDevice` will keep on playing when an application starts.

The stack is illustrated in figure 24.

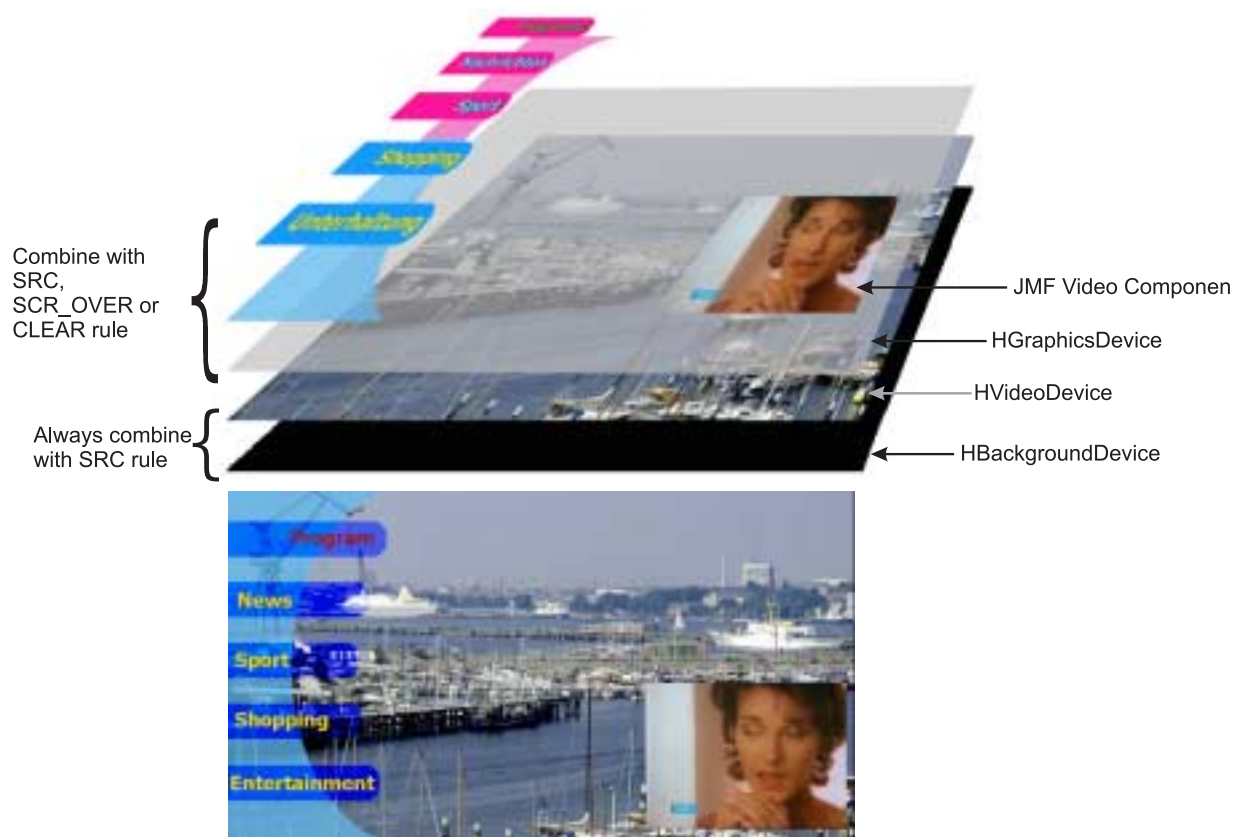


Figure 24 : The MHP display stack illustrated

13.3.2 AWT Reference Model in the MHP

In the AWT all graphics rendering of the lightweight components is done via the `java.awt.Graphics` class. When a component needs to be redrawn it issues a repaint command which gets passed from component to component from top to bottom until a heavyweight component is reached. Although there are no heavyweight components in the MHP the `HScene` can be thought of being similar to a heavyweight component. Thus in MHP devices the repaint command gets passed until it reaches the root container - the `HScene`. The repaint method of the `HScene` gets a `org.dvb.ui`.

DVBGraphics object cast to `java.awt.Graphics` from the underlying implementation and calls its `paint` method. The `paint` method of the `HScene` does no drawing, it only calls the `paint` methods of its children. Before calling the `paint` method of a child the origin gets translated to the coordinate system of the child and the graphics object passed is clipped to the size of the child (see figure 25)

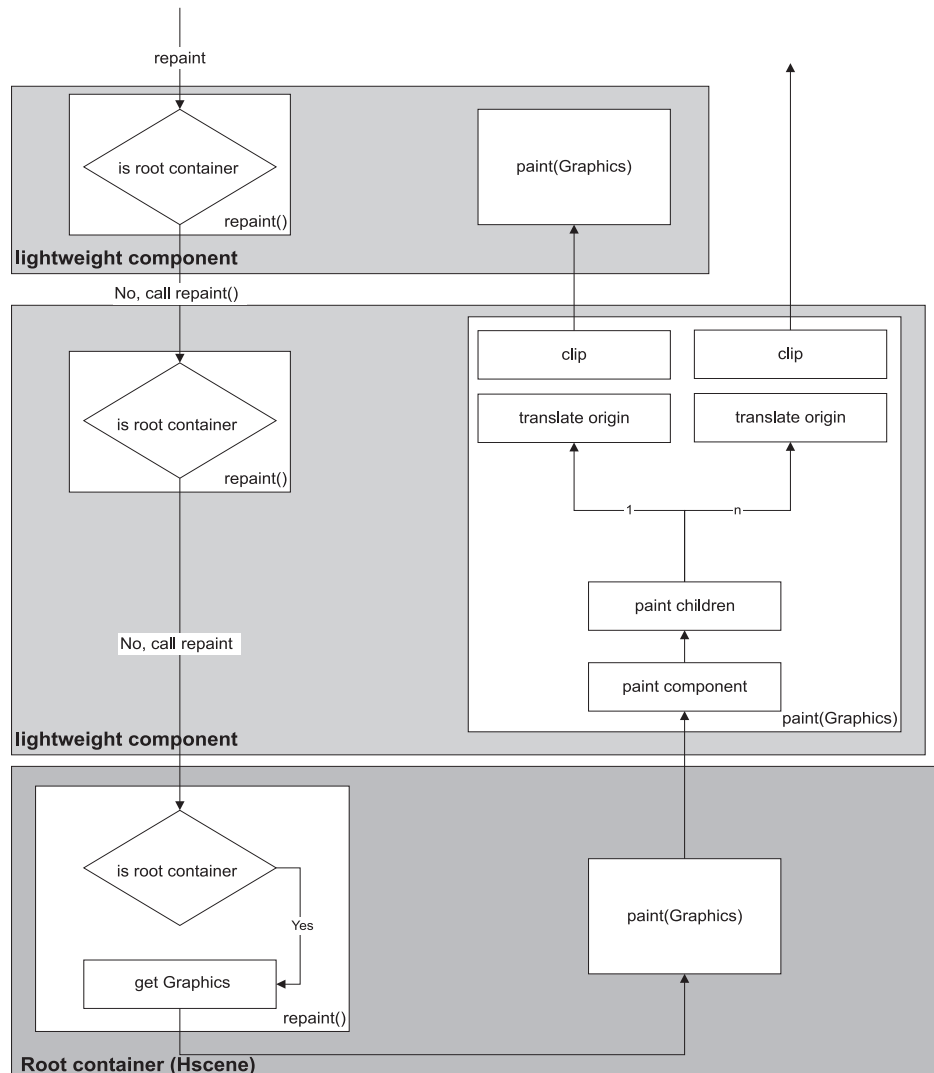


Figure 25 : Repaint model in the MHP

13.3.3 HAVi devices and AWT components

The top level user interface container for DVB-J applications is represented by the `org.havi.ui.HScene` class. DVB-J applications may obtain an instance of this class from an instance of `org.havi.ui.HSceneFactory`. The `HSceneFactory` class provides a number of methods which may be used to obtain an `HScene` depending on the specific requirements of the DVB-J application. `HScene` is conceptually equivalent to `java.awt.Window` or `java.awt.Frame` however it models the differing graphical environment found in many digital TV receivers. In this environment, there are typically significant constraints on what sizes and positions of top level containers may be possible.

One means for obtaining an `HScene` from an `HSceneFactory` is to populate an `HSceneTemplate` with a set of constraints and then request an `HScene` from the `getBestScene()` method which meets these constraints. Applications wishing to obtain a full screen sized `HScene` may use the `getFullScreenScene()` method specifying a particular graphics device on which the full screen scene should be presented. Applications wishing to ensure their graphics can cover a particular area of the screen may use the `getSelectedScene()` method to create an `HScene` meeting this requirement.

MHP terminals are allowed to support only non overlapping HScenes. In implementations not supporting overlapping HScenes following behaviour shall be implemented:

- Overlapping at creation or size change through HSceneFactory:
returns a null reference if "REQUIRED" is used. Returns best effort if "PREFERRED" is used.
- Overlapping later when sizes change by awt:
Size does not change. Fails silently.

The MHP specification provides a general model for video output devices using the model found in the HAVi specification. A final output video signal is expressed through the `org.havi.ui.HScreen` class and is the result of adding a number of different video components.

- The output of one or more graphics decoders
- The output of one or more video decoders
- The output of any special decoders, e.g. a background

An abstraction of each of these decoders is represented by an instance of a class inheriting from `HScreenDevice` - `HGraphicsDevice`, `HVideoDevice` and `HBackgroundDevice` respectively. Each of these can potentially exist in a range of configurations which are exposed by instances of classes inheriting from `HScreenConfiguration` - `HGraphicsConfiguration`, `HVideoConfiguration` and `HBackgroundConfiguration` respectively. Where devices support multiple configurations, applications may construct and populate templates to define criteria to select between configurations. These templates are classes inheriting from `HScreenConfigTemplate`.

As well as the general features, some of these sub-classes provide support for specific features of the devices concerned. `HGraphicsConfiguration` supports loading of images and listing of fonts specific to that configuration. It also support conversion between various coordinate systems. `HVideoDevice` provides access to the source of the video currently being decoded (a Locator) and provides access to the decoder object for the video currently being decoded (a `javax.media.Player`). The `HBackgroundClass` provides a means to support MPEG I-frames through the `HStillImageBackgroundConfiguration` class.

The method `HScreen.getCoherentScreenConfigurations (HScreenConfigTemplate[] configs)` allows applications to express a common set of constraints for video, graphics and backgrounds and get back a coherent answer. In `HGraphicsConfigTemplate`, the constant `VIDEO_MIXING` allows applications to request configurations where graphics is super-imposed above video but without any requirement for pixels to be aligned. In `HScreenConfigTemplate`, there are constants to allow applications to ask for configurations as follows:-

- `VIDEO_GRAPHICS_PIXEL_ALIGNED` - video & graphics pixels are the same size and aligned
- `ZERO_VIDEO_IMPACT` - a graphics configuration must not change the existing video configuration
- `ZERO_GRAPHICS_IMPACT` - a video configuration must not change the existing graphics configuration

13.3.3.1 Video and graphics pixel aligned

The VIDEO_GRAPHICS_PIXEL_ALIGNED relationship between the pixels in the HGraphicsDevice and the pixels in the HVideoDevice is shown in figure 26. Note that the relationship applies to the pixels in HVideoDevice after "Decoder Format Conversion" processing, and the pixels in HGraphicsDevice. As a result of this relationship the following constraint holds for the configurations of HGraphicsDevice and HVideoDevice that have aligned video and graphics pixels:

- the pixel aspect ratio of the pixels in both devices is equal.

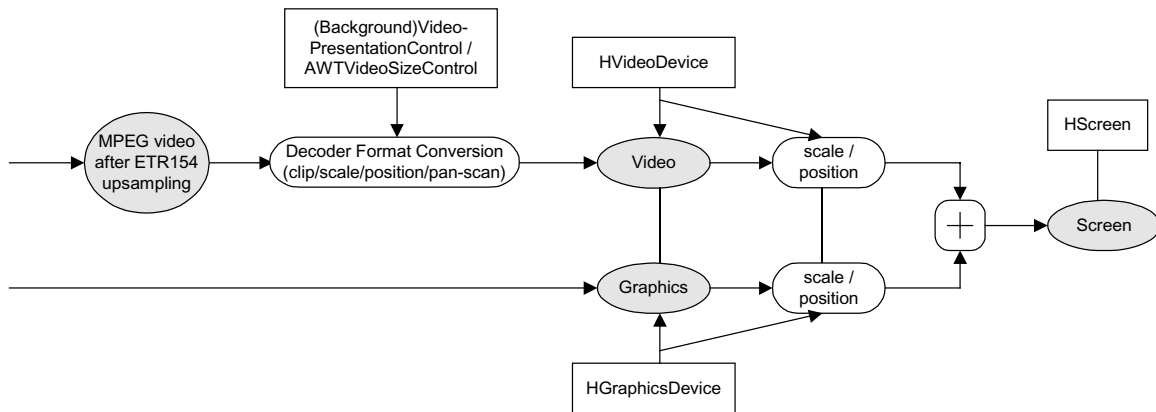


Figure 26 : Video and graphics pixel impact

13.3.3.2 Zero graphics impact

Constants ZERO_GRAPHICS_IMPACT and ZERO_VIDEO_IMPACT can be used by applications to prevent changes to the HGraphicsDevice or the HVideoDevice respectively, in the case that changes are not intended. In general a change of the configuration of the HGraphicsDevice may lead to an automatic change of the configuration of, for example, the HVideoDevice (if the application is authorised to make this change), because restricted systems may not be able to deal with the two different configurations simultaneously. Therefore an application must specify ZERO_GRAPHICS_IMPACT or ZERO_VIDEO_IMPACT in the configuration template if it does not want to change the configuration of another device.

13.3.4 Composition

13.3.4.1 AWT paint rule

The normal AWT paint rules shall be followed. That is the root container (the HScene) is painted and then its components are painted recursively.

The observed *behaviour* shall be such that of each component drawing directly into the root component. Any use of temporary storage or double buffering shall not affect the final result of the AWT composition or its subsequent composition with the result of the video composition.

The process is shown in Figure 27. The numbers in the arrows indicate the chronological order of the painting (note the root container is painted first). If a container has multiple components they get painted in the order N, N-1, ..., 0 where N indicates the order components are added to the parent container. (See Documentation on `java.awt.Container` in JAE 1.1.8 API [31]).

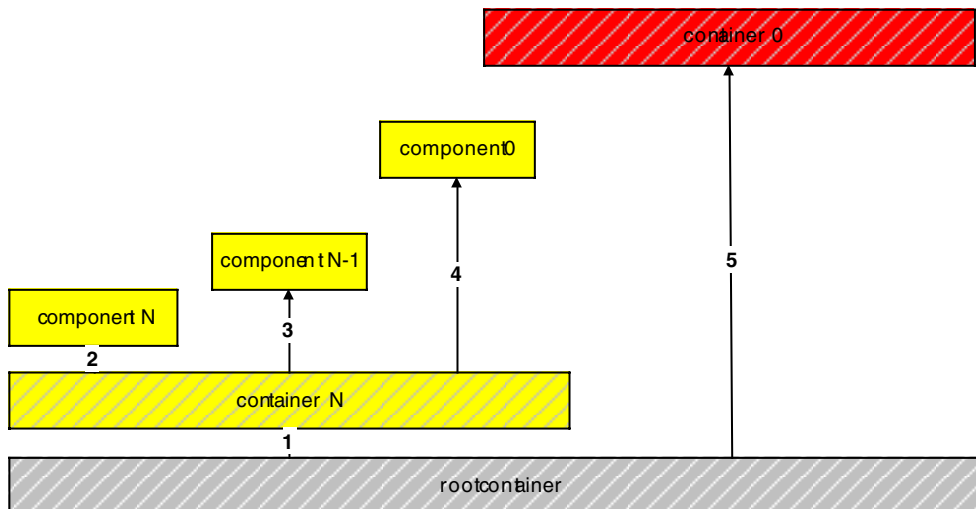


Figure 27 : Chronological order of painting

13.3.5 Composition Rules

13.3.5.1 Components generally

By setting an appropriate `DVBAAlphaComposite` rule on a `DVBGraphics` and using translucent colours blending may be achieved. By repeated placement of components complex scenes can be described. In figure 28 the background picture (of the harbour) is representative of the video plane. The translucent grey rectangle is drawn into a transparent off-screen buffer using the SRC rule. The red circle is then drawn into this off-screen buffer using one of the 8 most common Porter-Duff operations. When the AWT rendering in the off-screen buffer is complete it is composited with the video using the SRC_OVER rule.



Figure 28 : Summary of the Porter-Duff rules

13.3.6 Extensions to the AWT graphics capabilities

For graphics the MHP specification mainly uses AWT facilities defined in Java 1.1.x. However, certain extensions are made.

In order to allow compositing in the MHP the graphics capabilities of the JDK1.1 have been extended by providing the `org.dvb.ui` package.

The package consist of the classes `DVBGraphics`, `DVBAlphaComposite`, `DVBBufferedImage`, `DVBColor` and one Exception. See U, "(normative): Extended graphics APIs" on page 592.

13.3.6.1 Graphics Objects in the MHP

The class `org.dvb.ui.DVBGraphics` extends the normal `java.awt.Graphics` class by adding support for alpha compositing.

In the MHP each platform-created graphics object shall be an instance of `org.dvb.ui.DVBGraphics`.

`DVBGraphics` and `DVBAlphaComposite` has a principle support of 8 different Porter-Duff compositing rules but not all rules have to be supported for all `DVBGraphics` Objects.

Different `DVBGraphics` Object could support different compositing rules. E.g. a `DVBGraphics` Object created using a `DVBBufferedImage` with an image type of `DVBBufferedImage.TYPE_ADVANCED` supports all 8 specified Porter-Duff rules, `TYPE_BASIC` supports only `SRC`, `CLEAR`, `SRC_OVER`. Application can query the available compositing rules using `DVBGraphics.getAvailableCompositingRules()`. When setting an unsupported compositing rule a `org.dvb.ui.UnsupportedDrawingOperationException` will be thrown.

The supported compositing rules are defined in G, "(normative): Minimum Platform Capabilities" on page 282.

The default compositing rule used by all graphics objects is `SRC`.

13.3.6.2 Buffered Image

The class `DVBBufferedImage` in the package `org.dvb.ui` adds the support for an accessible, transparent Image which can be used e.g. for off screen buffers. Two different platform dependent sample models are supported by `DVBBufferedImage`. When doing compositing in the `TYPE_BASE` sample model approximations may be applied (using `SRC` instead of `SRC_OVER`, see figure 36 or by approximating the alpha, see G, "(normative): Minimum Platform Capabilities" on page 282) while in the `TYPE_ADVANCED` sample model the compositing rules set by the program will be used.

`TYPE_ADVANCED` is always a direct colour model while `TYPE_BASE` can be a CLUT based colour model.

13.3.6.3 DVBColor

Note The general philosophy of this class has been to imitate the features of JDK 1.2 dealing with colour.

Unless explicitly specified otherwise, the internal implementation of the platform (e.g. `java.awt`) shall use the `org.dvb.ui.DVBColor` class instead of the `java.awt.Color` where technically possible (e.g. not the constructor for `java.awt.Color`). The class signatures shall not change. For example, where a method is specified to return `java.awt.Color` it shall return an instance of `org.dvb.ui.DVBColor`.

13.3.6.3.1 Modified packed colour representation

The most significant byte of the integer representation of an RGB colour is defined to hold an alpha value as is illustrated in figure 29. This data type is used in various of the constructors and methods described in the API documentation. It is referred to in the API documentation as `TYPE_INT_ARGB`.

MSB				LSB			
31	24	23	16	15	8	7	0
Alpha		Red		Green		Blue	
7	0	7	0	7	0	7	0

Figure 29 : MHP colour format (`TYPE_INT_ARGB`)

13.4 Video

13.4.1 Component-based players and background players

Video is received by the MHP as an MPEG sequence of compressed frames, each of which contains a large number of picture elements (pels) arranged in rows and columns. The MHP decodes the MPEG stream to a presented stream which may be placed either in the video plane, or in a component in the graphics plane.

These two different ways of presenting video result in having two different kinds of JMF players, a background JMF player and a component-based JMF player.

A component-based JMF player plays video inside an AWT component, and the video inside that component is positioned and scaled by positioning and resizing the component. The video is always scaled to the full size of the component. Support for component-based players is not mandatory in all profiles.

Support for background players is mandatory for broadcast streaming formats (see 7.2, "Broadcast streaming formats" on page 49).

Background JMF players play video in the video plane, outside and independent of any AWT component hierarchy.

13.4.2 Modelling MPEG decoding and presentation pipeline

Figure 30 illustrates the underlying format conversion control process in a TR 101 154 [9] compliant SD digital receiver. In this model the video decoder produces "full-screen" video from the MPEG data (i.e. the decoder resolves any sub-sampling in the MPEG broadcast). Subsequent "Decoder Format Conversion" adapts this for the display device taking account of:

- broadcast meta data (aspect ratio, pan/scan and active format description)
- display knowledge (4:3 or 16:9, and resolution)
- user preferences (e.g. display wide screen in a letterbox)

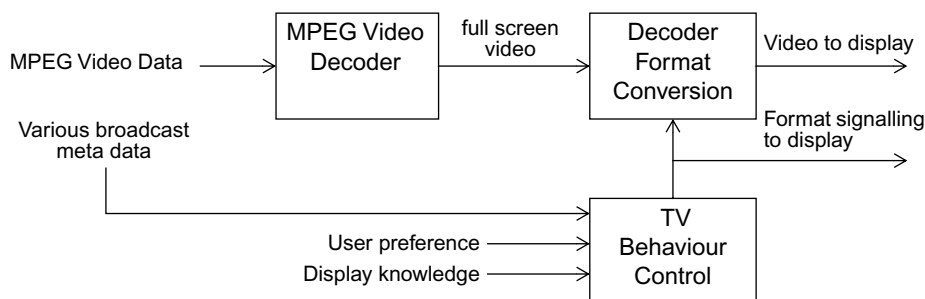


Figure 30 : Format control in TV mode

If appropriate, the video that is sent to the display is accompanied by the proper WSS or SCART signalling to indicate the format of the video that is being sent.

Note that the display device may do its own Decoder Format Conversion on top of the Decoder Format Conversion that the MHP device does. This is beyond the control of the MHP device.

The JMF players in this version of the MHP specification are "DVB ETR 154 Standard Definition" players and so act as if they are taking the full screen output of the MPEG Video Decoder as their logical input video source, as is illustrated in figure 31. In addition, there are two alternative sources of control for the "Decoder Format Conversion" process:

- Conventional TV format control behaviour (as in figure 30)
- Application format control behaviour

The selection between these behaviours is under the control of the application. Before and after the existence of an application the behaviour is that for a conventional TV. During application execution the default behaviour of the JMF player's decoder format conversion shall be the conventional TV behaviour.

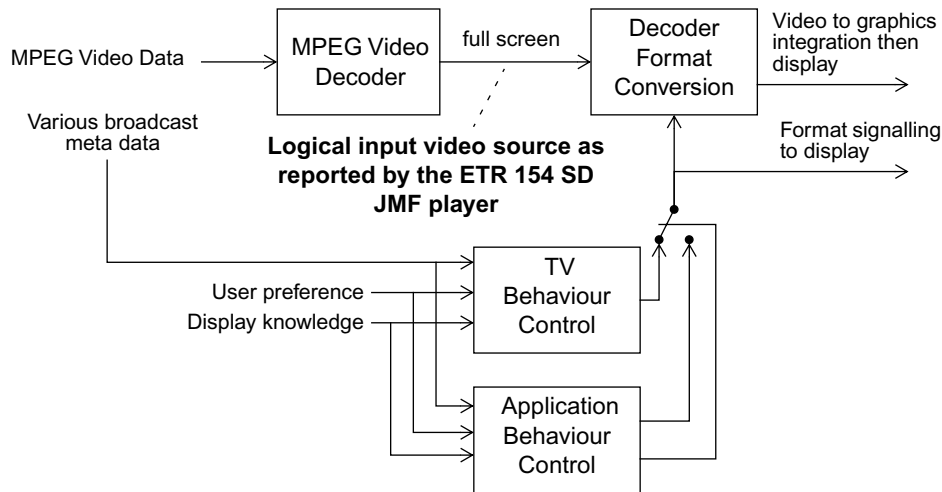


Figure 31 : Format control in the presence of a JMF player

The Decoder Format Conversion consists of three steps that are performed on the full screen input video, which may have been up-sampled by the MPEG video decoder to become full screen. As illustrated in Figure 32, these steps are clipping, scaling and positioning.

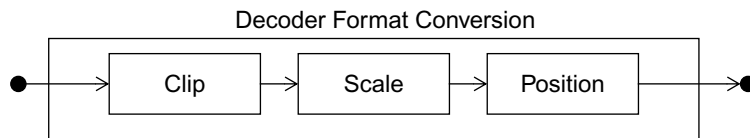


Figure 32 : Reference model for Decoder Format Conversion

An application can query the implemented capabilities of each step of the Decoder Format Conversion using the `org.dvb.media.VideoPresentationControl` ("VideoPresentationControl" on page 448). For instance, it can query the supported scaling factors.

An application can also set up the Decoder Format Conversion steps atomically by using an `org.dvb.media.VideoTransformation` object ("VideoTransformation" on page 453) that encapsulates the clipping, scaling, and positioning parameters. An application can get a number of pre-defined video transformations that correspond with standard Decoder Format Conversions like 16:9 letterboxing in a 4:3 display. It can either use these video transformations directly to set the Decoder Format Conversion, or it can change one or more parameters of the transformation before setting it. The API also offers support for querying the current video transformation.

13.4.3 Coordinate Spaces

The input to the Decoder Format Conversion block is always full screen video. If necessary, the MPEG video decoder block performs up-sampling as required by ETR154 to get full screen video.

An application expresses the video clipping in terms of the pixel-based coordinate space of the full screen video. For 50Hz SD video this is always a 720x576 raster.

Positioning of the video is expressed in the normalised coordinate space for background JMF players. For component-based JMF players, the position of the video component is expressed in the pixel-based device coordinate space (i.e., a video component is positioned like any other AWT component).

13.4.4 Video components

A scaled portion of a video can be presented as a component within the AWT hierarchy. The controls that influence this presentation are parts of AWT and JMF.

Video components are treated just like any other component. However, it shall be noted that pixels within the video have opaque colours. The mapping to the source video is provided by the video presentation control (see N, "(normative): Streamed Media API Extensions" on page 413) which allows an arbitrary portion of the video to be placed within the AWT hierarchy.

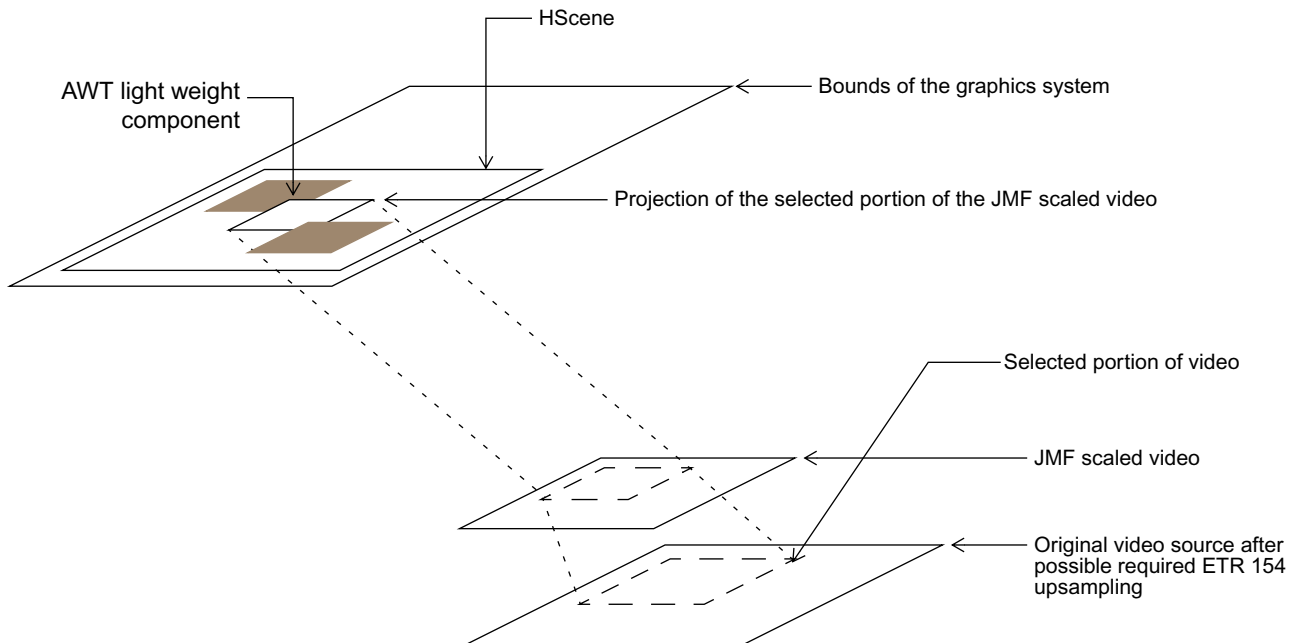


Figure 33 : Introducing video into the AWT component stack

13.5 Subtitles

13.5.1 Language and presentation setting

The following reference model shows how the presentation of subtitles is controlled. The selection of the subtitles language depends by default on the user's preferences, the audio language and can be overridden by the application. The end user can set the subtitles on or off where the default depends on the preferences. The application can override all this and switch the subtitles off even if the user has set them on.

The figure below illustrates the decision procedure:

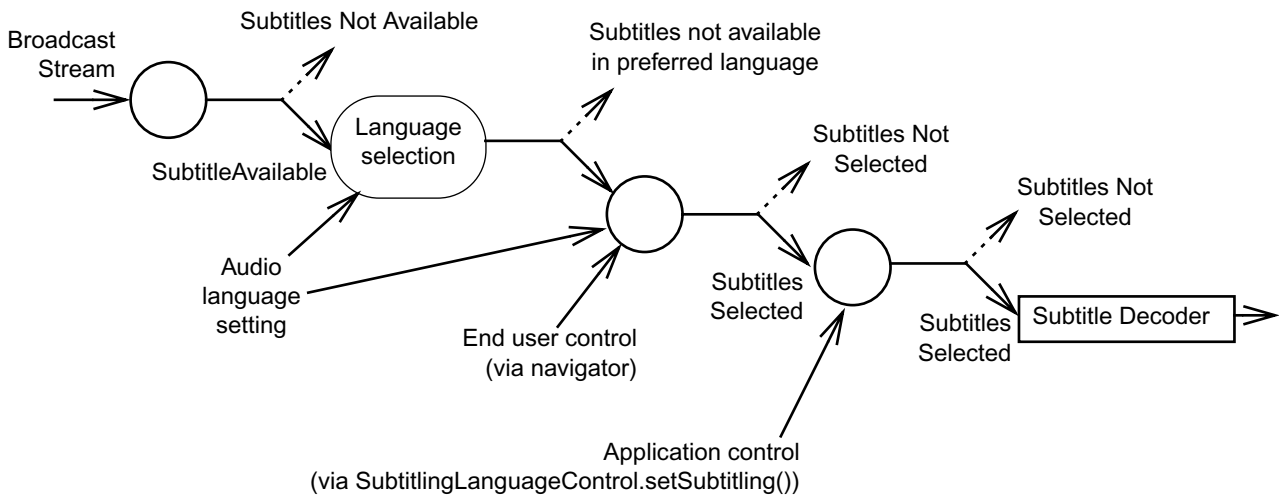


Figure 34 : Determining subtitling language and presentation setting

The DVB-J API includes a control (see "[SubtitlingEventControl](#)" on page 440) that the application can use to get notified of the state changes in the availability and presentation status of the subtitles. This corresponds to the status of the left hand side input and the right hand side output in the diagram.

The `org.davic.media.SubtitlingLanguageControl` allows the application to query the currently set subtitling language, override the default language setting and switch the subtitles off or let them be end user controlled. This corresponds to the language selection phase and the application controlled switch in the diagram

13.5.2 Relation to graphics

Ideally subtitles should be presented on top of the video plane but below the graphics plane(s). However, MHP terminals conforming to this specification are only required to support subtitles in areas where they are not overlapped by application graphics (i.e. by an `HScene` for a DVB-J application). The behaviour if the subtitles overlap with application graphics is non deterministic. Therefore, when presenting application graphics on screen, the application should either turn subtitles off or the broadcaster shall coordinate the use of screen area between subtitling and application graphics so that they will not overlap.

The subtitling plane is full screen and allows the subtitles to be positioned anywhere on screen. The positioning of the subtitling texts is part of the subtitling stream content and is fully controlled by the broadcaster.

13.5.3 Coordinate Spaces

Subtitles are decoded into a plane with the same coordinate system and position as the `HVideoDevice`.

13.6 Approximations

13.6.1 Approximations in composition

The MHP specification references the Porter-Duff rules for composition (see [Porter-Duff \[D\]](#)). The set of operations required is profile specific in addition the implementation of the compositions may be approximated in some profiles.

13.6.1.1 Implementation of modes

Typical implementations have a hardware blending process that blends the graphics plane over the video using SRC_OVER (see [figure 35](#)). This places certain practical limitations on the purity of the display model.

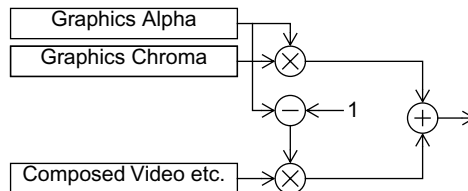


Figure 35 : Typical current technology implementation

The SRC rule simply requires that the colour and alpha characteristics of the new pixels replace those previously present.

HVideoComponents are treated as having an alpha of 1 so whether SRC or SRC_OVER is used when placing the video component the effect is that the video completely replaces anything previously drawn.

13.6.1.1.1 Graphics directly over video

When drawing graphics directly over a video component:

- The effect of SRC_OVER mode is as expected as the alpha value of the drawn graphics is used to control blending of the graphics with the video.

13.6.1.1.2 Graphics over other graphics

13.6.1.1.2.1 SRC

If (non-MPEG) graphics are painted over other (non-MPEG) graphics using SRC mode the result is as expected.

13.6.1.1.2.2 SRC_OVER

If (non-MPEG) graphics are painted over other (non-MPEG) graphics using SRC_OVER mode the result will be implementation dependant. [Figure 36 on page 196](#) illustrates a variety of implementations of SRC_OVER graphics to graphics blending.

13.6.1.1.2.3 CLEAR

If (non-MPEG) graphics are painted over other (non-MPEG) graphics using the CLEAR mode the result is as expected. This operation is the same as using a source with alpha=0 and the SRC rule.

- [a] Shows the logically correct result where the green and red areas mix to produce intermediate colours.

This implies a graphics to graphics blending process, it also implies a large gamut in both the chroma and alpha channels. This may not be practical in many early implementations.

The following cases illustrate simplifications of the blending scheme. These should not be considered equally good approximations:

- [b] Here the graphics alpha is preserved only when it is drawn directly over a video component. When drawn over another (non-MPEG) graphic the alpha facets of the colours are considered to be 1.

- [c] Here the source graphics alpha is preserved when it is drawn over a video component even if there is an intermediate semi-transparent graphic. Where the source is over opaque graphics then a graphic to graphic blend is implemented.
- [d] Here the source graphics alpha becomes the hardware mixing alpha regardless of what has been drawn previously over the MPEG image.
- [e] Here the source graphics alpha becomes the hardware mixing alpha in areas where the alpha is already less than 1. Where the alpha is currently 1 (i.e. over opaque graphics) the alpha remains 1.

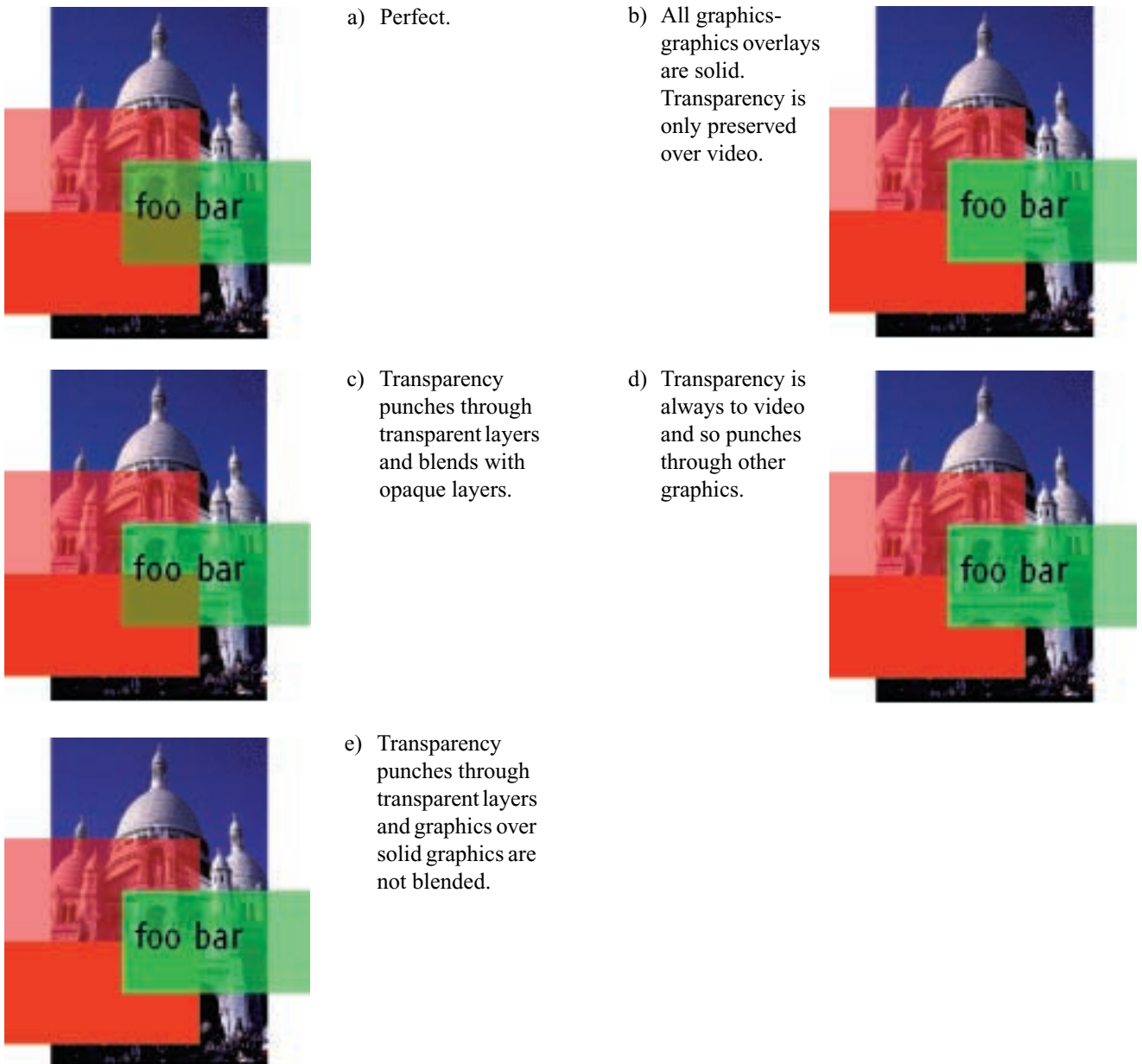


Figure 36 : Implementations of blending

13.6.1.2 Approximation of alpha

The precision of implementation of alpha depends on the `DVBGraphics` object concerned. The minimum requirements are specified in G, "(normative): Minimum Platform Capabilities" on page 282. The actual colour used for a given colour can be queried using `org.dvb.ui.DVBGraphics.getBestColorMatch()`.

13.6.1.3 Approximation of colour

Logically the colour model is a "true colour" one. However, colour approximation is allowed as described in G.1.5, "Colour capabilities" on page 283.

14 System integration aspects

14.1 Namespace mapping (DVB Locator)

An extended format of the DAVIC DVB URL (DAVIC 1.4.1p9 [3]) shall be used for addressing DVB-SI entities as well as files within object carousels. This extension of the DAVIC locator is backwards compatible with both the original DAVIC locator as well as the UK DTG extension (UK MHEG Profile [B]). The main extensions are support for multiple component tags for specifying a subset of the components of a service, and a specified way of referencing files in an object carousel within a service.

Using the same informal notation as used above, the following locator formats shall be used:

```
dvb://<original_network_id>[.<transport_stream_id>][.<service_id>[.<component_tag>{&<component_tag>}][;.<event_id>]]{<path_segments>}
```

or

```
dvb://'<textual_service_identifier>'[.<component_tag>{&<component_tag>}][;.<event_id>]]{<path_segments>}
```

A more formal specification of the DVB URL expressed in BNF (as used in RFC 2396 [41]) is presented below:

Table 62 : DVB URL syntax

dvb_url	= dvb_scheme ":" dvb_hier_part
dvb_scheme	= "dvb"
dvb_hier_part	= dvb_net_path dvb_abs_path
dvb_net_path	= "/" dvb_entity [dvb_abs_path]
dvb_entity	= dvb_transport_stream dvb_service dvb_service_component
dvb_transport_stream	= original_network_id "." transport_stream_id
dvb_service	= dvb_service_without_event [dvb_event_constraint]
dvb_service_component	= dvb_service_without_event "." component_tag_set [dvb_event_constraint]
dvb_service_without_event	= original_network_id "." [transport_stream_id] "." service_id "'" textual_service_identifier "'"
component_tag_set	= component_tag *("&" component_tag)
dvb_event_constraint	= ";" event_id
original_network_id	= hex_string
transport_stream_id	= hex_string
service_id	= hex_string
component_tag	= hex_string
event_id	= hex_string
hex_string	= 1*hex
hex	= digit "A" "B" "C" "D" "E" "F" "a" "b" "c" "d" "e" "f"
digit	= "0" "1" "2" "3" "4" "5" "6" "7" "8" "9"
dvb_abs_path	= "/" path_segments
(path_segments as defined in RFC 2396 [41])	

It should be noted that this syntax is fully compliant with the generic syntax of URIs as specified in RFC 2396 [41] and uses the registry-based naming authority version of that. Furthermore, all generic definitions specified in RFC 2396 [41] shall be valid for the DVB URL as well (e.g. escaping of special characters within file names, etc.).

RFC 2396 [41] defines methods for path segments to include parameters (introduce with a semicolon character ";"). This specification currently makes no use of such parameters. Implementations conforming to this specification shall ignore any such parameters to ensure compatibility with future specifications.

14.1.1 dvb_entity = dvb_service

When a path is present in a URL where the dvb_entity part identifies a DVB service, the path references an object in an object carousel within the service. If the dvb_service_component element is not present there shall only be one Object Carousel in the DVB service.

14.1.2 dvb_entity = dvb_service_component

When a path is present in a URL where the `dvb_entity` part identifies one component of a DVB service and that component carries an object carousel stream, the path references an object in an object carousel whose "root" (i.e. DSI message) is sent within that component. In this case the component tag set shall only contain one element.

The semantics when the path is present in URL where the `dvb_entity` part identifies something else than the two cases described above are not specified in this specification.

14.1.3 dvb_hier_part = dvb_abs_path

When the `dvb_net_path` part is missing and only the `dvb_abs_path` is present, the URL refers to a file in a default object carousel within the current service. The "current" service is dependent on the usage context.

14.1.4 dvb_abs_path

The following restrictions apply to the `dvb_abs_path` part of a name:

- The total length of pathnames, separators and filename shall be less than or equal to 254 bytes long.
- The following characters are not allowed in filenames and pathnames: character null (0xC080), byte zero.
- The encoding of the filename is in UTF-8 (see 7.1.5 on page 49).
- The directory separator character (i.e. Java's `path.separator` property) shall be a slash character (0x2F).
- An absolute filename starts with a slash character (as indicated in the BNF above).

14.2 Reserved names

File names starting with the characters "dvb." are reserved for use as "well known" files defined in this or future specifications.

Authors shall not use file names with this form to avoid possible collision with standards defined files.

14.3 XML notation

These rules shall apply to the processing and encoding of all the files where XML is used as an encoding format in the MHP.

Rules for encoding of the XML formatted files:

- the file shall be a well-formed XML document (but not necessarily valid against the DTD specified in this version of this specification). Here 'well-formed' and 'valid' are used as defined in the XML 1.0 (see [XML 1.0 \[65\]](#)) specification.

NOTE: The remark on validity is included, because it is possible to be valid only relative to one DTD. Valid documents relative to a DTD specified in a later version of this specification would not be valid relative to the DTD specified in this specification - however, the rules defined here intend to provide this future-proofness and allow terminal implementations compliant with this specification to be able to process files that may be encoded according to a later version of this specification.

- the XML files may contain the XMLDecl item ("<?xml ... ?>" tag) in the prologue in the beginning of the file
- all the XML files shall be formatted using the UTF-8 character encoding which is the default used in XML
- the possible XMLDecl item in the beginning of the file shall not contain an 'encoding' attribute specifying another encoding than UTF-8
- if the XMLDecl item is included in files conforming to this specification, it shall indicate XML version 1.0
- the XML file shall contain a document type declaration ("<!DOCTYPE ...>" tag) where the Name is the same as the name of the root element
- the document type declaration shall contain an ExternalID item with the "PUBLIC" identifier and both a PublicLiteral and a SystemLiteral. This specification specifies the PublicLiteral that shall be used to identify the document types defined in this specification. This specification specifies a SystemLiteral that can be used for identifying a location where the DTD can be retrieved. The SystemLiteral included in the document type declaration shall point to a location where the DTD can be obtained via the Internet using the HTTP protocol as specified in this specification.
- the PublicLiteral is used for identifying the type of the file. For document types specified in this specification, the PublicLiteral shall have the following syntax:

```
"-//DVB//DTD " <document type> " " <version_number> "-//EN"
```

where:

<document type> has the following syntax:

```
<document_type> = letter letters
letters = "" | letter letters
letter = uppercase_letter | lowercase_letter | space
uppercase_letter = "A" | "B" | "C" | "D" | "E" | "F" | "G" | "H"
                  | "I" | "J" | "K" | "L" | "M" | "N" | "O"
                  | "P" | "Q" | "R" | "S" | "T" | "U" | "V"
                  | "W" | "X" | "Y" | "Z"
lowercase_letter = "a" | "b" | "c" | "d" | "e" | "f" | "g" | "h"
                  | "i" | "j" | "k" | "l" | "m" | "n" | "o"
                  | "p" | "q" | "r" | "s" | "t" | "u" | "v"
                  | "w" | "x" | "y" | "z"
space = " "
```

<version_number> has the following syntax:

```
<version_number> = major_version "." minor_version
major_version = digit digits
minor_version = digit digits
digit = "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
digits = "" | digit digits
```

The `<document_type>` part of the `PublicLiteral` is used as an identifier of the document type. When future versions of this specification specify newer, backwards compatible versions of the document type, the `<document_type>` part shall not be changed and the `<version_number>` part shall be changed to a new version number unused in a previous version of this specification for that document type.

- the XML file shall be valid relative to the DTD identified in the `ExternalId` document type declaration. Here 'valid' is used as defined in the XML 1.0 specification.
- the document type declaration shall not contain a declaration part in square brackets ('[' and ']')
- where the XML type PCDATA is used in XML elements and it is specified that this contains a string (for example a file name), these strings shall not contain '<', '&' or '>' characters that might be mistaken as XML tags or references of the markup.

NOTE: Strings where these characters must be allowed should be specified to be encoded as CDATA, leading to a more complex notation but allowing those symbols to be used.

- the file shall include only tags and attributes that are defined in this specification or a later version of this specification
- the file shall not include XML entity declarations ("`<!ENTITY ...>`" tags)
- the file shall not include XML character or entity references (references starting with '&' character)
- the file shall not include XML processing instructions, except optionally the "`<?xml ...?>`" XMLDecl item
- the file may include XML comments ("`<!-- ... -->`" strings), but not within elements that are specified as PCDATA containing strings to be encoded as defined in this specification

Rules for processing of the XML formatted files in the MHP terminal:

- the parser shall use the `PublicLiteral` in the document type declaration in the XML file ("`<!DOCTYPE ...>`" tag) for identifying the type of the file.
- The `PublicLiteral` in the document type declaration identifies the version of the DTD that is used for this file. There is no requirement for the parser to try to fetch that DTD file using the URL defined by the `SystemLiteral`. It is an implementation option for the parser to retrieve the DTD from that URL. If the DTD is unavailable from that URL, then the behaviour shall be platform dependent.
- The parser shall accept files that have a different version number in the `PublicLiteral` than the one specified in this specification for the given file type. These are probably files encoded according to a later version of this specification. From those files, the parser shall parse, recognize and handle all those elements and attributes that are part of the DTD included in this specification.
- the parser shall ignore all XML elements (start tag, end tag, and possible string between them) that are not specified in the DTD included in this specification.

NOTE: This allows extending the DTDs in the future in a future proof manner where existing terminals ignore all the elements introduced in later versions of this specification

- the parser shall ignore such attributes of XML tags that are not specified in the DTD included in this specification
- the parser shall ignore XML comments encoded as defined in the XML 1.0 specification
- the parser must accept empty XML elements specified in this specification both in their start-tag and end-tag form as well as in the empty element tag form (e.g. '<tuning value="true"></tuning>' may be used as well as '<tuning value="true"/>')
- rules for evolving the specification must ensure that the encoding of the file will always be maintained backwards compatible when these rules are followed (i.e. later versions of this specification may add new XML tags and new attributes to existing XML tags, but may not change the semantics of the existing elements)
- if the encoding of the file violates the rules defined for the encoding above, the behaviour of the parser can be platform dependent, including the possibility that the parser may completely discard such files and the system may behave as if the file is not present at all.

14.4 Network signalling

The behaviour of MHP terminals when receiving incorrect transmissions is not specified. MHP terminals may implement whatever strategy they like for this situation. It is an allowed implementation choice to pass values from the network straight through to applications without checking them for correctness. Hence API calls which are specified as returning a specific piece of information may not return a valid piece of information if the original information in the network is wrong.

14.5 Text encoding of application identifiers

Where an [organisation_id](#) or [application_id](#) is encoded in textual form it shall be encoded as follows:

- a hexadecimal representation of the value
- lower case letters
- no extra leading zeros (as would be produced by Integer.toHexString)

Where both an [organisation_id](#) and [application_id](#) are combined into an application identifier, they will be represented as a single hexadecimal number using the previously described encoding with the [organisation_id](#) as the most significant bits and the [application_id](#) as the least significant bits.

14.6 Reserved names for persistent storage

File names are restricted to `persistentstoragename` as specified in the following BNF:

```

lowalpha = "a" | "b" | "c" | "d" | "e" | "f" | "g" | "h" | "i" |
           "j" | "k" | "l" | "m" | "n" | "o" | "p" | "q" | "r" |
           "s" | "t" | "u" | "v" | "w" | "x" | "y" | "z"

upalpha  = "A" | "B" | "C" | "D" | "E" | "F" | "G" | "H" | "I" |
           "J" | "K" | "L" | "M" | "N" | "O" | "P" | "Q" | "R" |
           "S" | "T" | "U" | "V" | "W" | "X" | "Y" | "Z"

alpha    = lowalpha | upalpha

digit    = "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" |
           "8" | "9"

punct    = "_"

persistentstoragename = alpha | digit | punct

```

14.7 Files and file names

The MHP specification defines how applications can use the names of files in order to access content held in files. It is intentionally silent about the file systems and file system namespaces of MHP terminals except as defined below.

- When an MHP application starts, the filesystem where that application is carried will be mounted into the file system namespace of the MHP terminal concerned. For a DVB-J application 11.5.1, "Broadcast Transport Protocol Access API" on page 112 defines that creating a new instance of `java.io.File(" . ")` will result in a reference to the base directory of the application. This base directory may be a sub-directory within this filesystem.
- MHP applications which have requested the right to access persistent storage, and had this right granted, are allowed to access the persistent file namespace. For DVB-J applications, the top level directory of this namespace is obtainable from the system property, `"dvb.persistent.root"`.
- MHP applications may have the ability to mount additional filesystems into the file system namespace of the MHP terminal concerned. DVB-J applications are allowed to use the `attach()` method on the `org.dvb.dsmcc.ServiceDomain` class in order to attach an object carousel as an additional file system. In all other methods, using a DVB locator including the `dvb_abs_path` part of the name part of the syntax shall not mount the specified object carousel file system.
- Conformant MHP applications shall not attempt to access files or file systems outside what is allowed by this specification. The consequences should they attempt to do this are undefined and implementation dependent. Platforms are allowed to choose to limit the access rights of DVB-J applications through use of platform security mechanisms, e.g. `java.io.FilePermission`.
- References to content carried in files shall either be done using names of files encoded in text or using "file:" URLs as defined in RFC 1738 [67]. File names encoded in "dvb:" URLs shall be transformed to "file:" URLs before use. For DVB-J applications, file names shall be encoded in Java String objects and "file:" URLs shall be encoded in instances of `java.net.URL`.

14.8 Locators and content referencing

The table below lists the types of entity which may be addressed by locators in this specification and defines the text representation for each entity. This specification does not require support for addressing any other type of entity in an MHP system by locator or URL.

Table 63 : Addressable entities, locators and their text representation (Sheet 1 of 2)

Entity	Text Representation
Transport stream	DVB locator including "dvb_transport_stream" element
Network	No standardised text representation
Bouquet	No standardised text representation
DVB Service	DVB locator including "dvb_service" element
Generic Service	No standardised text representation unless also a DVB service
DVB Event	DVB locator including "dvb_service" element and "dvb_event_constraint" element
MPEG Elementary Stream	DVB locator including "dvb_service_component" element
File	"file:" URL as defined in RFC 1738 [67] (note 1) DVB locator including "dvb_abs_path" element (note 2)
Directory	"file:" URL as defined in RFC 1738 [67] (note 1) DVB locator including "dvb_abs_path" element (note 2)

Table 63 : Addressable entities, locators and their text representation (Sheet 2 of 2)

Entity	Text Representation
Drip feed decoder	"dripfeed://"
NOTE 1: The hostname part of a "file:" URL shall always be the empty string. These URLs are always in the namespace of the receiver. Transmitting them across a network as part of an application is meaningless.	
NOTE 2: DVB locators including the "dVB_abs_path" element may be returned by MHP APIs as a mechanism to provide references to files in carousels which may not currently be mounted. These locators can only be used to mount new carousels or be translated into a "file:" URL once a new carousel has been mounted.	

The DVB specifications define two places where multiple logical service components can be carried in a single MPEG elementary stream - DVB subtitles and MPEG-2 multichannel audio. This specification does not provide locators to distinguish between multiple languages of subtitles or audio carried in a single MPEG elementary stream in this way. Hence methods returning locators for service components / elementary streams shall return the same locator regardless of any selection between such logical service components. Methods accepting locators for service components / elementary streams shall select between any such logical service components based on the rules for elementary stream selection in section 11.4.2.2, "Clarifications" on page 107.

14.9 Service identification

In the MHP, there are two mechanisms for uniquely identifying a service:

- the triplet of numeric SI identifiers:

`original_network_id`, `transport_stream_id` and `service_id` (corresponding to identifiers with the same name defined by EN 300 468 [4] carried in the SI of the broadcast)

- a textual service identifier:

`textual_service_identifier_bytes` carried in the optional *Service identifier descriptor* in the SDT (see 10.12.1 on page 97).

Both enable global, unique identification of a service.

The textual identifier has additional properties:

- They can identify two (or more) service instances as being the same service even if they for technical reasons have different numeric identifiers.

It is up to the service provider to decide whether different service instances are identified as being the same service.

- They can give alternative identifications for a single service.

14.9.1 Syntax of the textual service identifier

The syntax of the textual service identifier is:

```
<service_name> "." <service_provider_domain_name>
```

where:

<service_name>: is a unique name for the service within the service provider's domain

<service_provider_domain_name>: is an Internet DNS domain name that the service provider has rights to control. The organization's administrating the Internet DNS domain names are used as a globally unique registration mechanism that allows these textual service identifiers to be globally unique names.

The `<service_name>` field shall follow the rules defined for Internet DNS names so that the whole textual service identifier is a valid host name to be used in the Internet DNS as defined in RFC 1035 [75].

An example of a textual service identifier is:

```
movie_channel_1.broadcaster_b.com
```

where "broadcaster_b.com" is an Internet DNS domain owned by the broadcaster and "movie_channel_1" is a unique name for the service assigned by the service provider

NOTE: The textual service identifier has the same syntax as an Internet host name and it must be assigned in a domain that the service provider has the rights to control. However, the textual service name for a service is not required to resolve to any IP address using the Internet DNS service and if it does, this version of this specification does not specify any specific services that this host should provide if contacted using the IP protocols.

14.9.2 Handling of the textual service identifiers within the MHP terminal

The MHP terminal discovers the textual service identifiers for a given service from the SDT table similarly as it discovers the existence of the service in the first place. The MHP terminal shall know the textual service identifiers for the available services in the same way that it knows the numeric identifiers: `original_network_id`, `transport_stream_id` and `service_id`.

When the application uses a URI referring to a DVB service, the resolution of this URI to the necessary information needed to locate the service happens in the same way regardless of if this URI contains a textual identifier or the numeric identifiers.

The URI string provided by the application shall be considered to match the one included in the SDT when the strings are the same.

15 Detailed platform profile definitions

This chapter defines the capabilities of platforms as presented to applications. Products that claim to conform to a profile shall provide at least the minimum capabilities identified for the profile. In some cases this implies that specific hardware resources are present in the platform.

Table 64 : Detailed platform profile definitions (Sheet 1 of 2)

Area	Specification	Enhanced Broadcast Profile 1	Interactive Broadcast Profile 1	Internet Access Profile 1
Static formats				
Bitmap pictures	7.1.1.3, "PNG" on page 47 + 15.1, "PNG - restrictions" on page 208	M	M	
	7.1.1.3, "PNG" on page 47 without restrictions	-	-	
	7.1.1.4, "GIF" on page 47	-	-	
	7.1.2, "MPEG-2 I-Frames" on page 47	M	M	
	7.1.1.2, "JPEG" on page 47 + 15.3, "JPEG - restrictions" on page 208	M	-	-
	7.1.1.2, "JPEG" on page 47 without restrictions	-	M	
Audio clips	7.1.4, "Monomedia format for audio clips" on page 49	M	M	
Video drips	7.1.3, "MPEG-2 Video "drips"" on page 47	M	M	
Text encoding	7.1.5, "Monomedia format for text" on page 49	M	M	
Broadcast streaming formats				
Video	7.2.2, "Video" on page 49	M	M	
Audio	7.2.1, "Audio" on page 49	M	M	
Subtitles	7.2.3, "Subtitles" on page 49	M	M	
Fonts				
Built in	Character set see annex E, "(normative): Character set" on page 276, Metrics see annex D, "(normative): Text presentation" on page 263 Face: UK RNIB 'Tiresias'	M	M	
Downloadable	7.4, "Downloadable Fonts" on page 50	M	M	
Broadcast channel protocols				
	6.2.2, "MPEG-2 Sections" on page 43	M	M	
	6.2.5, "DSM-CC User-to-User Object Carousel" on page 43	M	M	
	IP Multicast stack based on: 6.2.6, "DVB Multiprotocol Encapsulation" on page 44, 6.2.7, "Internet Protocol (IP)" on page 44 6.2.8, "User Datagram Protocol (UDP)" on page 44	O	Ro	M
Interaction channel protocols				
TCP/IP	6.3.3, "Transmission Control Protocol (TCP)" on page 45 6.3.2, "Internet Protocol (IP)" on page 45	-	M	M
UDP/IP	6.2.8, "User Datagram Protocol (UDP)" on page 44 6.3.2, "Internet Protocol (IP)" on page 45	-	M	M
DSM-CC U-U RPC	6.2.5, "DSM-CC User-to-User Object Carousel" on page 43 6.3.4, "UNO-RPC" on page 45 6.3.5, "UNO-CDR" on page 45	-	O	
HTTP	6.3.7.1, "HTTP 1.1" on page 46	-	O	M
DVB-J				
Core	11.3, "Fundamental DVB-J APIs" on page 100	M	M	
Presentation	11.4.1, "Graphical User Interface API" on page 103	M (note 1)	M (note 1)	
	11.4.2, "Streamed Media API" on page 107	M	M	

Table 64 : Detailed platform profile definitions (Sheet 2 of 2)

Area	Specification	Enhanced Broadcast Profile 1	Interactive Broadcast Profile 1	Internet Access Profile 1
Data Access	11.5.1, "Broadcast Transport Protocol Access API" on page 112	M	M	
	11.5.2, "Support for Multicast IP over the Broadcast Channel" on page 114	O	Ro	
	11.5.3, "Support for IP over the Return Channel" on page 115	-	M	
	11.5.4, "MPEG-2 Section Filter API" on page 115	M	M	
	11.5.5, "Mid-Level Communications API" on page 115	-	M	
	11.5.6, "Persistent Storage API" on page 115	M	M	
Service Information & Selection	11.6.1, "DVB Service Information API" on page 116	M	M	
	11.6.2, "Service Selection API" on page 116	M	M	
	11.6.3, "Tuning API" on page 116	M	M	
	11.6.4, "Conditional Access API" on page 117	M	M	
	11.6.5, "Protocol Independent SI API" on page 117	M	M	
Common Infrastructure	11.7.1, "APIs to support DVB-J application lifecycle" on page 118	M	M	
	11.7.2, "Application discovery and launching APIs" on page 118	M	M	
	11.7.3, "Inter-Application communication API" on page 119	M	M	
	11.7.4, "Basic MPEG Concepts" on page 122	M	M	
	11.7.5, "Resource Notification" on page 122	M	M	
	11.7.6, "Content Referencing" on page 122	M	M	
	11.7.7, "Common Error Reporting" on page 123	M	M	
Security	11.8.1, "Basic Security" on page 124	M	M	
	11.8.2, "APIs to Support TLS / SSL Over the Return Channel" on page 125	-	M	
	11.8.3, "Additional permissions classes" on page 125	M	M	
Others	11.9.1, "Timer Support" on page 125	M	M	
	11.9.2, "User Settings and Preferences API" on page 126	M	M	
	11.9.3, "Profile and version properties" on page 126	M	M	
NOTE 1: The javax.tv.graphics.TVContainer.getRootContainer method shall return an instance of org.havi.ui.HScene or null.				

Key	
-	Not required / Not applicable
O	Optional feature in the receiver
Ro	Recommended optional feature in the receiver
M	Mandatory feature in the receiver

15.1 PNG - restrictions

Engines are required to support ALL of the PNG colour types defines in PNG Specification Version 1.0 (see table 65). Engines are responsible for mapping these colours to those used by the engine's OSD.

Any combination of PNGs with different colour types may be active at any one time. Similarly, engines are responsible for mapping RGB16 direct colour specifications to colours that the OSD can support.

Table 65 : PNG Formats

Colour Type	Allowed Bit Depths	Interpretation
0	1, 2, 4, 8, 16	Each pixel is a grayscale sample.
2	8, 16	Each pixel is an R,G,B triple.
3	1, 2, 4, 8	Each pixel is a palette index; PLTE chunk must appear.
4	8, 16	Each pixel is a grayscale sample, followed by an alpha sample.
6	8, 16	Each pixel is an R,G,B triple, followed by an alpha sample.

Where PNG graphics use colours defined in the currently active application palette these colours shall be reproduced correctly. Other colours shall be reproduced in an implementation dependent way.

Receivers should ignore gAMA (gamma) and cHRM (chromaticity) chunks in PNG files.

In this profile, all PNG graphics should be gamma corrected.

15.1.1 PNG Aspect ratios

PNG bitmaps shall carry a pHYs chunk indicating the pixel aspect ratio of the bitmap. This aspect ratio should be the same as that of the scene containing the bitmap.

The PNG specification indicates that if the aspect ratio is absent square pixels should be assumed. To avoid overriding this specification the aspect ratio should be signalled explicitly.

15.2 Minimum media formats supported by DVB-J APIs

The following table specifies the minimum set of media types that implementations of the "Enhanced Broadcast Profile 1" and "Interactive Broadcast Profile 1" shall support. It also identifies the APIs that shall provide this support:

Table 66 : Media type support required in Enhanced and Interactive Broadcast profile 1

Media type	Section Reference	API(s)
Downloadable fonts	7.4	java.awt.Font
Audio from file	7.1.4	org.havi.ui.HSound JMF
MPEG I frame images	7.1.1	org.havi.ui.HBackgroundImage
PNG images	7.1.1.3	java.awt.Image
JPEG images	7.1.1.2	java.awt.Image
DVB service	7.2	JMF
Video "drips"	7.1.3	org.dvb.media.DripFeedDataSource

15.3 JPEG - restrictions

The restricted JPEG specification is as specified in 7.1.1.2, "JPEG" on page 47 except that the "progressive DCT-based" mode is excluded.

15.4 Locale support

Support of resources for the following locales is required:

- one guaranteed one (EN.UK)
- zero (or more) implementation dependant ones

Further it is guaranteed that the default Locale shall have resources. The default Locale is implementation dependant.

16 Registry of Constants

16.1 System constants

Table 67 : Registry of constants

Entity	Value	Description
PTimerMinRepeatInterval	40 ms	This (or optionally a smaller) value shall be returned by javax.tv.util.TVTimer.getMinRepeatInterval(). See 11.9.1, "Timer Support" on page 125.
PTimerGranularity	10ms	This (or optionally a smaller) value shall be returned by javax.tv.util.TVTimer.getGranularity(). See 11.9.1, "Timer Support" on page 125.

Table 68 : Profile encoding

application profile	version			Definition
	major	minor	micro	
1	1	0	1	Enhanced Broadcast Profile 1 as defined in this specification
2	1	0	1	Interactive Broadcast Profile 1 as defined in this specification

16.2 DVB-J constants

This section to be populated with the values of public final static symbols from the various Java APIs.

16.2.1 Public and Protected final static primitive fields from DVB packages

The following is a list of the values assigned for public and protected final static primitive fields defined in the DVB defined DVB-J packages:

```

public final static int org.dvb.application.AppAttributes.DVB_J_application = 1;
public final static int org.dvb.application.AppAttributes.DVB_HTML_application = 2;
public final static int org.dvb.application.AppProxy.STARTED = 0;
public final static int org.dvb.application.AppProxy.DESTROYED = 1;
public final static int org.dvb.application.AppProxy.NOT_LOADED = 2;
public final static int org.dvb.application.AppProxy.PAUSED = 3;
public final static int org.dvb.application.AppsDatabaseEvent.NEW_DATABASE = 0;
public final static int org.dvb.application.AppsDatabaseEvent.APP_CHANGED = 1;
public final static int org.dvb.application.AppsDatabaseEvent.APP_ADDED = 2;
public final static int org.dvb.application.AppsDatabaseEvent.APP_DELETED = 3;
public final static int org.dvb.application.DVBJProxy.LOADED = 5;

public final static int org.dvb.dsmcc.DSMCCObject.FROM_CACHE = 1;
public final static int org.dvb.dsmcc.DSMCCObject.FROM_CACHE_OR_STREAM = 2;
public final static int org.dvb.dsmcc.DSMCCObject.FROM_STREAM_ONLY = 3;

public final static int org.dvb.event.UserEvent.UEF_KEY_EVENT = 1;

public final static int org.dvb.io.persistent.FileAttributes.PRIORITY_LOW = 1;
public final static int org.dvb.io.persistent.FileAttributes.PRIORITY_MEDIUM = 2;
public final static int org.dvb.io.persistent.FileAttributes.PRIORITY_HIGH = 3;

public final static int org.dvb.media.PresentationChangedEvent.STREAM_UNAVAILABLE = 0;
public final static int org.dvb.media.PresentationChangedEvent.CA_FAILURE = 1;
public final static int org.dvb.media.PresentationChangedEvent.CA_RETURNED = 2;
public final static int org.dvb.media.VideoFormatControl.ASPECT_RATIO_UNKNOWN = -1;
public final static int org.dvb.media.VideoFormatControl.AFD_NOT_PRESENT = -1;
public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_UNKNOWN = -1;

```

```

public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_NONE = 0;
public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_FULL = 1;
public final static int org.dvb.media.VideoFormatControl.DAR_4_3 = 1;
public final static int org.dvb.media.VideoFormatControl.ASPECT_RATIO_4_3 = 2;
public final static int org.dvb.media.VideoFormatControl.AFD_16_9_TOP = 2;
public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_LB_16_9 = 2;
public final static int org.dvb.media.VideoFormatControl.DAR_16_9 = 2;
public final static int org.dvb.media.VideoFormatControl.ASPECT_RATIO_16_9 = 3;
public final static int org.dvb.media.VideoFormatControl.AFD_14_9_TOP = 3;
public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_LB_14_9 = 3;
public final static int org.dvb.media.VideoFormatControl.ASPECT_RATIO_2_21_1 = 4;
public final static int org.dvb.media.VideoFormatControl.AFD_GT_16_9 = 4;
public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_CCO = 4;
public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_PAN_SCAN = 5;
public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_LB_2_21_1_ON_4_3 = 6;
public final static int org.dvb.media.VideoFormatControl.DFC_PROCESSING_LB_2_21_1_ON_16_9 = 7;
public final static int org.dvb.media.VideoFormatControl.AFD_SAME = 8;
public final static int org.dvb.media.VideoFormatControl.DFC_PLATFORM = 8;
public final static int org.dvb.media.VideoFormatControl.AFD_4_3 = 9;
public final static int org.dvb.media.VideoFormatControl.AFD_16_9 = 10;
public final static int org.dvb.media.VideoFormatControl.AFD_14_9 = 11;
public final static int org.dvb.media.VideoFormatControl.AFD_4_3_SP_14_9 = 13;
public final static int org.dvb.media.VideoFormatControl.AFD_16_9_SP_14_9 = 14;
public final static int org.dvb.media.VideoFormatControl.AFD_16_9_SP_4_3 = 15;
public final static byte org.dvb.media.VideoPresentationControl.POS_CAP_OTHER = -1;
public final static byte org.dvb.media.VideoPresentationControl.POS_CAP_FULL = 0;
public final static byte org.dvb.media.VideoPresentationControl.POS_CAP_FULL_IF_ENTIRE_VIDEO_ON_SCREEN=1;
public final static byte org.dvb.media.VideoPresentationControl.POS_CAP_FULL_EVEN_LINES = 3;
public final static byte org.dvb.media.VideoPresentationControl.POS_CAP_FULL_EVEN_LINES_IF_ENTIRE_VIDEO_ON_SCREEN = 4;

public final static int org.dvb.net.rc.RCInterface.TYPE_PSTN = 1;
public final static int org.dvb.net.rc.RCInterface.TYPE_ISDN = 2;
public final static int org.dvb.net.rc.RCInterface.TYPE_DECT = 3;
public final static int org.dvb.net.rc.RCInterface.TYPE_CATV = 4;
public final static int org.dvb.net.rc.RCInterface.TYPE_LMDS = 5;
public final static int org.dvb.net.rc.RCInterface.TYPE_MATV = 6;

public final static short org.dvb.si.DescriptorTag.NETWORK_NAME = 64;
public final static short org.dvb.si.DescriptorTag.SERVICE_LIST = 65;
public final static short org.dvb.si.DescriptorTag.STUFFING = 66;
public final static short org.dvb.si.DescriptorTag.SATELLITE_DELIVERY_SYSTEM = 67;
public final static short org.dvb.si.DescriptorTag.CABLE_DELIVERY_SYSTEM = 68;
public final static short org.dvb.si.DescriptorTag.BOUQUET_NAME = 71;
public final static short org.dvb.si.DescriptorTag.SERVICE = 72;
public final static short org.dvb.si.DescriptorTag.COUNTRY_AVAILABILITY = 73;
public final static short org.dvb.si.DescriptorTag.LINKAGE = 74;
public final static short org.dvb.si.DescriptorTag.NVOD_REFERENCE = 75;
public final static short org.dvb.si.DescriptorTag.TIME_SHIFTED_SERVICE = 76;
public final static short org.dvb.si.DescriptorTag.SHORT_EVENT = 77;
public final static short org.dvb.si.DescriptorTag.EXTENDED_EVENT = 78;
public final static short org.dvb.si.DescriptorTag.TIME_SHIFTED_EVENT = 79;
public final static short org.dvb.si.DescriptorTag.COMPONENT = 80;
public final static short org.dvb.si.DescriptorTag.MOSAIC = 81;
public final static short org.dvb.si.DescriptorTag.STREAM_IDENTIFIER = 82;
public final static short org.dvb.si.DescriptorTag.CA_IDENTIFIER = 83;
public final static short org.dvb.si.DescriptorTag.CONTENT = 84;
public final static short org.dvb.si.DescriptorTag.PARENTAL_RATING = 85;
public final static short org.dvb.si.DescriptorTag.TELETEXT = 86;
public final static short org.dvb.si.DescriptorTag.TELEPHONE = 87;
public final static short org.dvb.si.DescriptorTag.LOCAL_TIME_OFFSET = 88;
public final static short org.dvb.si.DescriptorTag.SUBTITLING = 89;
public final static short org.dvb.si.DescriptorTag.TERRESTRIAL_DELIVERY_SYSTEM = 90;
public final static short org.dvb.si.DescriptorTag.MULTILINGUAL_NETWORK_NAME = 91;
public final static short org.dvb.si.DescriptorTag.MULTILINGUAL_BOUQUET_NAME = 92;
public final static short org.dvb.si.DescriptorTag.MULTILINGUAL_SERVICE_NAME = 93;
public final static short org.dvb.si.DescriptorTag.MULTILINGUAL_COMPONENT = 94;
public final static short org.dvb.si.DescriptorTag.PRIVATE_DATA_SPECIFIER = 95;
public final static short org.dvb.si.DescriptorTag.SERVICE_MOVE = 96;
public final static short org.dvb.si.DescriptorTag.SHORT_SMOOTHING_BUFFER = 97;
public final static short org.dvb.si.DescriptorTag.FREQUENCY_LIST = 98;

```

```

public final static short org.dvb.si.DescriptorTag.PARTIAL_TRANSPORT_STREAM = 99;
public final static short org.dvb.si.DescriptorTag.DATA_BROADCAST = 100;
public final static byte org.dvb.si.PMTStreamType.MPEG1_VIDEO = 1;
public final static byte org.dvb.si.PMTStreamType.MPEG2_VIDEO = 2;
public final static byte org.dvb.si.PMTStreamType.MPEG1_AUDIO = 3;
public final static byte org.dvb.si.PMTStreamType.MPEG2_AUDIO = 4;
public final static short org.dvb.si.SIInformation.FROM_CACHE_ONLY = 0;
public final static short org.dvb.si.SIInformation.FROM_CACHE_OR_STREAM = 1;
public final static short org.dvb.si.SIInformation.FROM_STREAM_ONLY = 2;
public final static byte org.dvb.si.SIMonitoringType.NETWORK = 1;
public final static byte org.dvb.si.SIMonitoringType.BOUQUET = 2;
public final static byte org.dvb.si.SIMonitoringType.SERVICE = 3;
public final static byte org.dvb.si.SIMonitoringType.PMT_SERVICE = 4;
public final static byte org.dvb.si.SIMonitoringType.PRESENT_FOLLOWING_EVENT = 5;
public final static byte org.dvb.si.SIMonitoringType.SCHEDULED_EVENT = 6;
public final static byte org.dvb.si.SIRunningStatus.UNDEFINED = 0;
public final static byte org.dvb.si.SIRunningStatus.NOT_RUNNING = 1;
public final static byte org.dvb.si.SIRunningStatus.STARTS_IN_A_FEW_SECONDS = 2;
public final static byte org.dvb.si.SIRunningStatus.PAUSING = 3;
public final static byte org.dvb.si.SIRunningStatus.RUNNING = 4;
public final static short org.dvb.si.SIServiceType.UNKNOWN = -1;
public final static short org.dvb.si.SIServiceType.DIGITAL_TELEVISION = 1;
public final static short org.dvb.si.SIServiceType.DIGITAL_RADIO_SOUND = 2;
public final static short org.dvb.si.SIServiceType.TELETEXT = 3;
public final static short org.dvb.si.SIServiceType.NVOD_REFERENCE = 4;
public final static short org.dvb.si.SIServiceType.NVOD_TIME_SHIFTED = 5;
public final static short org.dvb.si.SIServiceType.MOSAIC = 6;
public final static short org.dvb.si.SIServiceType.PAL = 7;
public final static short org.dvb.si.SIServiceType.SECAM = 8;
public final static short org.dvb.si.SIServiceType.D_D2_MAC = 9;
public final static short org.dvb.si.SIServiceType.FM_RADIO = 10;
public final static short org.dvb.si.SIServiceType.NTSC = 11;
public final static short org.dvb.si.SIServiceType.DATA_BROADCAST = 12;
public final static short org.dvb.si.SIServiceType.MHP_APPLICATION = 16;

public final static int org.dvb.test.DVBTest.UNTESTED = -5;
public final static int org.dvb.test.DVBTest.UNRESOLVED = -4;
public final static int org.dvb.test.DVBTest.HUMAN_INTERVENTION = -3;
public final static int org.dvb.test.DVBTest.OPTION_UNSUPPORTED = -2;
public final static int org.dvb.test.DVBTest.FAIL = -1;
public final static int org.dvb.test.DVBTest.PASS = 0;

public final static int org.dvb.ui.DVBAlphaComposite.CLEAR = 1;
public final static int org.dvb.ui.DVBAlphaComposite.SRC = 2;
public final static int org.dvb.ui.DVBAlphaComposite.SRC_OVER = 3;
public final static int org.dvb.ui.DVBAlphaComposite.DST_OVER = 4;
public final static int org.dvb.ui.DVBAlphaComposite.SRC_IN = 5;
public final static int org.dvb.ui.DVBAlphaComposite.DST_IN = 6;
public final static int org.dvb.ui.DVBAlphaComposite.SRC_OUT = 7;
public final static int org.dvb.ui.DVBAlphaComposite.DST_OUT = 8;
public final static int org.dvb.ui.DVBBufferedImage.TYPE_ADVANCED = 20;
public final static int org.dvb.ui.DVBBufferedImage.TYPE_BASE = 21;
public final static int org.dvb.ui.DVBTextLayoutManager.HORIZONTAL_START_ALIGN = 1;
public final static int org.dvb.ui.DVBTextLayoutManager.HORIZONTAL_END_ALIGN = 2;
public final static int org.dvb.ui.DVBTextLayoutManager.HORIZONTAL_CENTER = 3;
public final static int org.dvb.ui.DVBTextLayoutManager.VERTICAL_START_ALIGN = 4;
public final static int org.dvb.ui.DVBTextLayoutManager.VERTICAL_END_ALIGN = 5;
public final static int org.dvb.ui.DVBTextLayoutManager.VERTICAL_CENTER = 6;
public final static int org.dvb.ui.DVBTextLayoutManager.LINE_ORIENTATION_HORIZONTAL = 10;
public final static int org.dvb.ui.DVBTextLayoutManager.LINE_ORIENTATION_VERTICAL = 11;
public final static int org.dvb.ui.DVBTextLayoutManager.START_CORNER_UPPER_LEFT = 20;
public final static int org.dvb.ui.DVBTextLayoutManager.START_CORNER_UPPER_RIGHT = 21;
public final static int org.dvb.ui.DVBTextLayoutManager.START_CORNER_LOWER_LEFT = 22;
public final static int org.dvb.ui.DVBTextLayoutManager.START_CORNER_LOWER_RIGHT = 23;

```


16.2.2 Public and Protected final static primitive fields from standard Java packages

These constants are recorded in the following documents:

- [JAE 1.1.8 const \[72\]](#)
- [JAE 1.2.2 const \[73\]](#)
- [JMF const \[74\]](#)

NOTE: The constants for [Java TV \[51\]](#) are within that specification. [JSSE \[60\]](#) introduces no constants.

Annex A (normative): External references; errata, clarifications and exemptions

This section lists known errata in normative external references, as well as clarifications to those references and/or exemptions from requirements in those specifications.

A.1 JAE 1.1.8 API [31]

A.1.1 `java.lang.ThreadGroup.getParent()`

This specification is considered to include:

This method may throw a security exception.

A.1.2 `java.net.URLConnection.setFileNameMap`

The method `java.net.URLConnection.setFileNameMap` is considered to specify:

If there is a security manager, its `checkSetFactory` method is called with no arguments. This may result in a security exception.

A.1.3 `java.util.Locale.setDefault`

This specification is considered to include:

This method may throw a security exception.

A.1.4 `java.lang.Class`

The following clarifications are considered to be part of this specification:

Reflective operations, such as `Class.forName(String)` shall cause class initialization of the given class, if the call succeeds and the class had not previously been initialized.

A.1.5 `java.awt.Font`

Where an MHP terminal does not have available a font matching the specification of the parameters passed to the constructor of the `java.awt.Font` class, the implementation shall silently approximate to a font which is available. No runtime error or exception shall be thrown by the constructor. The approximation shall not be visible to implementations through any of the methods on the returned instance of `java.awt.Font`.

A.2 Java Language Spec [32]

A.2.1 `java.lang.ThreadGroup.getParent()`

This method may throw a security exception.

A.2.2 `java.lang.Runtime.runFinalizersOnExit()`

This method may throw a `SecurityException`

A.2.3 `java.lang.System.runFinalizersOnExit()`

This method may throw a `SecurityException`

A.3 Java Media Player Specification [33]

A.3.1 javax.media.protocol.URLDataSource.sources

The `javax.media.protocol.URLDataSource.sources` field shall be considered not to be present. So, any reference to it will fail.

A.4 Java VM [34]

The following clarifications are considered to be part of this specification:

- As described in sections 12.1.2 and 12.3.1 of *Java Language Spec* [32], class file verification is mandatory for all implementations that conform to *Java VM* [34].
- Resolving a class causes its superinterfaces to be resolved.
- As specified in section 13.1 of *Java Language Spec* [32], the target of the `invokeinterface` instruction's method invocation must support the referenced interface. If it does not, an `IncompatibleClassChangeError` shall be raised when the `invokeinterface` instruction is executed.

NOTE: This is described on page 282 of *Java VM2* [F].

Additionally for MHP terminals:

- MHP terminals are exempt from implementing class finalization, as required by section 2.16.8 of *Java VM* [34].

NOTE: As noted in the appendix of *Java VM2* [F], class finalization has not been implemented, and it is not required in the 2nd edition of the VM specification.

A.5 Java TV [51]

The following is considered to be present:

All methods in *JavaTV* whose name is of the form `removeXXXXListener`, shall have no effect if the listener concerned is not registered.

A.5.1 javax.tv.service.selection

A.5.1.1 PresentationTerminatedEvent

The following specification additions are considered to be present:

When a call to `ServiceContext.select()` fails for a service context in the not presenting state, the following table defines how the reason code for the `PresentationTerminatedEvent` shall be derived from the reason code of the `SelectionFailedEvent` which first notified applications of the failure of the method call.

Table A.1 : Reason code mapping

SelectionFailedEvent reason code	PresentationTerminatedEvent reason code
CA_REFUSAL	ACCESS_WITHDRAWN
CONTENT_NOT_FOUND	SERVICE_VANISHED
INSUFFICIENT_RESOURCES	RESOURCES_REMOVED
MISSING_HANDLER	RESOURCES_REMOVED
TUNING_FAILURE	TUNED_AWAY

No equivalent of the reason code `SelectionFailedEvent.INTERRUPTED` shall be generated for service contexts formerly in the `not_presenting` state since by definition, another selection is in process on the service context concerned.

In the definition of the `USER_STOP` code, replace "The user" with "An application or the end user".

A.5.1.2 ServiceContext.select(Locator [])

- a) The following text shall be considered as being added to the end of the description of this method.

If the content corresponding to any of the locators specified can be successfully presented then the selection operation shall be considered to have succeeded even if attempts to present content corresponding to other locators failed. If different locators failed for different reasons then the reason code is implementation dependent.

- b) Replace the following text:

Successful completion of a select operation using this method provides `ServiceContentHandler` instances for all components that are indicated in the `components` parameter.

with

Successful completion of a selection operation using this method provides `ServiceContentHandlers` for those components indicated in the `components` parameter which were successfully presented.

A.5.2 javax.tv.util.TVTimer

A.5.2.1 scheduleTimerSpec(TVTimerSpec)

The following specification changes are considered to be present:

Replace:

If you schedule an absolute specification that should have gone off already, it will go off immediately.

With:

If you schedule an absolute specification that should have gone off already, it will go off immediately, and the return value of this method will be an absolute specification reflecting the current absolute time.

A.5.3 javax.tv.util.TVTimerSpec

A.5.3.1 setAbsoluteTime(long)

The following specification additions are considered to be present:

If the time parameter passed is negative, this method shall throw an `IllegalArgumentException`.

A.5.3.2 setTime(long)

The following specification additions are considered to be present:

If the time parameter passed is negative, this method shall throw an `IllegalArgumentException`.

A.5.4 javax.tv.xlet.Xlet

In the table of `xlet` state descriptions in the package description of the `javax.tv.xlet` package, the description of the loaded state is considered to be modified as follows.

Replace "created using new" with "created using `Class.newInstance`".

A.6 DAVIC 1.4.1p9 [3]

A.6.1 org.davic.mpeg.NotAuthorizedException

The specification is considered to include `org.davic.mpeg.NotAuthorizedException` as specified below:

org.davic.mpeg NotAuthorizedException

Syntax

```
public class NotAuthorizedException extends java.lang.Exception implements org.davic.mpeg.
    NotAuthorizedInterface
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--org.davic.mpeg.NotAuthorizedException
```

All Implemented Interfaces:

NotAuthorizedInterface, java.io.Serializable

Description

This class is thrown by MPEG related APIs when access is requested to information which is scrambled and to which access is not permitted by the security system.

Constructors

NotAuthorizedException()

```
public NotAuthorizedException()
```

Constructs a NotAuthorizedException with no detail message

NotAuthorizedException(String)

```
public NotAuthorizedException(java.lang.String s)
```

Constructs a NotAuthorizedException with the specified detail message

Parameters:

s - the detail message

Methods

getElementaryStreams()

```
public ElementaryStream[] getElementaryStreams()
```

If `getType()` returns `ELEMENTARY_STREAM`, then this method returns the set of ElementaryStreams that could not be descrambled. Otherwise it returns null.

Specified By:

`NotAuthorizedInterface.getElementaryStreams()` in interface `NotAuthorizedInterface`

Returns:

either the set of ElementaryStreams that could not be descrambled or null

getReason(int)

```
public int[] getReason(int index)
```

Returns the reason(s) why descrambling was not possible.

Specified By:

`NotAuthorizedInterface.getReason(int)` in interface `NotAuthorizedInterface`

Parameters:

`index` - If the component to which access failed is a Service, `index` shall be 0. Otherwise `index` shall refer to one stream in the set returned by `getElementaryStreams()`.

Returns:

an array of length 2 where the first element of the array is the major reason and the second element of the array is the minor reason.

Throws:

`IndexOutOfBoundsException` - If the component to which access failed is a Service, this exception will be thrown if `index` is non zero. If the component(s) to which access failed was a (set of) elementary streams then this exception will be thrown where `index` is beyond the size of the array returned by `getElementaryStreams`.

See Also:

`NotAuthorizedInterface.getElementaryStreams()`

getService()

```
public Service getService()
```

If `getType()` returns `SERVICE`, then this method returns the Service that could not be descrambled. Otherwise it returns null.

Specified By:

`NotAuthorizedInterface.getService()` in interface `NotAuthorizedInterface`

Returns:

either the Service that could not be descrambled or null

getType()

```
public int getType()
```

Specified By:

`NotAuthorizedInterface.getType()` in interface `NotAuthorizedInterface`

Returns:

`SERVICE` or `ELEMENTARY_STREAM` to indicate that either a service (MPEG program) or one or more elementary streams could not be descrambled.

A.6.2 org.davic.mpeg.dvb

A.6.2.1 DvbElementaryStream

The following classes are considered to have a no argument protected constructor:

- DvbService
- DvbElementaryStream
- DvbTransportStream
- ElementaryStream
- Service
- TransportStream

A.6.3 org.davic.mpeg.sections

A.6.3.1 RingSectionFilter

Is considered to have the following text appended to its description:

All sections in a ring section filter are initialised to empty when the ring section filter is first created. Clearing them to empty any time after this is the responsibility of the application. Starting a ring section filter shall not clear any of the sections to empty.

A.6.3.2 Section

A.6.3.2.1 clone()

Section is considered to have the method clone() with the following behaviour.

A cloned Section object is a new and separate object. It is unaffected by changes in the state of the original Section object or restarting of the SectionFilter the source Section object originated from. The clone method must be implemented without declaring exceptions.

A.6.3.2.2 Started Section Filters

The class description is considered to have the following text added at its end.

When a SectionFilterGroup is detached, either by the client or through resource withdrawal, started SectionFilters shall remain started. Hence if the SectionFilterGroup is re-attached, those filters shall re-activate.

A.6.3.2.3 getData()

Remove the following text from the methods of org.davic.mpeg.sections.Section:

(everything after the length field, not including a CRC check)

A.6.3.2.4 getFullStatus()

Is considered to have the following text appended to its description:

Returns true when the Section object contains valid data.

A.6.3.3 SectionFilter

A.6.3.3.1 Cross reference error

In the description of this class there are 12 instances of a cross reference to H7. In each case this shall be considered as a reference to E.8.1.

A.6.3.3.2 `startFiltering(java.lang.Object, int, int)`

Is considered to have the following text appended to its description:

Note that this applied whether the parent section filter group is connected to a TS or not.

A.6.3.3.3 `startFiltering(java.lang.Object, int, int, int, byte[], byte[])`

Is considered to have the following text appended to its description:

`IllegalFilterDefinitionException` is thrown if offset is too small.

A.6.3.3.4 `startFiltering (appData, pid, tableId) exceptions`

Like other `startFiltering` methods `org.davic.mpeg.sections.SectionFilter.startFiltering (appData, pid, tableId)` shall throw an `IllegalFilterDefinitionException` where:

- the Java integer is negative
- the Java integer is larger than what is allowed for PID or `table_id` according to the relevant MPEG specification

A.6.3.4 `SectionFilterGroup`

A.6.3.4.1 `NotAuthorizedException`

A `NotAuthorizedException` is added to the definition of this class.

A.6.3.4.2 `numberOfFilters`

Is considered to have the following text appended to its description:

Throws illegal argument exception if `numberOfFilters < 1`.

A.6.3.4.3 `sectionSize`

Is considered to have the following text appended to its description:

Throws illegal argument exception if `sectionSize < 1`.

A.6.3.4.4 `ringSize`

Is considered to have the following text appended to its description:

Throws illegal argument exception if `ringSize < 1`.

A.6.3.5 `TimeoutEvent`

The specification is considered to include `org.davic.mpeg.sections.TimeoutEvent` as specified below:

org.davic.mpeg.sections.TimeoutEvent

Methods

`getSource()`

```
public java.lang.Object getSource()
```

This returns the `SectionFilter` object which timed out

Overrides:

EndOfFilteringEvent.getSource() in class EndOfFilteringEvent

A.6.4 org.davic.media**A.6.4.1 FreezeControl.resume()**

Add the following to the description of the semantics for this method:

If the player is started and if decoding of the media stream is not frozen then calls to this method shall have no effect otherwise an exception is thrown.

A.6.4.2 MediaTimePositionChangedEvent

Add the following constructor:

```
MediaTimePositionChangedEvent (
    Controller from,
    int previous,
    int current,
    int target,
    Time mediaTime)
```

A.6.4.3 NotAuthorizedMediaException

The following constructors are considered to be removed from the specification:

```
NotAuthorizedMediaException()
NotAuthorizedMediaException(java.lang.String reason)
```

The following constructors are considered to be a normative part of the specification:

```
NotAuthorizedMediaException( org.davic.mpeg.Service, int reason )
NotAuthorizedMediaException( org.davic.mpeg.ElementaryStream[], int reason[] )
```

NotAuthorizedMediaException(ElementaryStream[], int[])

```
public NotAuthorizedMediaException(org.davic.mpeg.ElementaryStream[] e, int[] reason)
```

Constructor for exception due to failure accessing one or more MPEG elementary streams The caller of this constructor is responsible for ensuring the two arrays provided as parameters are the same size. The implementation is not expected to check this.

Parameters:

e - the elementary streams which could not be accessed

reason - the reason why the exception was thrown for each elementary stream

NotAuthorizedMediaException(Service, int)

```
public NotAuthorizedMediaException(org.davic.mpeg.Service s, int reason)
```

Constructor for exception due to failure accessing an MPEG service

Parameters:

s - the service which could not be accessed

reason - the reason why the service could not be accessed

A.6.5 org.davic.net

A.6.5.1 InvalidLocatorException

The following class definition is considered to be a normative part of the specification:

org.davic.net InvalidLocatorException

Syntax

```
public class InvalidLocatorException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
|
+--java.lang.Exception
|
+--org.davic.net.InvalidLocatorException
```

All Implemented Interfaces:

java.io.Serializable

Description

This exception is thrown when one or more parameters to construct a Locator are invalid.

Constructors

InvalidLocatorException()

```
public InvalidLocatorException()
```

InvalidLocatorException(String)

```
public InvalidLocatorException(java.lang.String reason)
```

Constructor for the exception with a specified reason

Parameters:

`reason` - the reason why the exception was raised

A.6.5.2 Locator

A.6.5.2.1 Locator()

The no-argument constructor for `org.davic.net.Locator` is considered to not be present. The absence of any description on the method indicates that this was an editing error in the DAVIC specification.

A.6.5.2.2 toExternalForm()

Is considered to have the following text appended to its description:

If the instance of `Locator` has been created using `Locator(java.lang.String url)` and the URL is a non-null invalid URL the behaviour is implementation dependent.

A.6.5.3 tuning

A.6.5.3.1 NetworkInterfaceController

A.6.5.3.1.1 reserve()

The semantic of the following throws clause is corrected as follows:

```
Throws: NoFreeInterfaceException
        raised if the requested network interface can not be reserved
```

The following from the semantic of this method:

If this NetworkInterfaceController has already reserved another NetworkInterface, then it will either release that NetworkInterface and reserve the specified one, or throw an exception. If the specified NetworkInterface has already been reserved by this NetworkInterfaceController, then this method does nothing.

is replaced with the following:

If this NetworkInterfaceController has currently reserved another NetworkInterface, then it will either release that NetworkInterface and reserve an appropriate one, or throw an exception. If a NetworkInterface that is able to tune to the specified transport stream is currently reserved by this NetworkInterfaceController, then this method does nothing.

A.6.5.3.1.2 reserveFor()

The following from the semantic of this method:

If this NetworkInterfaceController has already reserved another NetworkInterface, then it will either release that NetworkInterface and reserve an appropriate one, or throw an exception. If NetworkInterfaceController has already reserved a NetworkInterface that is able to tune to the specified transport stream, then this method does nothing.

is replaced with the following:

If this NetworkInterfaceController has currently reserved another NetworkInterface, then it will either release that NetworkInterface and reserve an appropriate one, or throw an exception. If a NetworkInterface that is able to tune to the specified transport stream is currently reserved by this NetworkInterfaceController, then this method does nothing.

A.6.5.3.1.3 tune()

Replace "this NetworkInterface" with "the NetworkInterface reserved by this NetworkInterfaceController" in section H.5.4.3 of DAVIC specification.

A.6.5.4 ca

A.6.5.4.1 CAMessage

The following class definition is considered to be a normative part of the specification:

This class represents messages to ca modules.

```
public class CAMessage( byte[] data)
```

Constructor for the message

Parameters:

data - message data

Method Detail

getData

```
public byte[] getData()
```

Returns:

the data of the message

A.6.5.4.2 CAModule

A.6.5.4.2.1 buyEntitlement(org.davic.net.Locator)

This method is considered to have the amendment.

Replace:

Initiates a purchase dialogue for specified service or future event (specified by a Locator).

With:

Request to buy a specified service or future event (specified by a Locator) from a conditional access system.

In the comments of `org.davic.net.ca.CAModule.buyEntitlement()` the sentence:

In case of CA0 this maps onto `event_query` with `event_cmd_id = mmi` (Common Interface specification, section B.4.1.1)."

is replaced with

In case of DVB Common Interface, this maps onto CI messages as follows:

- when the Locator points to a service and the terminal is currently receiving the transport stream that this service is carried in and this transport stream is available to this CA module, then this method is mapped to a `ca_pmt` message with `ca_pmt_cmd_id` set to "ok_mmi". The value returned in the `ca_pmt_reply` is mapped as defined in the documentation of the constants in the class. If the module is currently descrambling the service and the terminal is aware of this, `ENTITLEMENT_AVAILABLE` shall be returned immediately without communicating with the module.
- when the Locator points to a service that is not carried in a currently received transport stream, `NotTunedException` is thrown
- when the Locator points to an event, this maps onto `event_query` message with `event_cmd_id` set to "mmi" (Common Interface specification, section B.4.1.1). The value returned in the `event_reply` message is mapped as defined in the documentation of the constants in this class.

In the CA API, the constants defined in the `org.davic.net.ca.CAModule` class are mapped to the `CA_enable` values of the `ca_pmt_response` message and the `event_status` values of the `event_reply` message in the Common Interface protocol as follows:

`ENTITLEMENT_AVAILABLE`:

`CA_enable` value "Descrambling possible" (0x01)
`event_status` value "entitlement_available" (0x01)
`event_status` value "mmi_complete_available" (0x05)

`ENTITLEMENT_NOT_AVAILABLE`:

`CA_enable` value "Descrambling not possible (because no entitlement)" (0x04)
`event_status` value "entitlement_not_available" (0x02)
`event_status` value "mmi_complete_not_available" (0x06)

`ENTITLEMENT_UNKNOWN`:

`CA_enable` value "Descrambling not possible (for technical reasons)" (0x05)
 all other `CA_enable` values not having an explicit mapping in this section
`event_status` value "entitlement_unknown" (0x00)
`event_status` value "mmi_complete_unknown" (0x04)
 all other `event_status` values not having an explicit mapping in this section

`MMI_DIALOGUE_REQUIRED`:

CA_enable value "Descrambling possible under conditions (purchase dialogue)" (0x02)

CA_enable value "Descrambling possible under conditions (technical dialogue)" (0x03)

event_status value "mmi_dialogue_required" (0x03)

A.6.5.4.2.2 isDescramblable(ElementaryStream streams[])

Is considered to have the following text appended to its description:

If an empty array is passed in, returns true.

A.6.5.4.2.3 openMessageSession(MessageListener)

This method is considered to have the amendment:

Modify:

Throws: ModuleBusyException

raised if the module is busy and is not able to handle a message session at the moment

To say:

Throws: ModuleBusyException

raised if the module is busy and is not able to handle a message session at the moment. This is CA system dependant.

A.6.5.4.2.4 queryEntitlement(org.davic.net.Locator)

This method is considered to include the following:

Throws: org.davic.net.InvalidLocatorException

if the locator does not point to a valid service or event

In the comments of `org.davic.net.ca.CAModule.queryEntitlement()` the sentence:

In case of CA0 this maps onto event_query with event_cmd_id = query (Common Interface specification, section B.4.1.1)."

is replaced with

In case of DVB Common Interface, this maps onto CI messages as follows:

- when the Locator points to a service and the terminal is currently receiving the transport stream that this service is carried in and this transport stream is available to this CA module, then this method is mapped to a ca_pmt message with ca_pmt_cmd_id set to "query". The value returned in the ca_pmt_reply is mapped as defined in the documentation of the constants in the class. If the module is currently descrambling the service and the terminal is aware of this, ENTITLEMENT_AVAILABLE shall be returned immediately without communicating with the module.
- when the Locator points to a service that is not carried in a currently received transport stream, ENTITLEMENT_UNKNOWN shall be returned.
- when the Locator points to an event, this maps onto event_query with event_cmd_id = query (Common Interface specification, section B.4.1.1). The return values is mapped as defined in the documentation of the constants in this class.

A.6.5.4.2.5 sendToModule

The description of this method is considered to have the following text added to it.

In systems based on the DVB common interface, messages sent using this method shall be mapped onto the CAPipelineRequest as defined in section 6.8.3 of the common interface extensions specification. Responses from the CA system reported through the CAPipelineResponse and CAPipelineNotification messages shall be mapped onto instances of ModuleResponseEvent.

A.6.5.4.3 CAModuleManager

A.6.5.4.3.1 addMMIListener()

Is considered to have the following text appended to its description:

If an application has registered (and not removed) a listener to handle the MMI dialogues and if an MMI dialogue is required, this causes the platform to ask the MMI listener to handle the MMI dialogues. If there is no application registered to handle the MMI dialogues, these will be handled by the platform.

A.6.5.4.3.2 getModules(Service s)

Is considered to have the following text appended to its description:

If the service passed as a parameter is not scrambled, returns an empty array whose length is 0.

A.6.5.4.4 NoFreeCapacityException

The following class definition is considered to be a normative part of the specification:

org.davic.net.ca NoFreeCapacityException

Syntax

```
public class NoFreeCapacityException extends org.davic.net.ca.CAException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--org.davic.net.ca.CAException
            |
            +--org.davic.net.ca.NoFreeCapacityException
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

This exception is thrown when a method is called and the CA module does not have the required capacity to perform the action

Constructors

NoFreeCapacityException()

```
public NoFreeCapacityException()
```

Default constructor for the exception

NoFreeCapacityException(String)

```
public NoFreeCapacityException(java.lang.String reason)
```

Constructor for the exception with a specified reason

Parameters:

`reason` - the reason why the exception was raised

A.6.5.4.5 **MMIObject**

The following class definition is considered to be a normative part of the specification:

org.davic.net.ca MMIObject

Syntax

```
public class MMIObject
    java.lang.Object
    |
    +--org.davic.net.ca.MMIObject
```

Direct Known Subclasses:**List, Text****Description**

The base class of all MMI classes.

Methods**close()**

```
public void close()
```

Closes the MMI object and informs the CA API implementation that the application intends to close or has closed the corresponding MMI screen.

A.6.5.4.6 **DescramblerProxy**A.6.5.4.6.1 **startDescrambling()**

In the comments of `org.davic.net.ca.DescramblerProxy.startDescrambling()` (all signature versions) the sentence:

This method may start an MMI dialog.

is replaced with

This method may result in the CA system requesting an MMI dialog.

A.6.5.4.6.2 **startDescrambling(org.davic.mpeg.Service, java.lang.Object)**

Is considered to have the following text appended to its description:

DescramblerProxy applies from the point of view of one application. Methods such as `startDescrambling()` and `stopDescrambling` apply on a per-application basis and do not impact descrambling on behalf of other applications, except subject to platform resource limitations.

A.6.5.4.6.3 `startDescrambling(org.davic.mpeg.ElementaryStream[], java.lang.Object)`

Is considered to have the following text appended to its description:

If `org.davic.mpeg.ElementaryStream[]` is a zero length array the method has no effect.

A.6.5.4.6.4 `startDescrambling(org.davic.mpeg.ElementaryStream[], CAModule, java.lang.Object)`

Is considered to have the following text appended to its description:

If `org.davic.mpeg.ElementaryStream[]` is a zero length array the method has no effect.

A.6.5.4.6.5 `startDescramblingDialog(org.davic.mpeg.ElementaryStream[])`

Is considered to have the following text appended to its description:

If `org.davic.mpeg.ElementaryStream[]` is a zero length array the method has no effect.

A.6.5.4.6.6 `stopDescrambling()`

Is considered to have the following text appended to its description:

If no descrambling is being done then this method has no effect

A.6.5.4.6.7 `stopDescrambling(org.davic.mpeg.ElementaryStream[] streams)`

Is considered to have the following text appended to its description:

The method `stopDescrambling(ElementaryStream[])` only stops the descrambling of streams which have been started through this `DescramblerProxy` instance, and not started through any other instance.

Is considered to include the following parameter specification:

streams: array of `ElementaryStreams` whose descrambling is to be stopped.

Is considered to have the following text appended to its description:

The `stopDescrambling` method only effects members of the array of streams that are being descrambled. There is no effect on any streams listed in the array that are not being descrambled.

A.6.5.4.7 `StartMMIEvent(MMIObject, int, java.lang.Object)`

Is considered to include the following parameter specification:

caModule: the `CAModule` object that is the source of the event, which shall be returned by the `getSource()` method.

A.6.5.5 `dvb.DvbLocator(int onid, int tsid, int serviceid, int eventid, int componenttags[], String filePath).`

The following parameter specification:

the: file path string including the slash character in the beginning

is considered to read:

filePath: string including the slash character in the beginning

A.6.5.6 `dvb.DvbLocator`

The following method is considered to be present:

```
/** Returns the textual service identifier, if present.
```



```
* @return the textual service identifier, null if not present
* @since MHP1.0.1
*/
public String getTextualServiceIdentifier() ;
```

The returns clause of the `getOriginalNetworkId()` method is considered to include "-1 if not present" similarly as the other methods returning the numeric identifiers.

Annex B (normative): Object carousel

B.1 Introduction

The broadcast applications are transmitted using the DSM-CC User-to-User Object Carousels.

This specification is based on the following specifications:

- ISO/IEC 13818-1 [23] - MPEG 2 systems
- ISO/IEC 13818-6 [26] - DSM-CC
- EN 301 192 [5] - DVB specification for data broadcasting
- TR 101 202 [49] - Implementation Guidelines for Databroadcasting

With the constraints and extensions described here.

B.1.1 Key to notation

Certain notations are used in the "value" columns of the syntax tables:

Table B.1 : Key to notation

Symbol	
+	A value that is "allocated" e.g. configuration parameter of the object carousel server.
*	A value that is "calculated" e.g. a field whose value is calculated by the carousel server as a consequence of the number of bytes in other fields

B.2 Object Carousel Profile

In the following chapter, the message structures of the Object carousels are introduced with associated additional restrictions. Each section contains a table specifying the restrictions on the usage of the fields. The table also indicates the source for these restrictions: the DSM-CC standard, DVB guidelines or a specific restriction for this specification.

For the object carousel messages, also the message syntax is included. **In the syntax tables grey shading indicates parts that the broadcaster may put in, but an MHP terminal compliant with this specification may ignore.**

B.2.1 DSM-CC Sections

All object carousels messages are transmitted using DSM-CC section format. The DSM-CC Section format is defined in chapter 9.2 of the DSM-CC specification.

The DSM-CC standard provides an option to use either a CRC32 or a checksum for detecting bit errors. For this specification, we make the following restriction:

Table B.2 : Restrictions on DSM-CC Section format

Field	Restrictions	Source
section_syntax_indicator	1 (indicating the use of the CRC32)	This spec.
last_section_number	For sections transporting DownloadDataBlock fragments: - all modules intended to be retrieved shall have the last section number $\leq 0xFE$ - if last section number = $0xFF$ implementations conforming to this spec are allowed to abort the retrieval and report error condition	This spec.

The maximum section length is 4096 bytes for all types of sections used in Object Carousels. The section overhead is 12 bytes, leaving a maximum of 4084 bytes of payload per section.

B.2.1.1 Sections per TS packet

Any single TS packet is allowed to contain no more than the payload of two sections (i.e. the end of one section and the beginning of another).

B.2.2 Data Carousel

This section defines the content of the data carousel messages when used in the object carousel.

B.2.2.1 General

The definitions in [Table B.3](#) apply to both the `dsmccDownloadDataHeader` and the similar `dsmccMessageHeader`.

Table B.3 : Restrictions on DSM-CC DownloadData and Message headers

Field	Restrictions	Source
TransactionId	See "Assignment and use of transactionId values" on page 251	This spec.
AdaptationLength	The MHP terminal may ignore the possible contents of the <code>dsmccAdaptationHeader</code> field.	This spec.

B.2.2.2 DownloadInfoIndication

The `DownloadInfoIndication` is a message that describes a set of modules and gives the necessary parameters to locate the module and retrieve it.

Table B.4 : Restrictions on the DII

Field	Restrictions	Source
blockSize	maximum size 4066 (max. section payload - DDB-header size (18)) The recommended blockSize is 4066.	DSM-CC (This spec. rec.)
windowSize	0 (not used for Object Carousels)	DSM-CC
ackPeriod	0 (not used for Object Carousels)	DSM-CC
tCDownloadWindow	0 (not used for Object Carousels)	DSM-CC
tCDownloadScenario	0 (not used for Object Carousels)	DSM-CC
compatibilityDescriptor(): compatibilityDescriptorLength	0 (no compatibility descriptor for Object Carousels)	DSM-CC
PrivateDataLength	The MHP terminal may ignore the possible contents of the <code>privateData</code> field	DVB

B.2.2.3 DownloadServerInitiate

The `DownloadServerInitiate` is used in the case of object carousels to provide the object reference to the `ServiceGateway` (i.e. root directory) of the object carousel.

Table B.5 : Restrictions on DSI

Field	Restrictions	Source
compatibilityDescriptor(): compatibilityDescriptorLength	0 (no compatibility descriptor for Object Carousels)	DSM-CC
privateData	Contains the <code>ServiceGatewayInfo</code> structure	DSM-CC
serverId	Shall be set to 20 bytes each with the value of 0xFF	DVB / This spec.

B.2.2.4 ModuleInfo

The moduleInfo structure is placed in the moduleInfo field of the DownloadInfoIndication of the data carousel. It contains the information needed to locate the module.

Table B.6 : Restrictions on the DII moduleInfo field

Field	Restrictions	Source
BIOP::ModuleInfo::Taps	The first tap shall have the "use" value 0x0017 (BIOP_OBJECT_USE). The id and selector fields are not used and the MHP terminal may ignore them. The MHP terminal may ignore possible other taps in the list.	DVB
BIOP::ModuleInfo::UserInfo	The userInfo field contains a loop of descriptors. These are specified in the DVB Data Broadcasting standard and/or this specification. The MHP terminal shall support the compressed_module_descriptor (tag 0x09) used to signal that the module is transmitted in compressed form. The userInfo field may also contain a caching_priority_descriptor and one or more label_descriptors.	DVB / This spec.

Table B.7 : BIOP::ModuleInfo syntax

Syntax	bits	Type	Value	Comment
BIOP::ModuleInfo() { moduleTimeOut blockTimeOut minBlockTime taps_count { id use assocTag selector_length } for (j=1; j<N1; j++) { id use assocTag selector_length for (j=0; j<N2; j++) { selector_data } } userInfoLength for (k=0; k<N3; j++) { userInfo_data } }	32 32 32 8 16 16 16 8 16 16 16 8 8 8 8	uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf	+ + + N1 0x0000 0x0017 + 0x00 + + + N2 + N3 +	≥ 1 user private BIOP_OBJECT_USE Possible additional taps that may be ignored by MHP terminals.

B.2.2.4.1 Label descriptor

The label_descriptor may be placed in the userInfo field of the moduleInfo structure. It attaches a label to the corresponding module. Multiple labels can be attached to a module by including multiple label descriptors in the same userInfo field. Labels can be used for pre-fetching modules (see 10.8.3.2, "Pre-fetch descriptor" on page 90).

Within one object carousel, the same label may not be used in multiple DII messages. This implies that all modules that share a label are signalled in the same DII message.

Table B.8 : Label descriptor syntax

Syntax	bits	Type	Value	Comment
label_descriptor() { descriptor_tag descriptor_length for (n=0; n<N1; n++) { text_char } }	8 8 8	uimsbf uimsbf uimsbf	0x70 N1	The label

descriptor_tag: This 8 bit integer value with 0x70 identifies this descriptor.

text_char: The label that is attached to the module

B.2.2.4.2 Caching priority descriptor

To indicate priorities for the objects, a caching_priority_descriptor may be included in the userInfo field of the moduleInfo in the DownloadInfoIndication message.

This descriptor provides a priority value for the caching. The same priority applies for each object in the module. The priority indicated in the descriptor is only a hint to the MHP terminal and implementations may use that in combination with other caching strategies.

The descriptor includes also the transparency level (see section B.5.2, "Transparency levels of caching" on page 259) that shall be used by the terminal implementation if it caches objects in this module.

Table B.9 : Caching priority descriptor syntax

Syntax	bits	Type	Value	Comment
caching_priority_descriptor() { descriptor_tag descriptor_length priority_value transparency_level }	8 8 8 8	uimsbf uimsbf uimsbf uimsbf	0x71	

descriptor_tag: This 8 bit integer value with 0x71 identifies this descriptor.

priority_value: indicates the caching priority for the objects within this module. A higher value indicates more importance for caching.

transparency_level: Transparency level that shall be used by the MHP terminal if it caches objects contained in this module. The possible values are listed in table B.10. The semantics of the policies are defined in section B.5.2, "Transparency levels of caching" on page 259.

Table B.10 : Transparency level values

Value	Description
0	reserved
1	Transparent caching
2	Semi-transparent caching
3	Static caching.
4...255	reserved for future use

When this descriptor is not included in the userInfo field of the moduleInfo for a module, the default values that shall be assumed are:

- priority_value: 128
- transparency_level: 1 (transparent caching)

B.2.2.5 ServiceGatewayInfo

The ServiceGatewayInfo structure is carried in the DownloadServerInitiate message and provides the object reference to the ServiceGateway object.

Table B.11 : Restrictions on the ServiceGatewayInfo

Field	Restrictions	Source
BIOP:: ServiceGatewayInfo:: downloadTaps	The MHP terminal may ignore the downloadTap list.	This spec.
BIOP:: ServiceGatewayInfo:: serviceContextList	The MHP terminal may ignore the service context list.	This spec.
BIOP:: ServiceGatewayInfo:: UserInfo	The MHP terminal may ignore the user info.	This spec.

Table B.12 : ServiceGatewayInfo() syntax

Syntax	bits	Type	Value	Comment
ServiceGatewayInfo() { IOP::IOR() downloadTaps_count	8	uimsbf	+ N1	See Table B.21 on page 239 software download Taps
for (i=0; i<N1; i++) { DSM::Tap() } serviceContextList_count	8	uimsbf	N2	serviceContextList
for (i=0; i<N2; i++) { context_id	32	uimsbf	N3	
context_data_length	16	uimsbf		
for (j=0; j<N3; j++) { context_data_byte	8	uimsbf		
} userInfoLength	16	uimsbf	N5	user info
for (i=0; i<N5; i++) { userInfo_data	8	uimsbf	+	
} }				

B.2.2.6 Download Cancel

There is no semantic for this message in this profile. Receivers may ignore them.

B.2.3 The Object Carousel

B.2.3.1 BIOP Generic Object Message

The BIOP Generic Object Message is a common structure used by all the BIOP (Broadcast Inter-ORB Protocol) messages.

Table B.13 : Restrictions on the BIOP Generic Object Message

Field	Restrictions	Source
MessageHeader::byte_order	0 (indicating big-endian byte order)	DVB
MessageSubHeader::objectKey	Maximum length of the key shall be four bytes.	DVB
MessageSubHeader::objectKind	The short three-letter aliases shall be used, plus the null-terminator.	DVB
Access attributes	Access attributes are not transmitted in object carousels	DSM-CC

B.2.3.2 CORBA strings

In a number of places Object Carousel messages include text strings. These are formatted in accordance with 12.3.2 of [CORBA/IIOP \[2\]](#) and using CDR-Lite encoding as specified by DSM-CC. I.e. the text is preceded by an integer specifying the length of the string and followed by a null terminator. The size of this integer depends on the string concerned and can be seen clearly in the syntax tables that follow. However, for clarity CORBA format strings and the size of their length fields are summarised in table B.14:

Table B.14 : Location of CORBA format strings

string	length field size (bits)	location
objectKind_data	8	Table B.16, "BIOP::FileMessage syntax," on page 236
objectKind_data id_data kind_data	32 8 8	Table B.19, "BIOP::DirectoryMessage syntax," on page 237
objectKind_data	8	Table B.28, "BIOP::StreamMessage syntax," on page 243
objectKind_data eventName_data	32 8	Table B.30, "BIOP::StreamEventMessage syntax," on page 245
type_id_byte	32	Table B.21, "IOP::IOR syntax," on page 239
id_data kind_data	32 32	Table B.25, "Syntax of Lite Options Profile Body with ServiceLocation component.," on page 242

B.2.3.3 BIOP FileMessage

The BIOP FileMessage is used for carrying file objects.

Table B.15 : Restrictions on the BIOP File Message

Field	Restrictions	Source
MessageSubHeader::ObjectInfo	The first 8 bytes of the ObjectInfo contain the ContentSize attribute. This is optionally followed by a loop of descriptors. The descriptors defined for possible use in this location are: Content type descriptor	This spec.
MessageSubHeader::ServiceContextList	The MHP terminal may skip the possible serviceContextList structures.	This spec.

Table B.16 : BIOP::FileMessage syntax

Syntax	bits	Type	Value	Comment
BIOP::FileMessage() {				
magic	4x8	uimsbf	0x42494F50	"BIOP"
biop_version.major	8	uimsbf	0x01	BIOP major version 1
biop_version.minor	8	uimsbf	0x00	BIOP minor version 0
byte_order	8	uimsbf	0x00	Big endian byte ordering
message_type	8	uimsbf	0x00	
message_size	32	uimsbf	*	
objectKey_length	8	uimsbf	N1	<= 4
for (i=0; i<N1; i++) {				
objectKey_data	8	uimsbf	+	
}				
objectKind_length	32	uimsbf	0x00000004	
objectKind_data	4x8	uimsbf	0x66696C00	"fil" type_id alias
objectInfo_length	16	uimsbf	N2	
DSM::File::ContentSize	64	uimsbf	+	objectInfo
for (i=0; i<N2-8; i++) {				
descriptor()	8	uimsbf	+	
}				
serviceContextList_count	8	uimsbf	N3	serviceContextList
for (i=0; i<N3; i++) {				
context_id	32	uimsbf		
context_data_length	16	uimsbf	N4	
for (j=0; j<N4; j++) {				
context_data_byte	8	uimsbf	+	
}				
}				
messageBody_length	32	uimsbf	*	
content_length	32	uimsbf	N5	
for (i=0; i<N5; i++) {				
content_byte	8	uimsbf	+	actual file content
}				
}				

B.2.3.4 Content type descriptor

Zero or one content type descriptors can be carried in the file `MessageSubHeader::ObjectInfo` or the `BIOP::Binding::ObjectInfo`. Where more than one content type descriptor is used they shall express the same content format. Also, the content type (if any) signalled in the directory binding shall be identical to that signalled in the bound file's header. This optional descriptor identifies the media type of the file.

This content type signalling only applies to objects of type file and is not appropriate for other object types.

If this descriptor is absent or not sufficient to categorise the content type then the extension portion of the file name should be used to provide the media type mapping via table 4, "File type identification" on page 53.

The format of the content type descriptor is shown in table B.17.

Table B.17 : Content type descriptor syntax

Syntax	bits	Type	Value	Comment
content_type_descriptor() { descriptor_tag descriptor_length for (i=0; i<descriptor_length; i++) { content_type_data_byte } }	8 8 8	uimsbf uimsbf uimsbf	0x72	A MIME type

descriptor_tag: This 8-bit integer with value 0x72 identifies this descriptor.

descriptor_length: This 8-bit integer identifies the number of bytes following it.

content_type_data_byte: These bytes form a string that indicates the MIME content type of the object. The string is specified as follows:

```
content_type_data = type "/" subtype *(";" parameter)
```

Where *type*, *subtype* and *parameter* are as defined in section 5 of RFC 2045 [64] and hence *content_type_data* carries the payload of the Content-Type header defined in [64].

B.2.3.5 BIOP DirectoryMessage

The BIOP DirectoryMessage is used for carrying the directory objects.

Table B.18 : Restrictions on the BIOP Directory Message

Field	Restrictions	Source
MessageSubHeader:: ObjectInfo	The MHP terminal may skip the N2 possible bytes in the objectInfo field.	This spec.
MessageSubHeader:: ServiceContextList	The MHP terminal may skip the N3 possible serviceContextList structures.	This spec.
BIOP::Name	The name shall contain exactly one NameComponent.	This spec.
BIOP::Binding:: BindingType	Either "ncontext" (in the case of a Directory object) or "nobject" (in the case of a File or a Stream object). Binding type "composite" shall not be used.	DVB
BIOP::Binding:: ObjectInfo	After any DSM-CC defined elements the ObjectInfo for bound objects can carry an optional descriptor loop. Where the bound object is a file, DSM-CC requires the first element to be DSM::File::ContentSize after which the descriptors can be placed. The descriptors defined for possible use in this location are: Content type descriptor	This spec.

Table B.19 : BIOP::DirectoryMessage syntax (Sheet 1 of 3)

Syntax	bits	Type	Value	Comment
BIOP::DirectoryMessage() { magic biop_version.major biop_version.minor byte_order message_type message_size objectKey_length for (i=0; i<N1; i++) {	4x8 8 8 8 8 32 8	uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf uimsbf	0x42494F50 0x01 0x00 0x00 0x00 * N1	"BIOP" BIOP major version 1 BIOP minor version 0 big endian byte ordering ≤ 4

Table B.19 : BIOP::DirectoryMessage syntax (Sheet 2 of 3)

Syntax	bits	Type	Value	Comment
objectKey_data	8	uimsbf	+	
objectKind_length	32	uimsbf	0x00000004	
objectKind_data	4x8	uimsbf	0x64697200	"dir" type_id alias
objectInfo_length	16	uimsbf	N2 = 0 (note 1)	objectInfo
for (i=0; i<N2; i++) { objectInfo_data }	8	uimsbf	+	
serviceContextList_count	8	uimsbf	N3	serviceContextList
for (i=0; i<N3; i++) { context_id context_data_length for (j=0; j<N4; j++) { context_data_byte } }	32 16 8	uimsbf uimsbf uimsbf	N4 +	
messageBody_length	32	uimsbf	*	
bindings_count	16	uimsbf	N5	Binding
for (i=0; i<N5; i++) { BIOP::Name() { nameComponents_count	8	uimsbf	N6 = 1	See Table B.15.
for (i=0; i<N6; i++) { id_length	8	uimsbf	N7	NameComponent id
for (j=0; j<N7; j++) { id_data	8	uimsbf	+	
} kind_length	8	uimsbf	N8	NameComponent kind
for (j=0; j<N8; j++) { kind_data	8	uimsbf	+	as type_id (see Table 4-4 in TR 101 202)
} } }				
BindingType	8	uimsbf	+	0x01 for nobject 0x02 for ncontext
IOP::IOR()			+	objectRef see Table B.21 on page 239
objectInfo_length	16	uimsbf	N9	
if(kind_data == "fil"){ DSM::File::ContentSize	64	uimsbf	+	0 means that file size is not signalled
for (j=0; j<N9-8; j++) { descriptor()			+	
} } else { for (j=0; j<N9; j++) { descriptor()			+	
} } }				

Table B.19 : BIOP::DirectoryMessage syntax (Sheet 3 of 3)

Syntax	bits	Type	Value	Comment
}				
NOTE 1: See item 2 under 11.3.2.2 "Directory Message Format" in DSM-CC "the objectInfo field shall be empty".				

B.2.3.6 BIOP ServiceGateway message

The syntax of the BIOP ServiceGateway message is identical to that of the [BIOP DirectoryMessage](#) (described above) with the following exceptions:

- the object kind is "srg" rather than "dir".

B.2.3.7 BIOP Interoperable Object References

The Interoperable Object References (IOR) are references to objects and contain the necessary information to locate the object. The IOR structure may contain different options to be able to point to objects that can be reached via different types of connections. For this specification, the use of IORs is limited to references to objects carried in broadcast object carousels. For object carousels, there are two types of object references: one to be used to reference objects carried in the same object carousel and one to be used to reference objects in other object carousels.

Table B.20 : Restrictions on the BIOP IOR

Field	Restrictions	Source
IOP::IOR::type_id	Contains the objectKind of the referenced object. A short three-letter aliases shall be used, plus a null-terminator.	This spec.
IOP::IOR::taggedProfileList	There shall be at least 1 taggedProfile included in an IOR. For objects carried in a broadcast object carousel, the first taggedProfile shall be either a TAG_BIOP profile or a TAG_LITE_OPTIONS. If the first tagged profile is some other profile, the object is not carried in a broadcast object carousel and the MHP terminal may ignore the object subject to its own capabilities.	This spec.

Table B.21 : IOP::IOR syntax

Syntax	bits	Type	Value	Comment
IOP::IOR { type_id_length for (i=0; i<N1; i++) { type_id_byte } taggedProfiles_count IOP::taggedProfile() for (n=0; n<N2-1;n++) { IOP::taggedProfile() } }	32	uimsbf	N1	
	8	uimsbf	+	Short alias type_id (e.g. "dir")
	32	uimsbf	N2	Profile bodies For objects in broadcast carousels: either BIOPProfileBody or LiteOptionsProfileBody .
				MHP terminal may ignore other profiles (2...N1) if present

B.2.3.7.1 BIOPProfileBody

The BiopProfileBody is used for references to objects within the same object carousel.

Table B.22 : Restrictions on the BIOP Profile Body

Field	Restrictions	Source
BiopProfileBody::byte_order	0 (indicating big-endian byte order)	DVB
BiopProfileBody::LiteComponent	The list shall contain exactly 1 BiopObjectLocation and exactly 1 DSM::ConnBinder as the first two components in that order. The MHP terminal may ignore possible other components in the list.	This spec.
DSM::ConnBinder	For objects carried in the broadcast object carousel, the first Tap shall be of type BIOP_DELIVERY_PARA_USE. If there is another type of tap in the first position, the MHP terminal may ignore this object reference, as it is a reference for object accessed using another type of protocol (e.g. for return channel use). The MHP terminal may ignore possible other taps in the list.	This spec.
DSM::Tap	In the BIOP_DELIVER_PARA_USE tap, the id field is not used and may be ignored by the MHP terminal.	This spec.

Table B.23 : BIOP Profile Body syntax (Sheet 1 of 2)

Syntax	bits	Type	Value	Comment
BIOPProfileBody {				
profileId_tag	32	uimsbf	0x49534F06	TAG_BIOP (BIOP Profile Body)
profile_data_length	32	uimsbf	*	
profile_data_byte_order	8	uimsbf	0x00	big endian byte order
lite_component_count	8	uimsbf	N1	
BIOP::ObjectLocation {				
componentId_tag	32	uimsbf	0x49534F50	TAG_ObjectLocation
component_data_length	8	uimsbf	*	
carouselId	32	uimsbf	+	
moduleId	16	uimsbf	+	
version.major	8	uimsbf	0x01	BIOP protocol major version 1
version.minor	8	uimsbf	0x00	BIOP protocol minor version 0
objectKey_length	8	uimsbf	N2	<= 4
for (k=0; k<N2; k++) {				
objectKey_data	8	uimsbf	+	
}				
}				
DSM::ConnBinder {				
componentId_tag	32	uimsbf	0x49534F40	TAG_ConnBinder
component_data_length	8	uimsbf	N4	
taps_count	8	uimsbf	N3	
DSM::Tap {				
id	16	uimsbf	0x0000	user private

Table B.23 : BIOP Profile Body syntax (Sheet 2 of 2)

Syntax	bits	Type	Value	Comment
<pre> use </pre>	16	uimsbf	0x0016	<p>If BIOP_DELIVERY_PARA_USE is provided it shall be the first tap.</p> <p>If there is another type of tap in the first position, the MHP terminal may ignore this object reference, as it is a reference for an object accessed using another type of protocol (e.g. for return channel use).</p>
<pre> assocTag </pre>	16	uimsbf	+	
<pre> selector_length </pre>	8	uimsbf	0x0A	
<pre> selector_type </pre>	16	uimsbf	0x0001	
<pre> transactionId </pre>	32	uimsbf	*	
<pre> timeout } </pre>	32	uimsbf	*	
<pre> for (n=0; n<N4-18; n++) { additional_tap_byte } } for (n=0;n<N6;n++) { BIOP::LiteComponent{ componentId_tag component_data_length for (i=0; i<N7; i++) { component_data_byte } } } } </pre>	8	uimsbf		<p>The MHP terminal may skip over the possible additional taps</p> <p>N6=N1-2</p>
<pre> } </pre>				

B.2.3.7.2 LiteOptionsProfileBody

The LiteOptionsProfileBody is used for making links to objects carried in other object carousels. The LiteOptionsProfileBody can be used to make references to objects carried in other carousels within the same transport or in other transport streams. In the API, when the LiteOptionsProfileBody is encountered, the application will get a ServiceXFRErrorEvent or a ServiceXFRException. The other carousel is never mounted automatically by the implementation, but the application may do so using the API.

Table B.24 : Restrictions on the Lite Options Profile Body

Field	Restrictions	Source
LiteOptionsProfileBody::profile_data_byte_order	0 (indicating big-endian byte order)	DVB
LiteOptionsProfileBody::LiteOptionComponents	The list shall contain a ServiceLocation component as the first component. The MHP terminal may ignore possible other components in the list.	This spec.
DSM::ServiceLocation	For objects carried in the broadcast object carousel, the service domain NSAP address shall follow the Carousel NSAP address format.	This spec.
DSM::ServiceLocation::InitialContext	The MHP terminal may ignore the initial context	This spec.

Table B.25 : Syntax of Lite Options Profile Body with ServiceLocation component.

Syntax	bits	Type	Value	Comment
LiteOptionsProfileBody {				
profileId_tag	32	uimsbf	0x49534F05	TAG_LITE_OPTIONS (Lite Options Profile Body)
profile_data_length	32	uimsbf	*	
profile_data_byte_order	8	uimsbf	0x00	big endian byte order
lite_component_count	8	uimsbf	N1	
DSM::ServiceLocation {				
componentId_tag	32	uimsbf	0x49534F46	TAG_ServiceLocation
component_data_length	8	uimsbf	*	
serviceDomain_length	8	uimsbf	0x14	Length of carousel NSAP address
serviceDomain_data()	160	uimsbf	+	Table B.26 "DVB Carousel NSAP Address" pathName
CosNaming::Name() {				
nameComponents_count	32	uimsbf	N2	
for (i=0; i<N2; i++) {				
id_length	32	uimsbf	N3	NameComponent id
for (j=0; j<N3 j++) {				
id_data	8	uimsbf	+	
}				
kind_length	32	uimsbf	N4	NameComponent kind
for (j=0; j<N4 j++) {				
kind_data	8	uimsbf	+	as type_id (see Table 4-4 in TR 101 202)
}				
}				
initialContext_length	32	uimsbf	N5	
for (n=0; n<N5 n++) {				
InitialContext_data_byte	8	uimsbf		
}				
for (n=0;n<N6;n++) {				N6=N1-1
BIOP::LiteComponent{				
componentId_tag	32	uimsbf	+	
component_data_length	8	uimsbf	N7	
for (i=0; i<N7; i++) {				
component_data_byte	8	uimsbf		
}				
}				
}				
}				

Table B.26 : DVB Carousel NSAP Address (Sheet 1 of 2)

Syntax	bits	Type	Value	Comment
DVBcarouselNSAPaddress {				
AFI	8	uimsbf	0x00	NSAP for private use
Type	8	uimsbf	0x00	Object carousel NSAP Address.

Table B.26 : DVB Carousel NSAP Address (Sheet 2 of 2)

Syntax	bits	Type	Value	Comment
carouselId	32	uimsbf	+	To resolve this reference a carousel_id_descriptor with the same carousel_id as indicated in this field must be present in the PMT signalling for the service identified below.
specifierType	8	uimsbf	0x01	IEEE OUI
specifierData { IEEE OUI }	24	uimsbf	0x00015A	Constant for DVB OUI
dvb_service_location () { transport_stream_id	16	uimsbf	+	This may be set to 0x0000 which indicates that the MHP terminal shall not use the transport_stream_id when locating the service. For any other value then this field shall be used.
original_network_id	16	uimsbf	+	(= MPEG-2 program_number)
service_id	16	uimsbf	+	
reserved	32	bslbf	0xFFFFFFFF	
}				

B.2.3.8 BIOP StreamMessage

Table B.27 : Restrictions on the BIOP Stream Message

Field	Restrictions	Source
MessageSubHeader:: ObjectInfo	The ObjectInfo field contains the DSM::Stream::Info_T structure and optionally other data after the Stream Info structure. MHP terminals may ignore the DSM::Stream::Info_T structure and the possible other object info data following it. Broadcasts may set the duration field to zero to indicate undefined duration.	This spec.
MessageSubHeader:: ServiceContextList	The MHP terminal may skip the possible serviceContextList structures.	This spec.
MessageSubHeader:: MessageBody	The MessageBody carries a sequence of taps. There shall be at most one tap of use BIOP_PROGRAM_USE. This tap identifies the service that provides the media stream associated with the Stream object (via a deferred_association_tags_descriptor in the PMT). The tap may only reference programs that are broadcast on the same multiplex (i.e. MHP terminals shall not need to tune to a different multiplex in order to receive the referenced media stream). There shall also be at most one tap with use STR_NPT_USE, which MHP terminals shall interpret as described in ISO/IEC 13818-6 [26] . MHP terminals may ignore possible other Taps (such as BIOP_ES_USE).	This spec.

Table B.28 : BIOP::StreamMessage syntax (Sheet 1 of 2)

Syntax	bits	Type	Value	Comment
BIOP::StreamMessage() {				
magic	4x8	uimsbf	0x42494F50	"BIOP"
biop_version.major	8	uimsbf	0x01	BIOP major version 1
biop_version.minor	8	uimsbf	0x00	BIOP minor version 0
byte_order	8	uimsbf	0x00	big endian byte ordering
message_type	8	uimsbf	0x00	
message_size	32	uimsbf	*	
objectKey_length	8	uimsbf	N1	<= 4
for (i=0; i<N1; i++) {				
objectKey_data	8	uimsbf	+	

B.2.3.9 BIOP StreamEventMessage

Table B.29 : Restrictions on the BIOP StreamEvent Message

Field	Restrictions	Source
MessageSubHeader::ObjectInfo	The ObjectInfo field contains the DSM::Stream::Info_T and DSM::Stream::EventList_T structures followed optionally by other object info data (which may be ignored by MHP terminals). See Table B.27 on page 243 regarding the DSM::Stream::Info_T. MHP terminals may ignore the possible other data following the DSM::Stream::EventList_T. The EventList_T defines a sequence of event names that correlates to the sequence of event ids in the MessageBody. eventNames_count shall equal eventIds_count.	This spec.
MessageSubHeader::ServiceContextList	The MHP terminal may skip the possible serviceContextList structures.	This spec.
MessageSubHeader::MessageBody	The MessageBody carries a sequence of taps followed by a sequence of event ids. The sequence of taps follows the following rules: <ul style="list-style-type: none"> • There shall be at most one tap of use BIOP_PROGRAM_USE. This tap identifies the service that provides the media stream associated with the Stream object (via a deferred_association_tags_descriptor in the PMT). The tap may only reference programs that are broadcast on the same multiplex (i.e. MHP terminals shall not need to tune to a different multiplex in order to receive the referenced media stream). • There shall be at most one tap with use STR_NPT_USE, which MHP terminals shall interpret as described in ISO/IEC 13818-6 [26]. • There shall be at most one tap with use STR_EVENT_USE or STR_STATUS_AND_EVENT_USE. This tap indicates the PID where all StreamEvent descriptors related to the StreamEvent object are broadcast. MHP terminals may ignore possible other Taps (such as BIOP_ES_USE). 	This spec.

Table B.30 : BIOP::StreamEventMessage syntax (Sheet 1 of 2)

Syntax	bits	Type	Value	Comment
BIOP::StreamEventMessage() {				
magic	4x8	uimsbf	0x42494F50	"BIOP"
biop_version.major	8	uimsbf	0x01	BIOP major version 1
biop_version.minor	8	uimsbf	0x00	BIOP minor version 0
byte_order	8	uimsbf	0x00	big endian byte ordering
message_type	8	uimsbf	0x00	
message_size	32	uimsbf	*	
objectKey_length	8	uimsbf	N1	
for (i=0; i<N1; i++) {				
objectKey_data	8	uimsbf	+	
}				
objectKind_length	32	uimsbf	0x00000004	
objectKind_data	4x8	uimsbf	0x73746500	"ste" type_id alias
objectInfo_length	16	uimsbf	N2	
DSM::Stream::Info_T {				
aDescription_length	8	uimsbf	N3	aDescription
for (i=0; i<N3; i++) {				
aDescription_bytes	8	uimsbf	+	see BIOP StreamMessage
}				
duration.aSeconds	32	simsbf	+	see BIOP StreamMessage
duration.aMicroSeconds	32	uimsbf	+	see BIOP StreamMessage
audio	8	uimsbf	+	see BIOP StreamMessage
video	8	uimsbf	+	see BIOP StreamMessage

Table B.30 : BIOP::StreamEventMessage syntax (Sheet 2 of 2)

Syntax	bits	Type	Value	Comment
data }	8	uimsbf	+	see BIOP StreamMessage
DSM::Event::EventList_T { eventNames_count	16	uimsbf	N4	(including zero terminator)
for (i=0; i<N4; i++) { eventName_length	8	uimsbf	N5	
for (j=0; j<N5; j++) { eventName_data	8	uimsbf	+	
} } }				
for (i=0; i<N2-(N3+10); i++) { objectInfo_byte	8	uimsbf	+	
} serviceContextList_count	8	uimsbf	N6	
for (i=0; i<N6; i++) { context_id	32	uimsbf	N7	
context_data_length	16	uimsbf		
for (j=0; j<N7; j++) { context_data_byte	8	uimsbf		
} } }				
messageBody_length	32	uimsbf	*	see B.2.4.4 "Timebases" see Table 4-12 in DVB Guidelines for Data Broadcasting no selector (= eventNames_count)
taps_count	8	uimsbf	N8	
for (i=0; i<N8; i++) { id	16	uimsbf	(note 1)	
use	16	uimsbf	+	
} assocTag	16	uimsbf	+	
selector_length	8	uimsbf	0x00	
} eventIds_count	8	uimsbf	N4	
for (i=0; i<N4; i++) { eventId	16	uimsbf	+	
} } }				
NOTE 1: If the tap use is STR_NPT_USE then the value of this 16 bit integer corresponds to the value of the contentId field of the NPTReferenceDescriptor that defines the time base for this stream. For other values of tap use the value of this field is undefined.				

B.2.4 Stream Events

There are two versions of stream messages. The BIOP StreamMessage is used for carrying the stream objects that don't use DSM-CC Stream events. The BIOP StreamEventMessage is used for carrying stream objects that include a stream carrying the DSM-CC Stream events. This section addresses the later.

B.2.4.1 Stream & StreamEvent messages

B.2.4.1.1 Association with time bases

The id field of the STR_NPT_USE tap of a StreamMessage or StreamEventMessage identifies the timebase associated with that Stream/StreamEvent object. Multiple StreamMessage or StreamEventMessage may be used at the same time to allow subscriptions to multiple timebases of the same service. See B.2.4.4, "Timebases" on page 249.

B.2.4.1.2 Event names and event ids

In StreamEventMessages the EventList_T defines a sequence of event names that correlates 1:1 to the sequence of event ids in the MessageBody. Within each BIOP::StreamEventMessage the event names uniquely associate to event id values.

- The eventNames_count shall equal eventIds_count.
- The names in the EventList_T are zero-terminated strings.
- The eventID values in the StreamEventMessage correspond to the eventID values carried in StreamEventDescriptors.

B.2.4.1.3 Stream event life time

In StreamEventMessages the set of events described in the BIOP::StreamEvent message is possibly a subset of the events that may be used by the application during the course of a programme. Therefore, applications may need to accommodate the dynamic change of such messages. Cache transparency (see section B.5.2.1, "Transparent caching" on page 259) and version listener mechanisms (see DSMCCObject methods in annex P, "(normative): Broadcast Transport Protocol Access" on page 463) provide applications with the means to do this.

Similarly the set of stream event descriptors being transmitted at any time may not correspond to the set of events described in the BIOP::StreamEventMessage.

The event id for an event name shall not change while the name exists. If a name is removed it shall not be reintroduced with within 60 seconds.

B.2.4.2 Stream Descriptors

B.2.4.2.1 NPT Reference descriptor

B.2.4.2.1.1 Usage scenarios

The following 3 usage scenarios are envisaged for NPT:

- No NPT for associated with a service
Enables use of "do it now" events but not scheduled events
- A single continuous timebase (i.e. a single progressing value of NPT)
In this case all types of stream event can be used. However, the broadcast is logically a single continuing interactive production and the broadcaster is responsible for preprocessing the applications etc. before broadcast to be suitable
- The signal received by the MHP terminal includes a unique timebase for each programme needing one. This timebase to be suspended during any insertion into that programme and this timebase to be discontinued at the end of the programme.

i.e. the timebase for each programme is preserved through the distribution network.

B.2.4.2.1.2 Syntax

MHP terminals shall interpret this descriptor as it is described in ISO/IEC 13818-6 [26] with the following clarifications and additions.

With regard to contentId:

- This 7 bit field identifies the "timebase" see B.2.4.4, "Timebases" on page 249.

With regard to scaleNumerator and scaleDenominator:

- 1/1 - means normal play.
i.e. NPT and STC advance at the same rate.
- 0/m (m > 0) - means the NPT value does not advance.

As a consequence no scheduled stream events will be raised. However, the "do it now" events continue to be effective.

- 0/0 - means that the scaleNumerator and scaleDenominator fields are not defined in the NPT Reference descriptor and should be derived as described in [ISO/IEC 13818-6 \[26\]](#) "8.1.2 Reconstruction of NPT"

MHP terminals are not required to support this mode of operation.

- m/0 ($m > 0$) - this is not allowed by [ISO/IEC 13818-6 \[26\]](#).

With regard to broadcast repetition rate:

- NPT Reference descriptors shall be transmitted at least once per second.

B.2.4.2.2 Stream event descriptor

B.2.4.2.2.1 Association of event ids to event time

The eventNPT field conveys the NPT value at which the event will occur (or has occurred).

Each StreamEventDescriptor provides a single association between an eventID and a value of eventNPT. If the MHP terminal detects a change in the value of eventNPT associated with a value of eventID this redefines the time at which the event should fire.

MHP terminals shall ignore scheduled events where the eventNPT has passed.

See also "number range for NPT" on page 248 and "Signalling of "do it now events"" on page 248.

B.2.4.2.2.2 Re-use of event ids

Event ID values may be re-used any number of times. For example, after an event has fired then stream event descriptors with the same eventID but different eventNPT may be broadcast.

B.2.4.2.2.3 Signalling of "do it now events"

[ISO/IEC 13818-6 \[26\]](#) is silent on the broadcast signalling of "do it now" events.

These events shall be identified by the value of eventID and hence table id extension (see "Encoding of table id extension" on page 249).

Where the value of eventID identifies a "do it now" event then the value of eventNPT shall be ignored by the MHP terminal.

B.2.4.2.2.4 Private data

The privateDataByte field does not need to be interpreted by the MHP terminal.

- NOTE: that an application can access the privateDataByte field via [11.4.2.5, "Extensions to the Framework" on page 108](#) and [11.5.1, "Broadcast Transport Protocol Access API" on page 112](#)

B.2.4.2.3 Unused descriptors

MHP terminals may ignore the following descriptors if present:

- NPT Endpoint descriptor
- Stream Mode descriptor

B.2.4.2.4 Clarification of number encoding

B.2.4.2.4.1 number range for NPT

There is some ambiguity in [ISO/IEC 13818-6 \[26\]](#) regarding the data type used to carry NPT values in the signalling (tcimsbf or uimsbf). The following requirements insulate this profile from this ambiguity:

- The range of values used shall be in the range 0 to 0x0FFFFFFF (which is unambiguous for both tcimsbf or uimsbf).

B.2.4.2.4.2 number range for scaleDenominator

There is some ambiguity in ISO/IEC 13818-6 [26] regarding the data type used to carry `scaleDenominator` values in the signalling (`tcimsbf` or `uimsbf`). The following requirements insulate this profile from this ambiguity:

- The range of values used shall be in the range 0 to 0x7FFF (which is unambiguous for both `tcimsbf` or `uimsbf`).

B.2.4.3 DSM-CC Sections carrying Stream Descriptors

B.2.4.3.1 Section version number

The section version number field increments to reflect changes in stream descriptor(s) carried by sections with the same value of `table_id` (0x3D) and `table_id_extension`.

The version number shall increment for reasons including the change in value of `eventNPT` for a given `eventId`.

B.2.4.3.2 Single firing of "do it now" events

MHP terminals shall respond at most one time to a "do it now" events delivered under a single table version.

B.2.4.3.3 Section number

For this specification MHP terminals shall only consider section number zero.

B.2.4.3.4 DSM-CC sections for `DSMCC_descriptor_list()`

If the `table_id` field equals 0x3D the `current_next_indicator` bit shall be set to "1".

B.2.4.3.5 Encoding of table id extension

The section's table id extension field provides information on the stream descriptor(s) carried by the section:

Table B.31 : Encoding of table id extension for `DSMCC_descriptor_lists`

table_id_extension bits			Payload of DSM-CC section with table ID 0x3D
[15]	[14]	[13...0]	
0	0	eventID[13...0]	Section carries a single "do it now" event
0	1	xx xxxx xxxx	Section carries a single NPT reference descriptor
1	0	xx xxxx xxxx	Section carries one or more other stream descriptors. I.e - Stream event descriptor(s) with a future eventNPTs - Stream mode descriptor (can be ignored in this profile) - NPT endpoint descriptor (can be ignored in this specification)
1	1	reserved for future use	

The value of `eventID` for "do it now" events shall be in the range 0x0001...0x3FFF. The value of `eventID` for scheduled events shall be in the range 0x8000...0xBFFF. The value 0 is not allowed (see 5.5.2.2.1 in ISO/IEC 13818-6 [26]).

B.2.4.4 Timebases

Multiple concurrent timebases may be defined for a single MPEG program but only a single time base is allowed to progress at any instant (the other timebases shall be paused). The relationship between each timebase and the MPEG timebase (STC) is defined by an `NPTReferenceDescriptor`. The `contentId` field of the `NPTReferenceDescriptor` (a 7 bit unsigned integer) identifies the timebase.

The value of the `id` field of the `STR_NPT_USE` tap (a 16 bit unsigned integer) of a `StreamMessage` or `StreamEventMessage` identifies the timebase associated with that `Stream/StreamEvent` object. Multiple `StreamMessage` or `StreamEventMessage` may be used at the same time to allow subscriptions to multiple timebases of the same service.

In this profile `NPTReferenceDescriptors` can indicate two states:

- non-paused

The scaleNumerator and scaleDenominator are both non-zero

- paused

The scaleNumerator is zero and the scaleDenominator is non-zero

When a timebase is signalled as paused then the NPT value for that timebase is frozen at NPT_Reference (as specified by equation 8-4 in DSM-CC).

All of the NPTReferenceDescriptors for all of the timebases shall be carried in a single DSMCC_descriptor_list section and shall be transmitted at least once every second. In any such set of NPTReferenceDescriptors at most one shall be non-paused and there shall be at most one instance of each value of contentId.

Timebases can be added or subtracted from the current set. The set of current timebases can be empty.

A stream (i.e. a StreamMessage or StreamEventMessage) may have no associated timebase (i.e. it may have no tap with use STR_NPT_USE). This is valid in the following cases:

- only "do it now" events are used
- no stream events are used

A value of contentId shall not be reused for a new timebase within 60 seconds of the removal of the timebase.

In normal use the NPT of a non-paused timebase progresses at a constant rate. Discontinuities should either be the results of errors in the broadcast or transient conditions (for example, while an NPT reference generator catches up with an MPEG PCR discontinuity). Transient discontinuities should be tolerated by the MHP Terminal. The behaviour of the MHP terminal when subject to a permanent discontinuity is not specified.

The broadcaster shall start generating corrected NPTReferenceDescriptors within at most 1 second of a PCR discontinuity (ideally the descriptors should be generated before the PCR discontinuity). If the receiver is sampling the NPTReferenceDescriptor at the lowest allowed rate (once every 5 seconds) then the receiver may not receive a correct NPTReferenceDescriptor for 5 seconds. During this period the receiver should linearly extrapolate the NPT from previous NPT values in the expectation that a corrected NPTReferenceDescriptor will be delivered shortly.

There is a window of uncertainty around a segment of paused timebase due to the time taken for all receivers to acquire the new NPTReferenceDescriptor. During this window scheduled events cannot be used reliably.

NOTE: It is suggested that broadcasters use "do it now" events near junctions between different timebases.

B.2.4.5 Monitoring stream events

B.2.4.5.1 NPT reference monitoring

When supporting timebase stimulated events the MHP terminal shall allocate resources sufficient to ensure that updates to the set of timebases is detected within 5 seconds for conformant broadcasts.

B.2.4.5.2 Timebase stimulated event monitoring

When supporting timebase stimulated events the MHP terminal shall allocate resources sufficient to ensure that updates to the set of timebase stimulated events is detected within 5 seconds for conformant broadcasts. So, if an event is introduced or the NPT time at which it is specified to fire is changed then the MHP terminal will respect this change within 5 seconds. If the fire time for an event changes less than 5 seconds before it was previously scheduled to fire then there is no guarantee that all receivers will detect the change in time.

If a timebase is deleted (reference to it is removed from the set of NPTReferenceDescriptors) then the receiver shall deactivate any event listeners dependant on that timebase and may free resources associated with those listeners.

B.2.4.5.3 "do it now" events

"do it now" events are single shot events, accordingly MHP terminals need to make special efforts to ensure a high probability that they can be reliably received.

Broadcasters are responsible for placing all "do it now" stream descriptors that may be of interest to an application on a single PID. This may be the same PID as is used for other DSM-CC sections.

MHP terminals shall dedicate a section filter to monitoring the possible transmission of "do it now" events while there are any applications subscribed to these events.

B.2.4.5.4 scheduled events

The stream descriptors for scheduled events are transmitted several times in the period before the time that they should fire. This allows a high probability that they will be effective even if they are not monitored continuously by the MHP terminal.

Any scheduled stream event descriptors shall be transmitted at least once each second.

MHP terminals shall raise an event in response to a scheduled stream event provided that the stream event descriptors are broadcast for at least 5 seconds before the scheduled time.

B.2.4.5.5 number of NPT components

The MHP terminal is only required to monitor a single NPT component. So, if events from more than one DSM-CC StreamEventMessages are subscribed to no more than one stream component shall be specified as the source of NPTReferenceDescriptors (i.e. the taps with use STR_NPT_USE shall be the same).

B.2.5 Assignment and use of transactionId values

The use of the transactionId in the object carousel is inherited from its use as defined by the DSM-CC specification, and as such it can appear somewhat complex. The transactionId has a dual role, providing both identification and versioning mechanisms for control messages, i.e. DownloadInfoIndication and DownloadServerInitiate messages. The transactionId should uniquely identify a download control message within a data carousel, however it should be "incremented" whenever any field of the message is modified.

Note: The term "incremented" is used in the DSM-CC specification. Within the scope of this specification this should be interpreted as "changed".

The object carousel is carried on top of one or more data carousels. By a data carousel used below the object carousel, we mean in this specification a set of DownloadInfoIndication message transmitted on a single PID and the DownloadDataBlock messages carrying the modules described in the DownloadInfoIndication messages. The DownloadDataBlock messages may be spread on other elementary streams than the DownloadInfoIndication messages. The DownloadServerInitiate message in the context of object carousels is considered to be part of the top level of the object carousel and not associated with any data carousel.

When a module is changed, the version number of the module needs to be changed. This implies that the DownloadInfoIndication message that references the module needs to be also updated. Since the DownloadInfoIndication is updated, the transactionId needs to be also changed. However, the transactionId of the DownloadInfoIndication message is used in other messages also, but the need to change the other messages should specifically be avoided and the implications of updating a module should be limited to the module itself and the DownloadInfoIndication that references the module. Therefore, additional rules on the usage of the transactionId have been specified as follows.

The transactionId has been split up into a number of sub-fields defined in Table B.32. This reflects the dual role of the transactionId (outlined above) and constraints imposed to reduce the effects of updating a module. However, to increase interoperability the assignment of the transactionId has been designed to be independent of the expected filtering in target MHP terminals.

Table B.32 : Sub-fields of the transactionId (Sheet 1 of 2)

Bits	Value	Sub-field	Description
0	User-defined	Updated flag	This must be toggled every time the control message is updated
1-15	User-defined	Identification	This must and can only be all zeros for the DownloadServerInitiate message. All other control messages must have one or more non-zero bit(s).

Table B.32 : Sub-fields of the transactionId (Sheet 2 of 2)

Bits	Value	Sub-field	Description
16-29	User-defined	Version	This must be incremented/changed every time the control message is updated.
30-31	Bit 30 - zero Bit 31 - non-zero	Originator	This is defined in the DSM-CC specification [26] as 0x02 if the transactionId has been assigned by the network - in a broadcast scenario this is implicit.

Due to the role of the transactionId as a versioning mechanism, any change to a control message will cause the transactionId of that control message to be incremented. Any change to a Module will necessitate incrementing its moduleVersion field. This change must be reflected in the corresponding field in the description of the Module in the DownloadInfoIndication message(s) that describes it. Since a field in the DownloadInfoIndication message is changed its transactionId must be incremented to indicate a new version of the message. Also, any change in the DownloadServerInitiate message implies that its transactionId must also be incremented. However, when the transactionId is divided into subfields as specified above, updating a message will change only the Version part of the transactionId while the Identification part remains the same.

Since the transactionId is used also for identifying the messages when referencing the messages in other structures, it is very desirable that these referenced would not need to be updated every time the control message is update. Therefore the following rule shall be applied when locating the messages based on the references:

When locating a message based on the transactionId value used for referencing the message, only the Identification part (bits 1...15) shall be matched.

Using this rule, the implications of updating a module can be limited to the module itself and the DownloadInfoIndication message describing the module. Also, this implies that if an MHP terminal wants to find out if a particular module that it has retrieved earlier has changed, it needs to filter the DownloadInfoIndication message that described that module and check if it has been changed.

B.2.6 Mapping of objects to data carousel modules

The DSM-CC Object Carousels allow one or more objects to be carried in one module of the data carousel. In order to optimize the performance and memory requirements three additional requirements are specified:

- When mapping objects to modules of a data carousel, only closely related objects should be put into one module. Objects that are not closely related should not be put into the same module. If in the process of retrieving an object from the carousel an MHP terminal acquires a module containing multiple objects, it should attempt to cache these since the expectation should be that the other objects are related to the object requested and probably will be needed soon.
- The size of a module that contains multiple objects should not exceed 65536 bytes when decompressed¹. MHP terminals complying to this specification are only required to handle modules containing multiple objects where the module size when decompressed is 65536 bytes or less. Modules containing a single file message can exceed 65536 bytes with upper size only limited by the memory resources in the MHP terminal.
- In addition to the limitations imposed by the 65536 byte limit, directory and service gateway messages are limited to 512 object bindings per message.

B.2.7 Compression of modules

The modules may be transmitted either in uncompressed or compressed form. If the module is transmitted in compressed form, this is signalled by including the compressed_module_descriptor in the userInfo field of the moduleInfo in the DownloadInfoIndication message.

1. I.e. when the file has been decompressed from the file transport but before the content decoding has started.

Presence of the `compressed_module_descriptor` indicates that the data in the module has the "zlib" structure as defined in RFC 1950 [75].

Table B.33 shows the syntax of the `compressed_module_descriptor`:

Table B.33 : compressed_module_descriptor

	No. of bytes	Mnemonic	Value
<code>compressed_module_descriptor() {</code>			
<code>descriptor_tag</code>	1	uimsbf	0x09
<code>descriptor_length</code>	1	uimsbf	
<code>compression_method</code>	1	uimsbf	
<code>original_size</code>	4	uimsbf	
<code>}</code>			

Presence of the `compressed_module_descriptor` indicates that the data in the module has the "zlib" structure as defined in RFC 1950 [75]. Table B.34 shows the syntax of the ZLIB structure.

Table B.34 : zlib structure

	No. of bytes	Value	
<code>zlib structure() {</code>			
<code>compression_method</code>	1		
<code>flags_check</code>	1		
<code>compressed_data</code>	n		
<code>check value</code>	4		
<code>}</code>			

The MHP terminal shall support the Deflate compression algorithm as specified in RFC 1951 [76]. This is signalled setting the least significant nibble of the `compression_method` to 0x8 (i.e. `compression_method` is xxxx1000). The MHP terminal is not required to support other compression algorithms.

B.2.8 Mounting an Object Carousel

The ServiceGateway object is the root directory of the file system delivered by an Object Carousel and must be acquired before any other object can be downloaded. This may be achieved by two compatible mechanisms. The signalling of which mechanisms are being supported by a broadcast is provided by the `carousel_id_descriptor`. This descriptor may be included in the second descriptor loop of a PMT corresponding to a PID on which the DSI message for an Object Carousel is broadcast, i.e. the boot-PID.

In this specification the use of the `carousel_id_descriptor` for signalling is mandatory. The consequence is that if a PMT second descriptor loop contains a `data_broadcast_id_descriptor` that provides signalling for this specification, it shall also contain a `carousel_id_descriptor`.

Note: A single PID shall only contain messages from a single Object Carousel and so only one `carousel_id_descriptor` shall be present in any second descriptor loop. However, a single service may contain more than one Object Carousel. Consequently, the `carousel_id_descriptor` may appear more than once in any single PMT.

The acquisition of the ServiceGateway object may be via the standard DSI-DII mechanism. This shall be supported by all broadcasts regardless of signalling in the `carousel_id_descriptor` and shall be sufficient for all MHP terminals.

See also 10.2, "Program Specific Information" on page 72.

A broadcast may also contain additional information in the `carousel_id_descriptor` to support the "enhanced" boot mechanism. This is signalled by setting the `formatId` field for this descriptor to 0x01. This additional information is an aggregation of all the fields necessary to locate the ServiceGateway, also found in the DSI and DII messages. However, in such a case the module containing the ServiceGateway object shall be broadcast on the PID identified by the `data_broadcast_id_descriptor`. It is optional for both broadcasts and MHP terminals to support this mechanism.

B.2.8.1 carousel_id_descriptor

This descriptor is MPEG defined and in this specification may be included in the second descriptor loop of a PMT.

Table B.35 : Carousel identifier descriptor syntax

Syntax	bits	Type	Value
carousel_identifier_descriptor {			
descriptor_tag	8	uimsbf	0x13
descriptor_length	8	uimsbf	N1
carousel_id	32	uimsbf	
FormatID	8	uimsbf	
if(FormatID == 0x00) {			
for(i=0; i<N1-5; i++){			
private_data_byte	8		
}			
}			
if(FormatID == 0x01) {			
ModuleVersion	8	uimsbf	
ModuleId	16	uimsbf	
BlockSize	16	uimsbf	
ModuleSize	32	uimsbf	
CompressionMethod	8	uimsbf	
OriginalSize	32	uimsbf	
TimeOut	8	uimsbf	
ObjectKeyLength	8	uimsbf	N2 ≤ 4
for(i=0; i<N2; i++){			
ObjectKeyData	8	bslbf	
}			
for(i=0; i<N1-N2-21; i++){			
private_data_byte	8		
}			
}			
}			

carousel_id: The 32 bit field it identifies the object carousel with the corresponding carouselId.

FormatID: This 8 bit integer identifies whether the carousel supports the "enhanced boot" mechanism or not. The value 0x00 indicates "standard boot", 0x01 indicates that "enhanced boot" is possible.

ModuleVersion: This 8 bit integer is the version number of the module containing the service gateway. This is equivalent to moduleVersion in the DII.

ModuleId: This 16 bit integer is the identifier of the module in the carousel. This is equivalent to moduleId in the DII.

BlockSize: This 16 bit integer is the size in bytes of every block in the module (except for the last block which may be the same or smaller). This is equivalent to blockSize in the DII.

ModuleSize: This 32 bit integer is the size of the module in bytes. This is equivalent to moduleSize in the DII.

CompressionMethod: This 8 bit field identifies the compression algorithm defined in [RFC 1950 \[75\]](#) used to compress the module. It is equivalent to compression_method carried in the compressed_module_descriptor in the DII.

OriginalSize: This 32 bit integer is the size of the data (in bytes) carried by the module before it was compressed. It is equivalent to original_size carried in the compressed_module_descriptor in the DII.

If the module has not been compressed the values of OriginalSize and ModuleSize shall be equal and the value of CompressionMethod is not defined.

TimeOut: This 8 bit integer specifies the timeout in seconds for acquisition of all blocks of the module.

ObjectKeyLength: This 8 bit integer specifies the number of bytes of ObjectKeyData.

ObjectKeyData: These 8 bit values form an octet string that identifies the BIOP message that is the ServiceGateway message.

B.2.8.2 DVB-J mounting of an object carousel

DVB-J causes an object carousel to be mounted using `ServiceDomain.attach()`. It can be unmounted using `ServiceDomain.detach()`.

An application manager is also allowed to call these methods implicitly when launching or killing an application in order to access the signalled base directory of the application.

B.2.9 Unavailability of a carousel

Carousels become unavailable from the broadcast due to changes in the signalling including the following:

- The component signalled as carrying the DSI is removed from the PMT.
- Any value in the DSI changes.
- The value of carousel ID associated with the carousel changes.
- The program disappears from the PAT
- After an implementation dependent time general failure of the signalling (e.g. non-transmission of the PMT).

B.3 AssociationTag Mapping

B.3.1 Decision algorithm for association tag mapping

B.3.1.1 TapUse is **not** BIOP_PROGRAM_USE

The following figure illustrates the decision tree for identifying the elementary stream(s) by which the object carousel is distributed:

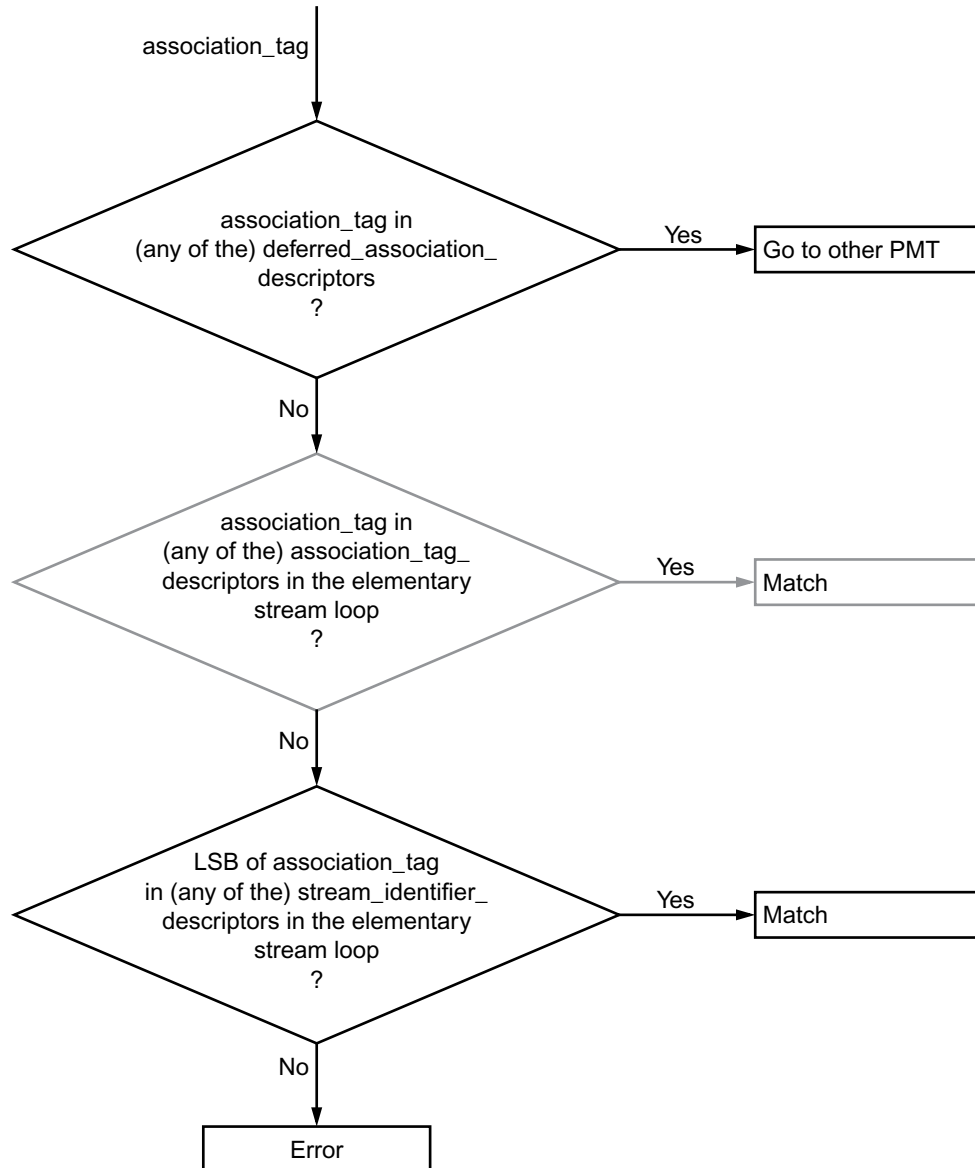


Figure B.1 : Object Carousel ES identification decision tree

In this specification, the stream_identifier_descriptor shall always be used for assigning a component_tag for the elementary streams. Use of association_tag_descriptors is not required. If the association_tag_descriptor is optionally used, a stream_identifier_descriptor shall still be present and the tag values shall be set consistently in each descriptor. This restriction simplifies the decision tree above so that the second decision can be skipped.

B.3.1.2 TapUse is BIOP_PROGRAM_USE

The decision tree in B.1 is not followed when resolving a BIOP_PROGRAM_USE tap as the only valid broadcast encoding is for a tap of use BIOP_PROGRAM_USE to resolve to deferred_association_tags_descriptor in the PMT even if the deferred_association_tags_descriptor identify the current service (i.e stream or streamEvent reference itself). If this resolution fails then there is an error in the broadcast.

B.3.2 DSM-CC association_tags to DVB component_tags

The component_tag in a PMT's stream_identifier_descriptor is used to relate SI service component information with an elementary stream without directly referring to a PID value. Likewise, association_tags are used by DSM-CC in order to refer to an elementary stream without directly referencing a PID value. An association_tag value is mapped to an elementary stream by matching the LSB of the association_tag with a component_tag. The stream_identifier_descriptor is mandatory for all components referenced by an application and/or object carousel.

Broadcasters may choose to use association_tag_descriptors (as defined by ISO/IEC 13818-6 [26]) which should (theoretically) be tested for a match before trying component_tags. However, the LSB of the association_tag value in an association_tag_descriptor has to be equal to the component_tag for that PID. Since the component_tag is unique within a PMT this removes the need to match against association_tag_descriptors.

The deferred_association_tag_descriptor, as defined by ISO/IEC 13818-6 [26] section 11.4.3, is used to refer an association_tag to a different PMT (i.e. a different service). When attempting to map an association_tag to an elementary stream the association_tag must first be checked against any deferred_association_tag_descriptors in the current PMT (current in this context means the PMT of the service within which the association_tag is being mapped). If the association_tag matches any of the association_tags present in a deferred_association_tag_descriptor then the matching process restarts in the service indicated in that descriptor. If the transport_stream_id field in the deferred_association_tag_descriptor is set to 0x0000 then it shall be ignored and the MHP terminal is free to choose which transport stream ID it selects when obtaining a service.

B.3.3 deferred_association_tag_descriptor

The transport_stream_id field may take value 0x0000 in which case it shall be ignored in resolving this reference.

B.4 Example of an Object Carousel (informative)

The figure below illustrates an object carousel that is distributed over three elementary streams belonging to the same service.

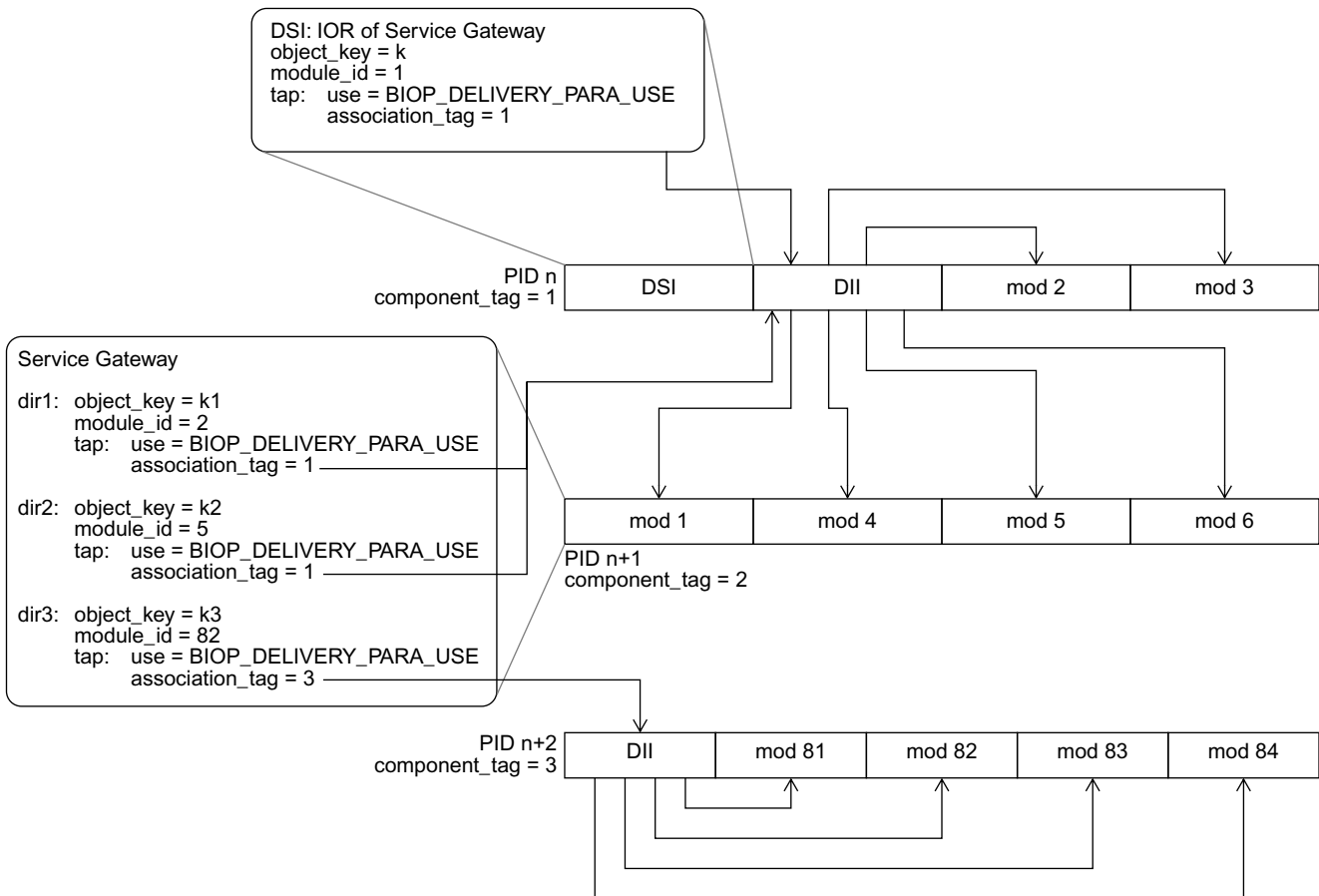


Figure B.2 : Example carousel

The DownloadServerInitiate (DSI) message is carried on the first elementary stream. It contains the object reference that points to the ServiceGateway. The tap with the BIOP_DELIVERY_PARA_USE points to a DownloadInfoIndication (DII) message that provides the information about the module and the location where the module is being broadcasted. In the example, the ServiceGateway object is in the module number 1 that is carried on the second elementary stream (indicated by a BIOP_OBJECT_USE tap structure in the DII message).

The ServiceGateway object is a root directory that, in this example, references three subdirectories. Taps with BIOP_DELIVERY_PARA_USE are used in the object references of the subdirectories to provide links to the modules via the DownloadInfoIndication (DII) message. The two first subdirectories "dir1" and "dir2" are referenced in the DII message that is carried in the first elementary stream. The third subdirectory is referenced in the DII message carried in the third elementary stream.

In this example, the two first elementary streams carry the messages of one logical data carousel while the third elementary stream carries the messages of another logical data carousel. All these belong to the same object carousel. In the example, the third elementary stream contains the objects in the "dir3" subdirectory and the objects in the "dir1" and "dir2" subdirectories are distributed over the first and second elementary stream.

It is important to note that the third elementary stream may originate from a completely separate source than the first two elementary streams. The directory hierarchy and objects contained in the third elementary stream are "mounted" in the root directory by providing the "dir3" directory entry with the appropriate location information.

This type of structure could be used, for example, in a national information service that contains some regional parts. The common national parts could be carried in this example case on the two first elementary streams that are distributed unmodified in the whole country. The regional parts are carried in the third elementary stream that is locally inserted at each region. From the application's point of view, the common national parts are in the "dir1" and "dir2" subdirectories while the regional parts are in the "dir3" subdirectory.

Another example where this type of structure could be used is if the service contains multiple independent applications. In this case, each application could be placed in its own subdirectory and these subdirectories might be carried as separate data carousels on different elementary streams.

B.5 Caching

This section describes the constraints that an MHP terminal compliant with this specification shall implement when caching any content from the object carousel in the memory of the MHP terminal. Caching is optional for the MHP terminal, but if implemented shall conform to the constraints set in this section.

B.5.1 Determining file version

There is no version number directly related to files (or other BIOP messages), the closest association is the moduleVersion in the DII that references the module that contains the BIOP message. Therefore, to ensure that a file is up to date the MHP terminal must determine that the moduleVersion for the appropriate module is current and reacquire if necessary.

When this checking is required is defined by the transparency level as specified in the following section.

B.5.2 Transparency levels of caching

The definition of transparency levels describes the behaviour that the MHP terminal shall implement when the content in the object carousel is changing. The transparency level determines how certain the MHP terminal is required to be about the validity of the content when returning the content to the application. The object carousel provides a mechanism for determining version changes of the content by monitoring the DII messages.

Validity of content is specified here in terms of the version number of the module that is broadcast in the DII message. The contents of an object as cached in the memory of the MHP terminal are defined to be valid at a certain point in time when the version number of the module in the cache matches the version number of the module as signalled in the DII message describing that module as it was last broadcast. Note that the definition is based on the DII message that was last broadcast and it may be that the MHP terminal was not filtering for this message at that time and did not receive it.

From the MHP terminal point of view, the transparency level indicates the constraints that the terminal needs to implement for monitoring the DII messages.

The broadcaster can indicate the appropriate transparency level that shall be applied for a given piece of content by using a descriptor associated with a module in the DII message (see "[Caching priority descriptor](#)" on page 233). In the absence of this descriptor from a module, the transparent caching is the default level.

B.5.2.1 Transparent caching

The transparent caching is a caching level that ensures that the application can not practically notice a difference in the validity of the returned content between an implementation that caches content and an implementation that does not cache any content. Naturally, an implementation that caches the content will return it to the application faster.

When returning content from the cache to the application, the MHP terminal shall ensure that the version number of the cached content matches the version number indicated in the current DII message describing that module. Once a DII has been received it can be assumed that it is current at least for 500 ms and after that period until receiving the next instance of the relevant DII. If filtering for that DII has not resumed by the end of this period, the state of that DII is to be considered unknown until it is received again.

Therefore, terminals must not return transparently cached data if it has waited more than half a second between receiving the relevant DII and *starting to filter* for that DII again. If the terminal does not resume filtering within the 500ms grace period, it must download the relevant DII again when it wishes to use that DII to check cache validity.

The choice of 500 ms is based on the normal timing uncertainty in data delivery through the broadcast chain and is independent of the repetition rate of the DII messages.

B.5.2.1.1 Active caching

There are several ways the MHP terminal can organise its caching strategy. One possible strategy is so-called active caching. This means that the terminal has a dedicated section filter for each DII message it needs to monitor. Keeping that filter continuously filtering for the DII guarantees that the terminal will notice the update of a module as soon as it happens and can thus be aware of the validity of all the content it has cached.

However, in some cases the DII messages might be sent with a very high repetition rate that may cause a high processing load because the terminal needs to do some processing every DII message that it receives. The 500 ms grace period is designed to help this, as it allows the terminal to stop the section filter for 500 ms after receiving the DII message. This lessens the processing burden on the terminal as it only needs to process each DII message twice a second, even if it may be repeated on the transmission much more frequently.

B.5.2.1.2 Passive caching

With active caching, the terminal may need to have a dedicated section filter reserved for each DII message that it needs to monitor. This would effectively limit the amount of content that can be cached, possibly to a very small number. Therefore, the terminal may choose a so-called passive caching strategy. This means that the terminal does not even try to monitor for the DII messages continuously, but each time an application wants to retrieve an object, it at that time retrieves the current DII and checks if the cached content is still valid. Although, this strategy imposes a delay before returning the content to the application, this delay is usually significantly smaller than having to retrieve the content from the broadcast stream.

B.5.2.1.3 DII repetition rate

It should be noted that the description of active and passive caching are only informative here and terminal implementations can use any strategy fulfilling the normative constraints set above. However, broadcasters should set the repetition rate of the DIIs so that a terminal implementing the passive caching strategy will provide the expected benefits of caching over a terminal implementing no caching.

B.5.2.2 Semi-transparent caching

The semi-transparent caching level allows the MHP terminal to cache the data and also return slightly out-dated data to the application. The benefit of this caching level is that it allows terminals to cache larger quantities of content with a reasonable resource usage while allowing the data to be returned usually immediately to the application. The semi-transparent caching level provides less guarantees about validity of the content, but does not cause the delay implied by the passive caching strategy with the transparent caching level.

When returning content from the cache to the application, the terminal shall ensure that the version number of the cached content matches the version number indicated in a valid DII message describing that module. Once a DII has been received it can be assumed to be valid at least for 30 s and after that period until receiving the next instance of the relevant DII. If filtering for that DII has not resumed by the end of this period, the state of that DII is to be considered unknown until it is received again.

Therefore, terminals must not return semi-transparently cached data if it has waited more than 30 seconds between receiving the relevant DII and starting to filter for that DII again. If the terminal does not resume filtering within the 30 s grace period, it must download the relevant DII again when it wishes to use that DII to check cache validity.

B.5.2.2.1 Implications for the terminal (informative)

Reasons for selecting the 30 s value for the grace period in the semi-transparent caching level are different from the reasons for the 500 ms grace period in the transparent level. The 30 s grace period in this level is intended e.g. to allow terminals to keep typically a valid copy of each DII by retrieving each DII in a round robin fashion using a single section filter. Naturally, whether this goal can be achieved, depends on the repetition rate of the DIIs and the amount of content that is cached. If this is not possible, the terminal might use the passive caching strategy with this transparency level as well. These strategies are only examples and the terminal may implement any strategy as long the normative constraints defined above are fulfilled (this includes implementing no caching as it is optional, as well as treating the semi-transparent level the same as the transparent level).

B.5.2.3 Static caching

When using the static caching transparency level, the MHP terminal shall check the validity of the cached content from the version number in the DII message when it is used for the first time during the lifetime of an application instance. After the first usage time, the MHP terminal does not need to check the validity of the content during the lifetime of that application instance.

B.5.2.3.1 Implications for the broadcaster (informative)

This has the implication, that content with this transparency level is appropriate for very static content that is updated only rarely and where the possible update of the content does not need to be noticed by the application during the lifetime of one application instance.

B.5.2.3.2 Implications for the terminal (informative)

The MHP terminal, however, is allowed to update the contents of the statically cached files if it notices that they have been updated in the carousel as well as use any caching strategy as long as the normative constraint defined above are fulfilled (this includes implementing no caching as it is optional, as well as treating the static level the same as the semi-transparent and/or the transparent level).

Annex C (informative): References

	Reference	Edition	Description	Note
[A]	MHP045	Rev.11	Digital Video Broadcasting (DVB); Commercial requirements	
[B]	UK MHEG Profile	1.05	Digital Terrestrial Television MHEG-5 Specification, U. K. DTG	
[C]	Compilers	ISBN: 0201100886	Compilers: Principles, Techniques, and Tools by Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman (Contributor); Addison-Wesley Pub Co	
[D]	Porter-Duff		T. Porter and T. Duff, "Compositing Digital Images", SIGGRAPH 84, 253-259.	
[E]	Java Media Player guide	1.03, Nov 6, 1997	Sun Microsystems Java Media Player guide, Java Media Players. Version. http://java.sun.com/products/java-media/jmf/forDevelopers/playerguide/index.html .	
[F]	Java VM2	ISBN: 0-201-43294-3	The Java Virtual Machine Specification (2nd edition), T. Lindholm and F. Yellin, Addison-Wesley.	
[G]	Java Class Libraries Vol. 1	ISBN 0-201-31002-3	The Java Class Libraries, Second Edition, Volume 1 by Patrick Chan, Rosanna Lee and Douglas Kramer.	
[H]	Java Class Libraries Vol. 2	ISBN 0-201-31003-1	The Java Class Libraries, Second Edition, Volume 2 by Patrick Chan and Rosanna Lee.	
[I]	E-Book	1.1	EACEM Technical Report Number TR-030, Baseline Digital Terrestrial TV Receiver Specification.	

Annex D (normative): Text presentation

D.1 Scope

This section addresses the following topics:

- How downloaded fonts are associated with applications and accessed by them
- The DVB-J APIs that are used for presenting text and their behaviour

Two levels of interface are addressed:

- Simple string rendering as supported by `java.awt.Graphics.drawString`
- More complex text object rendering as supported by DVB Text Layout Manager as described in U, "(normative): Extended graphics APIs" on page 592.

Other parts of this specification that are related to this topic are:

- For character sets supported by implementations see E, "(normative): Character set" on page 276.
- For the font families, sizes, styles and weights supported by implementations see and the presentation of this to the API G.4, "Resident fonts and text rendering" on page 285.
- For the content formats used to deliver fonts see 7.4, "Downloadable Fonts" on page 50.

D.2 Fonts

D.2.1 Embedded fonts

See G.4, "Resident fonts and text rendering" on page 285.

D.2.2 Downloaded fonts

D.2.2.1 Font technology

See 7.4, "Downloadable Fonts" on page 50.

D.2.2.2 Font index files

D.2.2.2.1 Format of file

The font index file provides a mapping between a font face name and a file containing the font data. The file syntax is defined by the XML DTD shown in table D.1.

Table D.1 : Font index file syntax definition

```
<!ELEMENT fontdirectory (font+)>
  <!-- a font definition -->

<!ELEMENT font (name,fontformat,filename,style*,size?)>
  <!-- filename of the font file.
  Because the font directory is per directory, this should
  not contain any directories, but just be a file in that
  directory -->

<!ELEMENT filename (#PCDATA)>
  <!-- font format, e.g. "PFR" -->

<!ELEMENT fontformat (#PCDATA)>
  <!-- symbolic name of the font -->

<!ELEMENT style (#PCDATA)>
  <!-- font style -->

<!ELEMENT name (#PCDATA)>

<!ELEMENT size EMPTY>
<!ATTLIST size
  min CDATA "0"
  max CDATA "maxint"
>
```

The `PublicLiteral` to be used for specifying this DTD in document type declarations of the XML files is:

```
"-//DVB//DTD Font Directory 1.0//EN"
```

and the URL for the `SystemLiteral` is:

```
"http://www.dvb.org/mhp/dtd/fontdirectory-1-0.dtd"
```

The Name used in the document type declaration shall be "fontdirectory".

D.2.2.2.2 Element semantics

font: There shall be one font element per font file included in the font directory.

name : Contains the font face name of the font (e.g. "Helvetica")

fontformat : The file format of the font. For the PFR format used in this specification, this shall be "PFR".

filename: Relative path to the font file. This is relative to the directory containing the font index file. The separator character for directories is "/". As this is a relative path, it shall not begin with a "/" character.

style : The style elements contain the names of the styles of the font that are contained in this font file. The possible values for this specification are "PLAIN", "BOLD", "ITALIC" and "BOLD_ITALIC". There is one style element included per style contained in the indicated font file, except when all the usable styles of the font are in the same file in which case the style elements can be left out. When different styles of the font are contained in separate files, these are included in the directory as separate font entities with the same name but different style and filename.

size: Indicates the size range for which this font file can be used. The min. attribute contains the minimum size in points (default is "0"). The max attribute contains the maximum size in points or "maxint" if the maximum size is not limited (default is "maxint").

If all the usable sizes of the font are generated using the same font file, the size element can be left out. If there are separate files for different sizes, these are included in the directory as separate font entities with the same name and style but different size definition and filename.

D.2.2.2.3 Example

Table D.2 : Example index file

```
<?xml version="1.0"?>

<!DOCTYPE fontdirectory PUBLIC "-//DVB//DTD Font Directory 1.0//EN"
"http://www.dvb.org/mhp/dtd/fontdirectory-1-0.dtd">
<fontdirectory>
  <font>
    <name>Tiresias</name>
    <fontformat>PFR</fontformat>
    <filename>tiresias.pfr</filename>
    <style>BOLD</style>
  </font>
  <font>
    <name>Broadcaster X Screen Font</name>
    <fontformat>PFR</fontformat>
    <filename>brxsf.pfr</filename>
  </font>
</fontdirectory>
```

D.2.2.3 Name and location of font index files

D.2.2.3.1 General

The specification of font paths and fonts by an application are private to that application, they are not available to other applications.

If the application creates a Font object with a *font face name* that is the same as one of the receiver's resident fonts then the specified font is used instead of the resident font with the same name. So, a downloaded font with *font face name* of "Tiresias" or "SansSerif" overrides any resident font with that name (see G.4, "Resident fonts and text rendering" on page 285).

D.2.2.3.2 Name of file

The file name shall be:

```
"dvb.fontindex"
```

D.2.2.3.3 Location

The font index file shall be placed in the base directory of the application.

The referenced font files can be on other file systems. However, the other file system must have already been mounted for the file loading to be successful. Font loading problems caused by referencing an unmounted file system are handled with the behaviour specified in java.AWT for an unavailable font.

D.2.2.4 Specification of fonts at run time

D.2.2.4.1 DVB-J

The implementation locates the font file using the parameters passed to the `java.awt.Font` constructor.

```
public Font(String name,
            int style,
            int size)
```

The font file is located by searching the directory for a file where the name element matches the name parameter of the Font constructor, a `style` element matches the style parameter and the `size` parameter is within the limitations in the size element.

It is font format specific how the font information for a given style and size is encoded in the font file.

D.3 Text rendering

D.3.1 Philosophy

This section describes "logical" rules that ensure text flows predictably on all receivers and defines some rendering requirements to ensure that a minimum acceptable level of text legibility is achieved.

No restriction is placed on the rendering technology used in a receiver provided that it achieves the deterministic text flow characteristics and the minimum rendering requirements described in this section.

D.3.2 Low and high level rendering

Two levels of interface are addressed:

D.3.2.1 Low level rendering

Simple string rendering as supported by :

- `java.awt.Graphics.drawString`
- `java.awt.Graphics.drawChars`
- `java.awt.Graphics.drawBytes`

This is referred to as "low level" rendering implying that the application author has significant responsibilities for ensuring that the text is visible. This rendering obeys the normal AWT rules. For example, the author is responsible for placing individual words or lines of text on to a component.

D.3.2.2 High level rendering

More complex text object rendering as supported by :

- `org.dvb.DVBTextLayoutManager`

This is referred to as "high level" rendering implying that the application author may need less effort to ensure that the text is visible. For example, the author could use the text layout manager to handle flowing paragraphs of text into an `org.havi.ui.HText` object

D.3.3 Font Definition

The nomenclature used in this section is derived from the resident font format(s). The nomenclature and the numerics provided here are directly applicable to downloaded fonts.

Font bounds

The font definition induces a set of parameters `xMin`, `xMax`, `yMin` and `yMax` that are **properties of the font**. These define the maximum extent of the outline representation of characters within the physical font, and as such are defined in terms of outline resolution units (`outlineResolution`).

(x_{Min} , y_{Min}) and (x_{Max} , y_{Max}) are the bottom-left and top-right corners of an imaginary bounding rectangle within which all characters in the font can be completely enclosed.

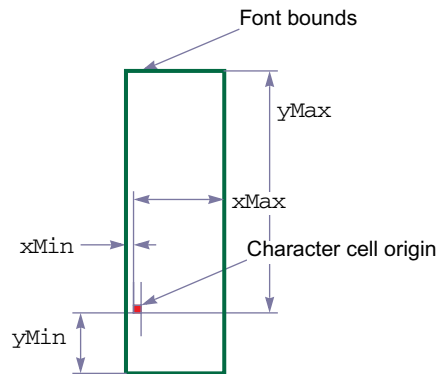


Figure D.1 : Font bounds

In "Low level rendering" the author is responsible for using knowledge of these values to correctly position text. The following Java methods provide access to these parameters:

- `java.awt.FontMetrics.getMaxAscent` derives from y_{Max}
- `java.awt.FontMetrics.getMaxDescent` derives from y_{Min}
- `java.awt.FontMetrics.getMaxAdvance` derives from x_{Max}

In each case the value returned is that in the font definition converted into the AWT device pixels. Typically there is a loss of precision in this process as the font is typically defined at higher resolution than the display device. In addition, precision may be lost if the aspect ratio of the font coordinate system is different from that of pixels in the display.

`java.awt.FontMetrics.stringWidth` contains the summated string widths of all of the characters in the string taking into account x_{Min} & x_{Max} plus any adjustments in the font such as kerning.

All approximations shall round up (see D.3.5, "Rendering within limits" on page 268).

In "High level rendering" the text layout manager uses this information when managing text flow to guarantee that the extremities of all characters are completely within the object. See D.3.5, "Rendering within limits" on page 268.

D.3.3.1 "Physical" font data

"Physical" font data such as horizontal escapement and kerning is defined in terms of metrics resolution units (`metricsResolution`). This is a high resolution representation, abstracted from any actual rendering system.

NOTE: The `outlineResolution` and `metricsResolution` are not necessarily the same.

D.3.4 Converting font metrics to display pixels

Many of the calculations in this section are in a high resolution physical coordinate system, either metrics or outline resolutions. These values need to be converted into the pixel resolution of the `HGraphicsDevice` to allow characters to be rendered.

Values in terms of these high level resolutions can be simply converted to values in terms of points by multiplying by the font size (in points) and dividing by the resolution, i.e. `metricsResolution` or `outlineResolution` as appropriate. However, this value in points still needs to be converted into a value in pixels.

Computer display systems typically assume a 72 pixel per inch display. So, as each point is 1/72 inch, the horizontal and vertical size of each pixel is 1 point.

D.3.4.1 Vertical resolution

Each pixel in the graphics device containing the component is equivalent to a single point.

D.3.4.2 Horizontal resolution

The horizontal relationship depends on the characteristics of the graphics device. For a square pixel graphics device the 1 pixel = 1 point convention can be preserved.

However, for a graphics device whose pixel aspect ratio is given by `org.havi.ui.HScreenConfiguration.getPixelAspectRatio` the horizontal resolution is the pixel aspect ratio * 1 point.

Table D.3 : Pixel width for non-square pixel graphics devices

Graphics device resolution	Graphics device aspect ratio	Typographic pixel size width in points
720 x 576	4:3	128/117
	14:9	56/45
	16:9	512/351

An emulated graphics could be constructed with 14:9 aspect ratio. This could be used where text is required to be acceptable when viewed on either a 4:3 or 16:9 display. A possible example of this is illustrated in figure D.2.

Text on a 4:3 display

The quick brown fox jumped over the lazy dog.
Cozy lummoX gives smart squid who asks for job pen.

Text on a 16:9 display

The quick brown fox jumped over the lazy dog.
Cozy lummoX gives smart squid who asks for job pen.

Figure D.2 : Example of 14:9 text on either 4:3 or 16:9 display

D.3.5 Rendering within limits

When typesetting for print, character extremities may extend beyond the nominal text flow area. However, print has margins so the edge of the text flow is not the technical limit to the area that can be printed. Component Insets can be used for the same purpose.

In "Low level rendering" the author is responsible for placing the text so that is not clipped.

In "High level rendering" the layout manager places the text within the inset rectangle, so that clipping does not occur if the object is sufficiently large. So, the "virtual margin" shall be defined as the greater of the inset value and the value computed using properties of the font (`xMin`, `yMin`, `xMax` and `yMax`) to ensure that all presented characters are completely rendered within the bounds of the object.

As stated previously, these parameters are defined in outline resolution units and so need to be converted to device pixels. Based on the principles described previously (see "Converting font metrics to display pixels") this can be achieved by using the following:

For `yMin` and `yMax`

$$Y_{\text{points}} = (\text{fontsize} \times Y_{\text{outlineResolution}}) / \text{outlineResolution}$$

$$Y_{\text{pixels}} = \text{roundupmag}(Y_{\text{points}})$$

and for x_{Min} and x_{Max}

$$X_{points} = (\text{fontsize} \times X_{outlineResolution}) / \text{outlineResolution}$$

$$X_{pixels} = \text{roundupmag}(X_{points} / \text{pixel_aspect_ratio})$$

outlineResolution is extracted from the font. The function $\text{roundupmag}(A)$ rounds the magnitude of A to the first integral number greater than or equal to A , whilst preserving the sign, e.g. $\text{roundupmag}(-4,32) = -5$.

D.3.5.1 Vertical limits

The origin of any character shall be at least y_{Max} inside the top edge of the object and at least y_{Min} inside its bottom edge. The distance from the edge of the component may be further increased by any margin. Assuming that all characters in a line of text share a common baseline then, **regardless of $vAlign$** the number of lines of text that may be presented within a text object is:

$$\text{num_lines} = \text{floor}((\text{object_height} - (y_{Min} + y_{Max})) / \text{linespace}) + 1$$

Where object_height is the height of the component less any margin.

All values are in pixels. The variable linespace is an attribute of the object that defines the space between the baselines of consecutive lines of text. The function $\text{floor}(A)$ rounds A to the first integral number less than or equal to A .

Note: linespace is defined in units of points but as described previously (see "[Converting font metrics to display pixels](#)").

- When $vAlign = TOP_ALIGN$ the baseline of the top most line shall be y_{Max} inside the "virtual margin" and each following line shall be spaced according to the value of linespace .

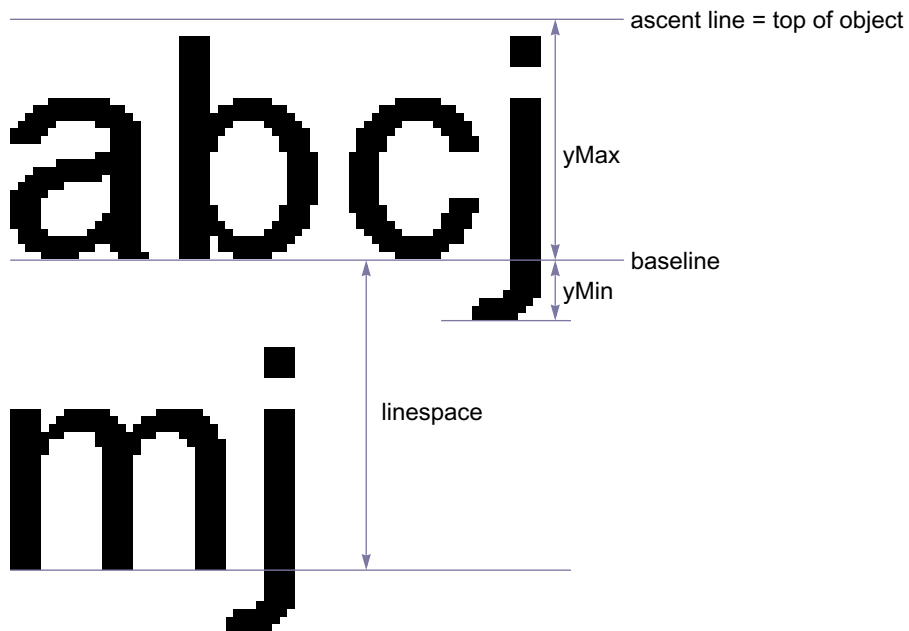


Figure D.3 : Vertical measures

- When $vAlign = BOTTOM_ALIGN$ the origin of the bottom most line shall be y_{Min} inside the "virtual margin" of the object and each previous line shall be spaced according to the value of linespace .
- For centring the midpoint of each line shall be the midpoint of the distance between the relevant "virtual margins"

D.3.5.2 Horizontal limits

The number of characters that may be rendered on a line is not simply dependent upon the width of the object and the horizontal escapement for each character, but also needs to consider that the rendering of the first character in a line may extend to the left of its origin. Thus, **regardless of** `hAlign` the space available for rendering a line of text within an object is

$$\text{available_width} = \text{object_width} - \text{xMin}$$

All values are in pixels. `available_width` may then be used with the "logical" text width rules to determine text flow.

- When `hAlign = LEFT_ALIGN` the origin of the left most character shall be `xMin` inside the left edge of the "virtual margin".
- When `hAlign = RIGHT_ALIGN` the origin of the right most character shall be as necessary to ensure that it is completely visible when rendered.

D.3.6 "logical" text width rules

This clause applies to both "[Low level rendering](#)" and "[High level rendering](#)". Its purpose is to ensure that text will flow predictably on different receivers and authoring stations, regardless of the quality of the character rendering, a set of "logical" text width rules are defined here.

NOTE: I.e. lines and words will break at the same character position.

These rules are a simplification of the rules that might be applied in a typographic rendering system. The objective of these simplifications is to reduce the receiver complexity required to ensure exact correlation of text flow behaviour.

The calculation of "logical" text width is based on "physical" font data. This data provides a description of the font at a very high resolution, abstracted from any actual rendering system. Consequently, the calculation of the "logical" width of a string of characters involves, computing their width at this high resolution and then converting to units appropriate to the rendering system, e.g. device pixels, before making decisions about text flow (see "[Converting font metrics to display pixels](#)").

In the case of "[Low level rendering](#)" it defines the internal computation performed by the AWT routines that measure the width of text:

- `java.awt.FontMetrics.charWidth`
- `java.awt.FontMetrics.stringWidth`
- `java.awt.FontMetrics.bytesWidth`

Due to the rounding processes within the calculations invoking these methods on subsets of a string may not yield the same total result as invoking the methods on the complete string. In particular the total of the values returned by `java.awt.FontMetrics.getWidths` may be different from the value returned by `java.awt.FontMetrics.stringWidth` for the same string.

In the case of "[High level rendering](#)" it defines the computations that the layout manager uses in the following cases:

- to determine when to wrap lines of text within an object
- to determine which tab stops text has passed when implementing tab characters

D.3.6.1 Computing "logical" text width

The key parameters when calculating the width of a string of N characters are:

- text font size
- `charSetWidth`
- The `metricsResolution`
- Any kerning adjustment

D.3.6.1.1 Font sizes

Font sizes are expressed as the size of an "Em" in units of "points".

NOTE 1: Broadly speaking an Em is the minimum distance between the baselines of consecutive lines of text in the given font. If text is 48 point then the Em at that size is 48 points.

NOTE 2: The point is an archaic typographical unit. Traditionally there were 72,27 points to an inch. Computerised systems now use 72 points per inch for simplicity.

D.3.6.1.2 Character widths

The font definition gives the width of each character relative to the size of an Em in metricsResolution units.

NOTE: If metrics are specified in 1/1000ths of an Em a character with a width of 0,6 Em will have a set width of 600.

D.3.6.1.3 Kerning

For certain character combinations (a "kerning pair") a kerning adjustment may also be provided. Typically kerning reduces character spacing for pairs such as AV instead of A V, these provide a signed adjustment to the nominal charSetWidth of the first character.

Like charSetWidth kerning adjustments are in terms of metricsResolution units.

Kerning adjustments only apply between non whitespace characters, not between the start of a line of text and the edge of the text object. If justification is being used, only whitespace between words may be adjusted.

D.3.6.1.4 Tracking

Tracking allows for an expansion/condensation of the character spacing for all of the characters in a text object including whitespace.

D.3.6.2 Logical text width

The equation below shows how the width of a string of N characters is computed.

$$\text{logical width of N characters}_{\text{points}} = \text{div}((N - 1) \times \text{track}, 256) + \text{div}(\text{fontsize} \times \left(\sum_1^N \text{charSetWidth}[i] + \sum_1^{N-1} \text{kern}[i, i+1] \right), \text{metricsResolution})$$

$$\text{logical width of N characters}_{\text{pixels}} = \text{div}(\text{logical width of N characters}_{\text{points}} \times H, W)$$

Where in $\text{div}(A, B)$:

- B is unsigned and A is signed
- and
- $\text{div}(A, B) = \text{ceil}(A / B)$

Where '/' is a rational divide and $\text{ceil}(A)$ is the first integral number greater than or equal to A. So, the calculations round up when reducing precision and tend to over estimate the width of text.

Where H and W are respectively the height and width returned by `org.havi.ui.HScreenConfiguration.getPixelAspectRatio()`.

D.3.7 Line breaking

The text layout manager shall wrap text within the text object. The behaviour is equivalent to identifying (based on the "logical" length) the first word that won't fit completely within the text object and replacing the space character that precedes the word with a Carriage Return character. I.e. line breaks are only inserted where there are space characters, this implies the receiver does not have to apply word hyphenation rules.

If a single word is bigger than the text object the text layout manager shall truncate text just before the last character that won't fit completely within the text box.

D.3.7.1 Truncation of text

High Level Text rendering shall not result in the presentation of partial characters.

If an object is too small to display all of the text that it contains the text shall be truncated so that only complete characters are displayed, the `notifyTextOverflow` method will be called so that the application can alert the viewer or take other remedial action.

If the object is not tall enough to be able to display all of the lines of text loaded to it then the rendering shall only display lines whose height can be completely displayed.

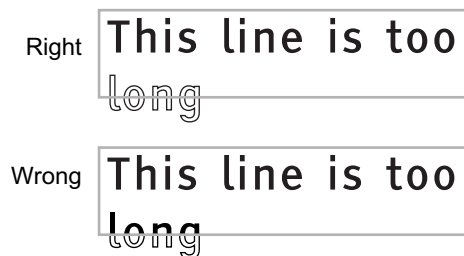


Figure D.4 : Truncation at vertical "end" edge

The examples illustrate the behaviour where `hAlign` is `LEFT_ALIGN` and `vAlign` is `TOP_ALIGN`. For other values the handling should be based on the same principles.

D.3.8 Tabulation

In left aligned text tab stops are defined by default horizontally every 56 points from the left edge of the text box.

"Horizontal Tabulation" advances the origin of the next character to be rendered to the next tab stop in the direction that the text is currently flowing (the character repertoire in Table E.1 only requires left to right text).

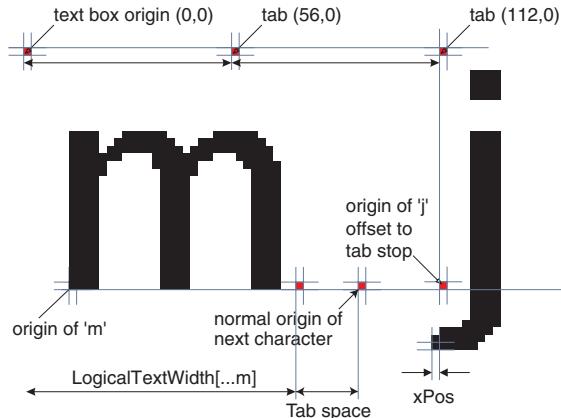


Figure D.5 : Effect of horizontal tabulation

- Tab characters only have meaning in left aligned text. If the text is right aligned, centred or justified then tab character shall be treated as a space character.
- A tab logically advances the rendering of the text by at least the width of a space character. If the normal origin of the next character to be rendered after the tab character is after a tab stop, a tab character will advance the rendering to the subsequent tab stop.
- The tab stops are at regular intervals from the left edge of the object and are not affected by the `xMin` offset to the origin of the first character.

D.3.9 Placing runs of characters & words

A run of characters starts from a well defined point:

- The start edge of the text object (see D.3.5 on page 268)
- A tab stop

After this origin the fine positioning of character cells and the gaps between words is not fully specified.

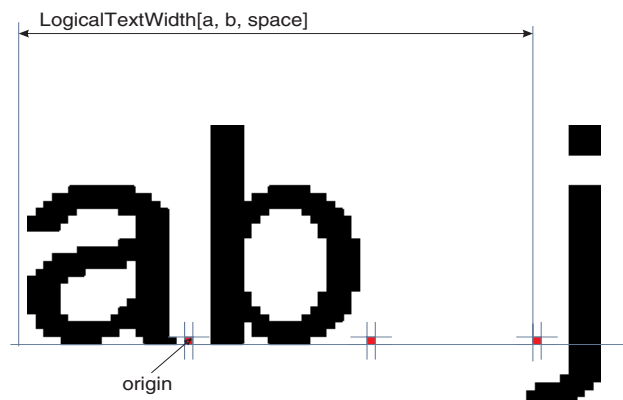


Figure D.6 : Calculation of character placement

However, the following rendering requirements shall be observed to ensure that a minimum acceptable level of text legibility is achieved:

- The spacing between any pair of non whitespace characters should be consistent wherever that pair of characters is displayed.
- At the default character spacing no two non-whitespace characters should "appear" to touch, except for special cases such as where ligatures diphthongs etc. are being used. The definition of the underlying font may make this requirement impossible.
- The physical rendering of a run of text as determined by the "logical" rules shall be achieved completely within the space used for the "logical" calculation.
- No partially rendered characters shall be presented.

D.3.10 Control of text flow

See the definition of the DVB text layout manager.

D.4 Text mark-up

This clause on text mark-up applies to "High level rendering".

D.4.1 White Space Characters

Certain non-printing characters have special meaning. These are identified in [Table D.4](#).

Table D.4 : Special characters

UTF8 Value(s)	Name	Meaning
0x09	Tab	See "Tabulation" on page 272
0x0D	Carriage Return	Causes the text flow to break. The origin for the next character to be rendered moves to a new baseline "linespace" below that just rendered. The horizontal position of the next line will depend on the <code>hAlign</code> .
0x20	Space	Spaces text by the width defined for the space character. When a text object has the <code>TextWrapping</code> attribute set to "true" lines may be broken at a space. See D.3.7, "Line breaking" on page 272 .
0xC2 0xA0	Non-breaking space	Identical spacing characteristics to 0x20 but is not seen as word boundary for deciding a position to break a line of text. (0xC2A0 is the UTF-8 representation of 0x00A0)

D.4.2 Marker characters

The codes 0x1C to 0x1F are zero width, non-spacing, non-printing characters available for use by authors as markers in text objects, i.e. when using string operations.

D.4.3 Non-printing characters

Certain characters (or character sequences) have no immediate visual representation.

These include:

- 0x1C to 0x1F marker characters (see [D.4.2 on page 274](#))
- Format control mark-up (see [D.4.4 on page 275](#))
- other characters not recognised by the receiver

When presenting text that includes these characters the character placement shall be as if the non-printing characters were eliminated from the text before rendering. In particular, the character spacing and inter character kerning shall be computed as if the non-printing characters were not present.

D.4.4 Format Control Mark-up

Within text objects mark-up codes can be used to control the presentation of text. The sequence in table D.5 marks the start of some marked-up text. For each "start of mark-up" a corresponding "end of mark-up" is defined. The byte sequence for the "end of mark-up" is illustrated in Table D.6. The minimum number of supported mark-up instances, where each instance is a start and end mark-up pair, is 256.

Table D.5 : General format for start of text mark-up

	bits	value	note
start_of_markup	8	0x1B	Escape
markup_start_identifier	8	0x40-0x5E	"@" to "^"
parameters_length	8	N	
for(i=0; i<N; i++) { parameter_byte }	8	0x00...0xFF	

Table D.6 : General format for end of text mark-up

	bits	value	note
end_of_markup	8	0x1B	Escape
markup_end_identifier	8	0x60-0x7E	"" to "~"

Table D.7 : Text object mark-up codes

Min. Nesting	start mark-up	end mark-up	description
	0x1B 0x42 0x00	0x1B 0x62	Applies "bold" style to the text enclosed (note 1)
16	0x1B 0x43 0x04 0xrr 0xgg 0xbb 0xtt	0x1B 0x63	Applies colour to the text enclosed. 0xrr specifies the red intensity, 0xgg the green, 0xbb the blue and 0xtt the transparency.
NOTE 1: Not supported in this profile			

D.4.5 Future compatibility

Compatible extensions to the set of mark-up codes may be defined in future profiles. For each the markup_end_identifier will be 32 (0x20) greater than the markup_start_identifier. Engines shall ignore unrecognised mark-up and shall display any text enclosed within an unrecognised mark-up.

Annex E (normative): Character set

E.1 Basic Euro Latin character set

The MHP shall be able to *display* and *accept as input* at least the set of characters shown in table E.1 "Extended Latin set".

The range of characters accepted as input may be limited by the capabilities of the available input devices. This paragraph does not imply that keyboards (real and virtual) for MHP terminals are required to support input of this full character set.

Table E.1 : Extended Latin set (Sheet 1 of 9)

Code	Unicode 2.0 Character name
0x0020	SPACE
0x0021	EXCLAMATION MARK
0x0022	QUOTATION MARK
0x0023	NUMBER SIGN
0x0024	DOLLAR SIGN
0x0025	PERCENT SIGN
0x0026	AMPERSAND
0x0027	APOSTROPHE
0x0028	LEFT PARENTHESIS
0x0029	RIGHT PARENTHESIS
0x002A	ASTERISK
0x002B	PLUS SIGN
0x002C	COMMA
0x002D	HYPHEN-MINUS
0x002E	FULL STOP
0x002F	SOLIDUS
0x0030	DIGIT ZERO
0x0031	DIGIT ONE
0x0032	DIGIT TWO
0x0033	DIGIT THREE
0x0034	DIGIT FOUR
0x0035	DIGIT FIVE
0x0036	DIGIT SIX
0x0037	DIGIT SEVEN
0x0038	DIGIT EIGHT
0x0039	DIGIT NINE
0x003A	COLON
0x003B	SEMICOLON
0x003C	LESS-THAN SIGN
0x003D	EQUALS SIGN

Table E.1 : Extended Latin set (Sheet 2 of 9)

Code	Unicode 2.0 Character name
0x003E	GREATER-THAN SIGN
0x003F	QUESTION MARK
0x0040	COMMERCIAL AT
0x0041	LATIN CAPITAL LETTER A
0x0042	LATIN CAPITAL LETTER B
0x0043	LATIN CAPITAL LETTER C
0x0044	LATIN CAPITAL LETTER D
0x0045	LATIN CAPITAL LETTER E
0x0046	LATIN CAPITAL LETTER F
0x0047	LATIN CAPITAL LETTER G
0x0048	LATIN CAPITAL LETTER H
0x0049	LATIN CAPITAL LETTER I
0x004A	LATIN CAPITAL LETTER J
0x004B	LATIN CAPITAL LETTER K
0x004C	LATIN CAPITAL LETTER L
0x004D	LATIN CAPITAL LETTER M
0x004E	LATIN CAPITAL LETTER N
0x004F	LATIN CAPITAL LETTER O
0x0050	LATIN CAPITAL LETTER P
0x0051	LATIN CAPITAL LETTER Q
0x0052	LATIN CAPITAL LETTER R
0x0053	LATIN CAPITAL LETTER S
0x0054	LATIN CAPITAL LETTER T
0x0055	LATIN CAPITAL LETTER U
0x0056	LATIN CAPITAL LETTER V
0x0057	LATIN CAPITAL LETTER W
0x0058	LATIN CAPITAL LETTER X
0x0059	LATIN CAPITAL LETTER Y
0x005A	LATIN CAPITAL LETTER Z
0x005B	LEFT SQUARE BRACKET
0x005C	REVERSE SOLIDUS
0x005D	RIGHT SQUARE BRACKET
0x005F	LOW LINE
0x0061	LATIN SMALL LETTER A
0x0062	LATIN SMALL LETTER B
0x0063	LATIN SMALL LETTER C
0x0064	LATIN SMALL LETTER D
0x0065	LATIN SMALL LETTER E
0x0066	LATIN SMALL LETTER F
0x0067	LATIN SMALL LETTER G
0x0068	LATIN SMALL LETTER H
0x0069	LATIN SMALL LETTER I
0x006A	LATIN SMALL LETTER J
0x006B	LATIN SMALL LETTER K
0x006C	LATIN SMALL LETTER L

Table E.1 : Extended Latin set (Sheet 3 of 9)

Code	Unicode 2.0 Character name
0x006D	LATIN SMALL LETTER M
0x006E	LATIN SMALL LETTER N
0x006F	LATIN SMALL LETTER O
0x0070	LATIN SMALL LETTER P
0x0071	LATIN SMALL LETTER Q
0x0072	LATIN SMALL LETTER R
0x0073	LATIN SMALL LETTER S
0x0074	LATIN SMALL LETTER T
0x0075	LATIN SMALL LETTER U
0x0076	LATIN SMALL LETTER V
0x0077	LATIN SMALL LETTER W
0x0078	LATIN SMALL LETTER X
0x0079	LATIN SMALL LETTER Y
0x007A	LATIN SMALL LETTER Z
0x007B	LEFT CURLY BRACKET
0x007C	VERTICAL LINE
0x007D	RIGHT CURLY BRACKET
0x007E	TILDE
0x00A0	NO-BREAK SPACE
0x00A1	INVERTED EXCLAMATION MARK
0x00A3	POUND SIGN
0x00A5	YEN SIGN
0x00A9	COPYRIGHT SIGN
0x00AA	FEMININE ORDINAL INDICATOR
0x00AE	REGISTERED SIGN
0x00B0	DEGREE SIGN
0x00B7	MIDDLE DOT
0x00BA	MASCULINE ORDINAL INDICATOR
0x00BC	VULGAR FRACTION ONE QUARTER
0x00BD	VULGAR FRACTION ONE HALF
0x00BE	VULGAR FRACTION THREE QUARTERS
0x00BF	INVERTED QUESTION MARK
0x00C0	LATIN CAPITAL LETTER A WITH GRAVE
0x00C1	LATIN CAPITAL LETTER A WITH ACUTE
0x00C2	LATIN CAPITAL LETTER A WITH CIRCUMFLEX
0x00C3	LATIN CAPITAL LETTER A WITH TILDE
0x00C4	LATIN CAPITAL LETTER A WITH DIAERESIS
0x00C5	LATIN CAPITAL LETTER A WITH RING ABOVE
0x00C6	LATIN CAPITAL LETTER AE
0x00C7	LATIN CAPITAL LETTER C WITH CEDILLA
0x00C8	LATIN CAPITAL LETTER E WITH GRAVE
0x00C9	LATIN CAPITAL LETTER E WITH ACUTE

Table E.1 : Extended Latin set (Sheet 4 of 9)

Code	Unicode 2.0 Character name
0x00CA	LATIN CAPITAL LETTER E WITH CIRCUMFLEX
0x00CB	LATIN CAPITAL LETTER E WITH DIAERESIS
0x00CC	LATIN CAPITAL LETTER I WITH GRAVE
0x00CD	LATIN CAPITAL LETTER I WITH ACUTE
0x00CE	LATIN CAPITAL LETTER I WITH CIRCUMFLEX
0x00CF	LATIN CAPITAL LETTER I WITH DIAERESIS
0x00D0	LATIN CAPITAL LETTER ETH
0x00D1	LATIN CAPITAL LETTER N WITH TILDE
0x00D2	LATIN CAPITAL LETTER O WITH GRAVE
0x00D3	LATIN CAPITAL LETTER O WITH ACUTE
0x00D4	LATIN CAPITAL LETTER O WITH CIRCUMFLEX
0x00D5	LATIN CAPITAL LETTER O WITH TILDE
0x00D6	LATIN CAPITAL LETTER O WITH DIAERESIS
0x00D7	MULTIPLICATION SIGN
0x00D8	LATIN CAPITAL LETTER O WITH STROKE
0x00D9	LATIN CAPITAL LETTER U WITH GRAVE
0x00DA	LATIN CAPITAL LETTER U WITH ACUTE
0x00DB	LATIN CAPITAL LETTER U WITH CIRCUMFLEX
0x00DC	LATIN CAPITAL LETTER U WITH DIAERESIS
0x00DD	LATIN CAPITAL LETTER Y WITH ACUTE
0x00DE	LATIN CAPITAL LETTER THORN
0x00DF	LATIN SMALL LETTER SHARP S
0x00E0	LATIN SMALL LETTER A WITH GRAVE
0x00E1	LATIN SMALL LETTER A WITH ACUTE
0x00E2	LATIN SMALL LETTER A WITH CIRCUMFLEX
0x00E3	LATIN SMALL LETTER A WITH TILDE
0x00E4	LATIN SMALL LETTER A WITH DIAERESIS
0x00E5	LATIN SMALL LETTER A WITH RING ABOVE
0x00E6	LATIN SMALL LETTER AE
0x00E7	LATIN SMALL LETTER C WITH CEDILLA
0x00E8	LATIN SMALL LETTER E WITH GRAVE
0x00E9	LATIN SMALL LETTER E WITH ACUTE
0x00EA	LATIN SMALL LETTER E WITH CIRCUMFLEX
0x00EB	LATIN SMALL LETTER E WITH DIAERESIS
0x00EC	LATIN SMALL LETTER I WITH GRAVE

Table E.1 : Extended Latin set (Sheet 5 of 9)

Code	Unicode 2.0 Character name
0x00ED	LATIN SMALL LETTER I WITH ACUTE
0x00EE	LATIN SMALL LETTER I WITH CIRCUMFLEX
0x00EF	LATIN SMALL LETTER I WITH DIAERESIS
0x00F0	LATIN SMALL LETTER ETH
0x00F1	LATIN SMALL LETTER N WITH TILDE
0x00F2	LATIN SMALL LETTER O WITH GRAVE
0x00F3	LATIN SMALL LETTER O WITH ACUTE
0x00F4	LATIN SMALL LETTER O WITH CIRCUMFLEX
0x00F5	LATIN SMALL LETTER O WITH TILDE
0x00F6	LATIN SMALL LETTER O WITH DIAERESIS
0x00F7	DIVISION SIGN
0x00F8	LATIN SMALL LETTER O WITH STROKE
0x00F9	LATIN SMALL LETTER U WITH GRAVE
0x00FA	LATIN SMALL LETTER U WITH ACUTE
0x00FB	LATIN SMALL LETTER U WITH CIRCUMFLEX
0x00FC	LATIN SMALL LETTER U WITH DIAERESIS
0x00FD	LATIN SMALL LETTER Y WITH ACUTE
0x00FE	LATIN SMALL LETTER THORN
0x00FF	LATIN SMALL LETTER Y WITH DIAERESIS
0x0100	LATIN CAPITAL LETTER A WITH MACRON
0x0101	LATIN SMALL LETTER A WITH MACRON
0x0102	LATIN CAPITAL LETTER A WITH BREVE
0x0103	LATIN SMALL LETTER A WITH BREVE
0x0104	LATIN CAPITAL LETTER A WITH OGONEK
0x0105	LATIN SMALL LETTER A WITH OGONEK
0x0106	LATIN CAPITAL LETTER C WITH ACUTE
0x0107	LATIN SMALL LETTER C WITH ACUTE
0x0108	LATIN CAPITAL LETTER C WITH CIRCUMFLEX
0x0109	LATIN SMALL LETTER C WITH CIRCUMFLEX
0x010A	LATIN CAPITAL LETTER C WITH DOT ABOVE
0x010B	LATIN SMALL LETTER C WITH DOT ABOVE
0x010C	LATIN CAPITAL LETTER C WITH CARON
0x010D	LATIN SMALL LETTER C WITH CARON
0x010E	LATIN CAPITAL LETTER D WITH CARON
0x010F	LATIN SMALL LETTER D WITH CARON

Table E.1 : Extended Latin set (Sheet 6 of 9)

Code	Unicode 2.0 Character name
0x0110	LATIN CAPITAL LETTER D WITH STROKE
0x0111	LATIN SMALL LETTER D WITH STROKE
0x0112	LATIN CAPITAL LETTER E WITH MACRON
0x0113	LATIN SMALL LETTER E WITH MACRON
0x0116	LATIN CAPITAL LETTER E WITH DOT ABOVE
0x0117	LATIN SMALL LETTER E WITH DOT ABOVE
0x0118	LATIN CAPITAL LETTER E WITH OGONEK
0x0119	LATIN SMALL LETTER E WITH OGONEK
0x011A	LATIN CAPITAL LETTER E WITH CARON
0x011B	LATIN SMALL LETTER E WITH CARON
0x011C	LATIN CAPITAL LETTER G WITH CIRCUMFLEX
0x011D	LATIN SMALL LETTER G WITH CIRCUMFLEX
0x011E	LATIN CAPITAL LETTER G WITH BREVE
0x011F	LATIN SMALL LETTER G WITH BREVE
0x0120	LATIN CAPITAL LETTER G WITH DOT ABOVE
0x0121	LATIN SMALL LETTER G WITH DOT ABOVE
0x0122	LATIN CAPITAL LETTER G WITH CEDILLA
0x0123	LATIN SMALL LETTER G WITH CEDILLA
0x0124	LATIN CAPITAL LETTER H WITH CIRCUMFLEX
0x0125	LATIN SMALL LETTER H WITH CIRCUMFLEX
0x0126	LATIN CAPITAL LETTER H WITH STROKE
0x0127	LATIN SMALL LETTER H WITH STROKE
0x0128	LATIN CAPITAL LETTER I WITH TILDE
0x0129	LATIN SMALL LETTER I WITH TILDE
0x012A	LATIN CAPITAL LETTER I WITH MACRON
0x012B	LATIN SMALL LETTER I WITH MACRON
0x012E	LATIN CAPITAL LETTER I WITH OGONEK
0x012F	LATIN SMALL LETTER I WITH OGONEK
0x0130	LATIN CAPITAL LETTER I WITH DOT ABOVE
0x0131	LATIN SMALL LETTER DOTLESS I
0x0132	LATIN CAPITAL LIGATURE IJ
0x0133	LATIN SMALL LIGATURE IJ
0x0134	LATIN CAPITAL LETTER J WITH CIRCUMFLEX

Table E.1 : Extended Latin set (Sheet 7 of 9)

Code	Unicode 2.0 Character name
0x0135	LATIN SMALL LETTER J WITH CIRCUMFLEX
0x0136	LATIN CAPITAL LETTER K WITH CEDILLA
0x0137	LATIN SMALL LETTER K WITH CEDILLA
0x0138	LATIN SMALL LETTER KRA
0x0139	LATIN CAPITAL LETTER L WITH ACUTE
0x013A	LATIN SMALL LETTER L WITH ACUTE
0x013B	LATIN CAPITAL LETTER L WITH CEDILLA
0x013C	LATIN SMALL LETTER L WITH CEDILLA
0x013D	LATIN CAPITAL LETTER L WITH CARON
0x013E	LATIN SMALL LETTER L WITH CARON
0x013F	LATIN CAPITAL LETTER L WITH MIDDLE DOT
0x0140	LATIN SMALL LETTER L WITH MIDDLE DOT
0x0141	LATIN CAPITAL LETTER L WITH STROKE
0x0142	LATIN SMALL LETTER L WITH STROKE
0x0143	LATIN CAPITAL LETTER N WITH ACUTE
0x0144	LATIN SMALL LETTER N WITH ACUTE
0x0145	LATIN CAPITAL LETTER N WITH CEDILLA
0x0146	LATIN SMALL LETTER N WITH CEDILLA
0x0147	LATIN CAPITAL LETTER N WITH CARON
0x0148	LATIN SMALL LETTER N WITH CARON
0x014A	LATIN CAPITAL LETTER ENG
0x014B	LATIN SMALL LETTER ENG
0x014C	LATIN CAPITAL LETTER O WITH MACRON
0x014D	LATIN SMALL LETTER O WITH MACRON
0x0152	LATIN CAPITAL LIGATURE OE
0x0153	LATIN SMALL LIGATURE OE
0x0154	LATIN CAPITAL LETTER R WITH ACUTE
0x0155	LATIN SMALL LETTER R WITH ACUTE
0x0156	LATIN CAPITAL LETTER R WITH CEDILLA
0x0157	LATIN SMALL LETTER R WITH CEDILLA
0x0158	LATIN CAPITAL LETTER R WITH CARON
0x0159	LATIN SMALL LETTER R WITH CARON
0x015A	LATIN CAPITAL LETTER S WITH ACUTE
0x015B	LATIN SMALL LETTER S WITH ACUTE
0x015C	LATIN CAPITAL LETTER S WITH CIRCUMFLEX
0x015D	LATIN SMALL LETTER S WITH CIRCUMFLEX
0x015E	LATIN CAPITAL LETTER S WITH CEDILLA

Table E.1 : Extended Latin set (Sheet 8 of 9)

Code	Unicode 2.0 Character name
0x015F	LATIN SMALL LETTER S WITH CEDILLA
0x0160	LATIN CAPITAL LETTER S WITH CARON
0x0161	LATIN SMALL LETTER S WITH CARON
0x0162	LATIN CAPITAL LETTER T WITH CEDILLA
0x0163	LATIN SMALL LETTER T WITH CEDILLA
0x0164	LATIN CAPITAL LETTER T WITH CARON
0x0165	LATIN SMALL LETTER T WITH CARON
0x0166	LATIN CAPITAL LETTER T WITH STROKE
0x0167	LATIN SMALL LETTER T WITH STROKE
0x0168	LATIN CAPITAL LETTER U WITH TILDE
0x0169	LATIN SMALL LETTER U WITH TILDE
0x016A	LATIN CAPITAL LETTER U WITH MACRON
0x016B	LATIN SMALL LETTER U WITH MACRON
0x016C	LATIN CAPITAL LETTER U WITH BREVE
0x016D	LATIN SMALL LETTER U WITH BREVE
0x016E	LATIN CAPITAL LETTER U WITH RING ABOVE
0x016F	LATIN SMALL LETTER U WITH RING ABOVE
0x0172	LATIN CAPITAL LETTER U WITH OGONEK
0x0173	LATIN SMALL LETTER U WITH OGONEK
0x0174	LATIN CAPITAL LETTER W WITH CIRCUMFLEX
0x0175	LATIN SMALL LETTER W WITH CIRCUMFLEX
0x0176	LATIN CAPITAL LETTER Y WITH CIRCUMFLEX
0x0177	LATIN SMALL LETTER Y WITH CIRCUMFLEX
0x0178	LATIN CAPITAL LETTER Y WITH DIAERESIS
0x0179	LATIN CAPITAL LETTER Z WITH ACUTE
0x017A	LATIN SMALL LETTER Z WITH ACUTE
0x017B	LATIN CAPITAL LETTER Z WITH DOT ABOVE
0x017C	LATIN SMALL LETTER Z WITH DOT ABOVE
0x017D	LATIN CAPITAL LETTER Z WITH CARON
0x017E	LATIN SMALL LETTER Z WITH CARON
0x01CD	LATIN CAPITAL LETTER A WITH CARON
0x01CE	LATIN SMALL LETTER A WITH CARON
0x1E80	LATIN CAPITAL LETTER W WITH GRAVE
0x1E81	LATIN SMALL LETTER W WITH GRAVE
0x1E82	LATIN CAPITAL LETTER W WITH ACUTE
0x1E83	LATIN SMALL LETTER W WITH ACUTE

Table E.1 : Extended Latin set (Sheet 9 of 9)

Code	Unicode 2.0 Character name
0x1E84	LATIN CAPITAL LETTER W WITH DIAERESIS
0x1E85	LATIN SMALL LETTER W WITH DIAERESIS
0x1EF2	LATIN CAPITAL LETTER Y WITH GRAVE
0x1EF3	LATIN SMALL LETTER Y WITH GRAVE
0x2018	LEFT SINGLE QUOTATION MARK
0x2019	RIGHT SINGLE QUOTATION MARK
0x201C	LEFT DOUBLE QUOTATION MARK
0x201D	RIGHT DOUBLE QUOTATION MARK
0x2022	BULLET
0x2044	FRACTION SLASH
0x20AC	EURO SIGN
0x2190	LEFTWARDS ARROW
0x2191	UPWARDS ARROW
0x2192	RIGHTWARDS ARROW
0x2193	DOWNWARDS ARROW
0x221E	INFINITY
0x266B	BEAMED EIGHTH NOTES
0x2713	CHECK MARK
0x2717	BALLOT X

Annex F (informative): Authoring & Implementation Guidelines

F.1 Authoring Guidelines

- Authoring guidelines are needed to specify those methods, classes and interfaces which are intended for use by implementations of JMF players. These methods, classes and interfaces are not intended for use by applications except for this purpose and that should be made clear.
- Authoring guidelines are needed to make it clear that it is optional for JMF controls to have an associated java.awt component. This is in the JMF documentation but the phrasing implies this an exceptional case. In many MHP receivers, the presence of such a component would be the exceptional case. To be completed.

F.2 Implementation Guidelines

To be completed.

F.3 Authoring guidelines for DVB-J

< java stuff to go here >

Annex G (normative): Minimum Platform Capabilities

G.1 Graphics

In the area of graphics capability the following requirements are made on MHP terminals:

G.1.1 Device capabilities

- The number of applications concurrently using the display is not limited. However, the MHP terminal is not required to support overlapping HScenes.
- The MHP terminal shall implement at least one HGraphicsDevice which shall be full screen.
- The MHP terminal shall implement at least one HBackgroundDevice. These are always full screen.
- The MHP terminal shall implement at least one HVideoDevice which is always capable of being configured to be full screen.
- The minimum set of required device resolutions that MHP terminals shall support is illustrated in figure G.1. Specifically these are:
 - HBackgroundDevice resolution of 720x576
 - HVideoDevice resolution of 720x576
 - HGraphicsDevice resolution of 720x576
 These shall be supported for display aspect ratios of 4:3 and 16:9.

Optionally MHP terminals may also support square pixel HGraphicsDevice resolutions of 768x576 and 1024x576 for 4:3 and 16:9 displays respectively.

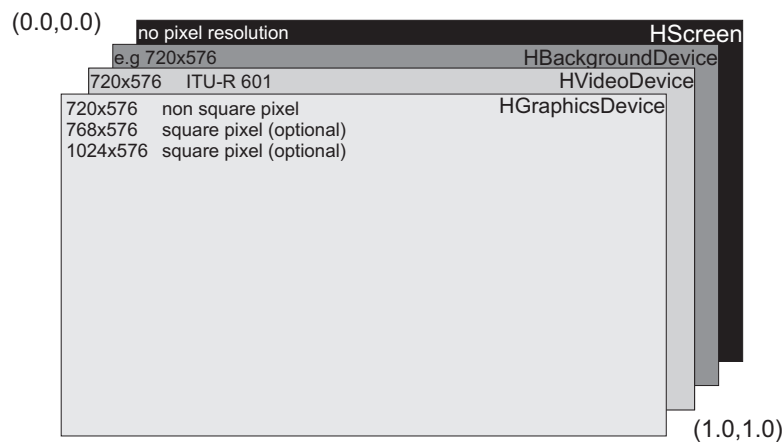


Figure G.1 : Required device resolutions

G.1.2 Video presentation capabilities

- The following set of standard decoder format conversions shall be supported by all MHP terminals:

DFC_PROCESSING_CCO

DFC_PROCESSING_FULL

DFC_PROCESSING_LB_16_9

DFC_PROCESSING_PAN_SCAN

The following modes are optional:

DFC_PROCESSING_LB_14_9

DFC_PROCESSING_LB_2_21_1_ON_16_9

DFC_PROCESSING_LB_2_21_1_ON_4_3

- MHP terminals are required to support both displaying MPEG video without any scaling and with 1/2 scaling both vertically and horizontally provided that in this latter case the entire resulting video area is fully on the screen
- Support for component based JMF players is not required for any profile in this specification.

G.1.3 Image processing capabilities

- All DVGraphics objects shall support SRC and CLEAR and SRC_OVER.
When SRC_OVER is used with DVGraphics objects with a sample model of the type TYPE_BASE a perfect result is only guaranteed to be produced with alpha values of 0 and 1. Alpha values other than 0 and 1 can be approximated. DVGraphics object with a type of TYPE_ADVANCED will produce a result as expected but those SRC_OVER operations are likely to be slow.
- DVGraphics object created from a DVBufferedImage with the type TYPE_ADVANCED shall perform SRC_OVER operations without approximations of the compositing rule.

G.1.4 Alpha capabilities

For any draw operations directly into the HGraphicsDevice the following rules shall be applied for the precision of implementation of alpha:

- MHP terminals are required to implement at least 3 levels of transparency: 0 % (opaque), 100 % (completely transparent) and an intermediate value of approximately 30 %. Implementation of additional intermediate levels of transparency is optional.
- Where the MHP terminal cannot implement a particular value of semi-transparency it shall replace it with the nearest value of transparency it can implement.

However, if the encoded value of transparency is in the range 10 %-90 % it shall not be approximated as either less than 10 % or greater than 90 % transparency.

So, 9 % may be approximated as 0 % but 10 % shall be represented with a value in the range 10 % to 90 % such as 30 %. Similarly, 91 % may be approximated as 100 %.

G.1.5 Colour capabilities

Logically the colour model is a "true colour" one. However, other implementations are possible.

Two styles of indexed colour implementations are considered:

- Dithering
- Nearest colour match

Where an indexed colour implementation can accurately reproduce colours using dithering it is considered to be a true colour implementation. In this case no restrictions are placed on the CLUT used.

Where an indexed colour receiver implements a simpler colour matching, or has other limitations on the number of colours it represents (for example requiring a reservation to accommodate subtitles). It shall use the 188 colour CLUT specified in table G.1. The reservation of 64 CLUT locations for use by the subtitling decoder is not appropriate to all implementations and assumes a corresponding broadcaster rule of operations restricting subtitle transmissions to use only 64 different colours.

Table G.1 : Palette construction rules

Transparency	Alpha	Additional Grey Levels (R=G=B)	Red	Green	Blue	Number of colours
0 %	255	42, 85, 170, 212	0, 63, 127, 191, 255	0, 31, 63, 95, 127, 159, 191, 223, 255	0, 127, 255	139
30 %	179 (note 1)	--	0, 85, 170, 255	0, 51, 102, 153, 204, 255	0, 255	48
100 %	0	--	--	--	--	1
					Total	188
NOTE 1: Where the receiver cannot implement this "ideal" value of semi-transparency it shall replace it with the nearest value of semi-transparency it can implement. Note: semi-transparency shall not be approximated as either 0 % or 100 % transparency.						

The opaque portion CLUT specified in table G.1 is illustrated in figure G.2.

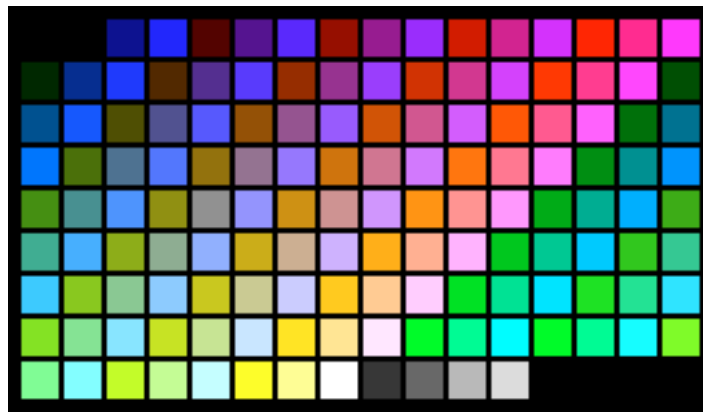


Figure G.2 : Opaque CLUT

G.1.6 MPEG I frame and Video drips

The minimum positioning and scaling capabilities defined above for MPEG video shall also apply to MPEG I frame and Video drips.

G.2 Audio

No audio mixing is required.

Audio played from memory may pre-empt any audio from the transport stream. This may disturb decoding of any broadcast video stream.

Audio from memory shall be output in preference to audio from stream if overall audio output has not been disabled by the user. On platforms capable of mixing audio from memory with audio from the stream it shall do this if there is a stream playing. Where audio from the stream is interrupted, decoding of it shall automatically resume when audio from memory ceases if the stream concerned is still playing. This only applies where the audio from memory and the stream are both under the control of the same MHP application. Where multiple applications are involved see 9.4, "Inter application resource management" on page 70.

G.3 Video

The MHP terminal is only required to support decoding of a single video stream at a given time. The number of implemented video decoders will affect the functionality of the video and background devices.

G.4 Resident fonts and text rendering

G.4.1 The built-in font

At least the RNIB/DTG font "Tiresias" shall be provided.

The font shall be able to present at least the sizes listed in G.2 and the weight ("PLAIN").

Table G.2 : Minimum set of sizes

Size (points)	TV lines (note 1) over "Cap-V"	Informative Name
36	24	Heading / Large subtitle
31	21	Subtitle
26	18	Body (note 2)
24	16	Footnote
NOTE 1: The primary definition of the character size is the font size in points, the height of a capital letter "V" in TV lines is provided for information only.		
NOTE 2: The default size and style.		

G.4.2 Presentation to DVB-J

The embedded font "Tiresias" shall have:

- the logical name "SansSerif" (for example returned by `java.awt.Toolkit.getFontList`)
- the family name "Tiresias" (for example returned by `java.awt.Font.getFamily`)
- the font face name "Tiresias PLAIN"

G.4.3 Text directions

The `DVBTextLayoutManager` is only required to support the following configuration of text direction:

- `LINE_ORIENTATION_HORIZONTAL` and `START_CORNER_UPPER_LEFT`

G.5 Input events

Table G.3 : Minimum set of input events

Input event
VK_0 to VK_9
VK_UP
VK_DOWN
VK_LEFT
VK_RIGHT
VK_ENTER
VK_TELETEXT
VK_COLORED_KEY_0
VK_COLORED_KEY_1
VK_COLORED_KEY_2
VK_COLORED_KEY_3

G.6 Memory

In order to be able to execute MHP conformance tests, the following minimum memory requirements are defined for MHP terminals. All of these are to be measured during normal usage and operational conditions of an MHP terminal. All are to be measured in the `initXlet` method of a DVB-J application which is both the only auto-start application signalled in a service and the only application running at that time.

- Enough memory to successfully load any arbitrary 262 144 (or less) Bytes of Java class files into the memory space of the Java virtual machine. Execution of code called as part of initializing fields in classes is excluded from consideration as part of "load"ing here. RAM usage by the bytecode verifier is included in consideration as part of "load"ing here.

Enough memory to do the above and individually each of the following:

- Enough memory to successfully create a Java byte array of lengths from 1 entry to 262 144 entries.
- Enough memory to successfully load & display any 720x576 8bit PNG image (conforming to 15.1, "PNG - restrictions" on page 208) from a file which contains just the mandatory information and excludes any optional extension fields or chunks.
- Enough memory to successfully load from file & play from memory 5 seconds of audio at 128 kbit/s (where kbit/s is as used in TR 101 154 [9]). In a similar way to as is required for PNG images above, it shall be measured using files that do not include any optional extension fields.
- Enough memory to successfully allocate an array of `java.lang.Object` of length 16 384 and fill each element of this array with a distinct instance of `java.lang.Object`.

The memory requirements detailed in this section are not exhaustive. For example, the specific requirement concerning an array of type `byte` in no way implies that MHP terminals are exempt from requirements found elsewhere in the MHP specification (including normatively referenced specifications) for supporting arrays of other types.

NOTE: Additional detail may be added to these requirements in order to properly enable the MHP conformance tests.

G.7 Other resources

Table G.4 : Minimum requirements for other resources

Feature	Specification
gamma correction in the receiver	none
HAVi mattes	Platforms are not required to implement the functionality of mattes in HAVi. Non-implementation should be implemented as specified by HAVi.
Overlapping applications	MHP terminals are not required to support overlapping top level UI containers (e.g. HScenes where DVB-J applications are concerned).
AIT section filtering	The implementation is not required to dedicate more than one section filter to monitoring the AIT.
Key lengths	Receivers shall support certificate key length up to 4096 bits.

NOTE: The values in the table below are set for the purposes of conformance testing and should not be used by application or MHP terminal developers as being indicative of the capabilities of commercial products.

Table G.5 : Minimum requirements for other resources for conformance purposes

Feature	Specification
Application accessible timers (note 2)	At least 4 timers for each ServiceContext which can be presenting MHP applications at the same time. (i.e. shared between the applications signalled as part of the same service). (note 1)
MPEG-2 transport stream network interface	Shall support at least one network interface enabling reception of an MPEG-2 transport stream and selection of that transport stream from among those available to be received. This shall support those broadcast channel protocols supported by the MHP terminal (see 6.2, "Broadcast Channel Protocols" on page 42) and the MHP APIs defined to interface to these protocols and to control these interfaces.
Bidirectional IP network interface	MHP terminals supporting the interactive broadcast profile shall support at least one network interface for bidirectional IP traffic. This shall support those interaction channel protocols supported by the MHP terminal (see 6.3, "Interaction Channel Protocols" on page 45) and the MHP APIs defined to interface to these protocols and to control these interfaces.
Conditional access	None required. The absence or optional presence of one shall be correctly reported through the Conditional access API. Local regulation may require more support than this minimum
Persistent storage	No requirement for storage which persists across interruption of power to an MHP.
Application accessible MPEG-2 section filters (note 2)	At least 2 shared among all applications signalled as part of the same service. (note 1).
Application accessible DVB-J threads (note 2)	At least 4 shared among all applications signalled as part of the same service. Threads created by the platform and used to call methods of the application are excluded from this number. (note 1).
NOTE 1: These requirements apply to one set of MHP applications signalled as part of the same service. If an MHP terminal supports simultaneous execution of more than one set of signalled applications then it shall make available at least these minimum resources for each set of signalled applications which can be executed simultaneously.	
NOTE 2: "Application accessible" means guaranteed to be accessible to MHP applications through the API defined in this specification for the feature concerned. This must be regardless of the extent of any usage of that feature or function as part of the MHP terminal implementation.	

Annex H (informative): Extensions

Private protocols and possibly APIs are not precluded and are outside of the scope of the MHP specification.

The addition of public or protected methods or fields to classes and interfaces in the `org.dvb` namespace is **not** allowed.

Annex I (normative): DVB-J fundamental classes

Package org.dvb.lang

Description

Provides those core platform related features not found in the java.lang package.

Class Summary

Classes

[DVBClassLoader](#)

This class loader is used to load classes and resources from a search path of URLs referring to locations where Java class files may be stored.

org.dvb.lang DVBClassLoader

Syntax

```
public class DVBClassLoader extends java.security.SecureClassLoader
```

```
java.lang.Object
|
+--java.lang.ClassLoader
|
+--java.security.SecureClassLoader
|
+--org.dvb.lang.DVBClassLoader
```

Description

This class loader is used to load classes and resources from a search path of URLs referring to locations where Java class files may be stored.

The classes that are loaded are by default only allowed to load code through the parent classloader, or from the URLs specified when the DVBClassLoader was created.

Constructors

DVBClassLoader(URL[])

```
public DVBClassLoader(java.net.URL[] URLs)
```

Constructs a new DVBClassLoader for the given URLs. The URLs will be searched in the order specified for classes and resources.

If there is a security manager, this method first calls the security manager's `checkCreateClassLoader` method to ensure creation of a class loader is allowed.

Parameters:

URLs - the URLs from which to load classes and resources

Throws:

`SecurityException` - if a security manager exists and its `checkCreateClassLoader` method doesn't allow creation of a class loader.

See Also:

`SecurityManager`

DVBClassLoader(URL[], ClassLoader)

```
public DVBClassLoader(java.net.URL[] URLs, java.lang.ClassLoader parent)
```

Constructs a new DVBClassLoader for the given URLs. The URLs will be searched in the order specified for classes and resources.

If there is a security manager, this method first calls the security manager's `checkCreateClassLoader` method to ensure creation of a class loader is allowed.

Parameters:

URLs - the URLs from which to load classes and resources

parent - the parent classloader for delegation

Throws:

`SecurityException` - if a security manager exists and its `checkCreateClassLoader` method doesn't allow creation of a class loader.

See Also:

`SecurityManager`

Methods

findClass(String)

```
public java.lang.Class findClass(java.lang.String name)
```

Finds and loads the class with the specified name from the URL search path. Any URLs are searched until the class is found.

Parameters:

`name` - the name of the class.

Returns:

the resulting class.

Throws:

`ClassNotFoundException` - if the named class could not be found.

newInstance(URL[])

```
public static DVBClassLoader newInstance(java.net.URL[] URLs)
```

Creates a new instance of `DVBClassLoader` for the specified URLs. If a security manager is installed, the `loadClass` method of the `DVBClassLoader` returned by this method will invoke the `SecurityManager.checkPackageAccess` method before loading the class.

Parameters:

`URLs` - the URLs to search for classes and resources.

Returns:

the resulting class loader

newInstance(URL[], ClassLoader)

```
public static DVBClassLoader newInstance(java.net.URL[] URLs, java.lang.ClassLoader parent)
```

Creates a new instance of `DVBClassLoader` for the specified URLs. If a security manager is installed, the `loadClass` method of the `DVBClassLoader` returned by this method will invoke the `SecurityManager.checkPackageAccess` method before loading the class.

Parameters:

`URLs` - the URLs to search for classes and resources.

`parent` - the parent class loader for delegation.

Returns:

the resulting class loader

Annex J (normative): DVB-J event API

Applications can use the `org.dvb.event` API, to receive events without being focused and/or to have exclusive access to events.

J.1 Overview

This API provides a mechanism allowing MHP applications to influence the routing of events to either MHP applications or the navigator. This typically would be used in a mode where the receiver is primarily used for TV viewing, allowing some events to be received by the application, and allowing the navigator to receive those events that are not requested by any MHP application. This API enables MHP applications to choose between the following mechanisms for receiving events:

- through the standard `java.awt` mechanism,
- through the standard `java.awt` mechanism, but for some events to be exclusively accessed by the application,
- through a mechanism defined by this API,
- through the mechanism defined by this API, but for some events to be exclusively accessed by the application.

The last two solutions could be used by non-graphical applications in order to receive events that are coming from the user. It could also be used by an invisible application if it wants to be presented when a specific key is pressed.

If an application wants to have exclusive access to some events and to manage them through the `java.awt` then it must use this API so that it can be aware of the fact that it has lost or gained access to these events. One must notice that an application based on `awt` event mechanism will receive events only if it is focused.

The diagram below shows how an event is dispatched depending on how it was requested:

```

User Event
|
|
. Is it in a repository used by the Event Manager
| or is there an application with AWT focus
| |
yes  no
|   |
|   |--> send the event to the navigator
|
. Is it in a repository used by the Event Manager?
| |
yes  no
|   |
|   |--> send the event to the awt application which is focused.
|
. Is it an exclusive event?
| |
yes  no
|   |
|   |--> send the event to the applications which do not use the awt
|       event mechanism and have asked for this event.
|
. Was it acquired by an awt application?
| |
yes  no

```

```

|   |
|   .-> send the event to the application which does not use the
|       awt event mechanism and has asked for an exclusive access
|       to this event.
|
|
. -----> send the event to the application if it is focused.

```

J.2 The resource management

An application asking for exclusive access to some events will use the resource framework defined in [DAVIC 1.4.1p9 \[3\]](#) so that it can be aware of the fact that it has lost access to the user events it asked for (see the example below).

J.3 The Event Repository

The `UserEventRepository` is the class that is used by the application to define the user events it intends to use. For the moment user events are just key events but it is a place-holder for new families of events (voice command for example). If an application asks for an exclusive access to events by means of a repository, this exclusive access will be lost at the time when one of the event is grabbed by another application. User events that can be accessed by an application are defined in the `UserEvent` class.

J.3.1 Example

exclusive access to events for a non-focused application

```

import org.davic.resources.ResourceClient.* ;
import org.dvb.event.* ;
class Example implements UserEventListener, ResourceStatusListener, ResourceClient {
    private int myStatus ;
    public Example () {
        EventManager em ;
        UserEventRepository repository ;
        em = EventManager.getInstance () ;
        repository = new UserEventRepository ("R1") ;
        repository.addKey (UserEvent.VK_ENTER) ;
        em.addUserListener ((UserEventListener)this, (ResourceClient)this, repository) ;
        em.addResourceStatusEventListener (this) ;
    }
    /**
     * methods defined by the UserEventListener interface.
     */
    public void UserEventReceived (UserEvent e) {
    }
    /**
     * Methods defined by the ResourceClient interface.
     */
    /**
     * In the case a cooperative application asks for an user event
     * exclusively used by me.
     */
    public boolean requestRelease(ResourceProxy proxy, Object requestData) {
        String name ;
        // let's retrieve the name of the repository, that I have created, and

```

```
// which contains the user event that the other application asks for.
name = (RepositoryDescriptor)proxy.getName () ;
if ((name.compareTo ("R1") == 0) & (myStatus == ...)) {
    // Ok I release this event.
    return true ;
} else {
    // No I need this event, sorry !
    return false ;
}
}
public void release (ResourceProxy proxy) {
    ...
}
public void notifyRelease (ResourceProxy proxy) {
    ...
}
public void statusChanged (ResourceStatusEvent event) {
    ...
}
}
```

Package org.dvb.event

Description

Provides access to user input events before they are processed through the event mechanism of the java.awt package.

Class Summary	
Interfaces	
<code>UserEventListener</code>	The listener interface for receiving user inputs.
Classes	
<code>EventManager</code>	The event manager allows an application to receive events coming from the user.
<code>OverallRepository</code>	This class defines a repository which contains all the user events defined in the <code>UserEvent</code> class.
<code>RepositoryDescriptor</code>	An instance of this class will be sent to clients of the DVB event API to notify them (through the interface <code>org.davic.resources.ResourceClient</code>) when they are about to lose, or have lost, access to an event source.
<code>UserEvent</code>	Represents a user event.
<code>UserEventRepository</code>	The application will use this class to define the events that it wants to receive.

org.dvb.event EventManager

Syntax

```
public final class EventManager implements org.davic.resources.ResourceServer
java.lang.Object
|
+--org.dvb.event.EventManager
```

All Implemented Interfaces:

org.davic.resources.ResourceServer

Description

The event manager allows an application to receive events coming from the user. These events can be sent exclusively to an application or can be shared between applications. The Event Manager allows also the application to ask for exclusive access to some events, these events being received either from the standard java.awt event mechanism or by the mechanism defined in this package. The EventManager is a singleton.

The right to receive events is considered as the same resource regardless of whether it is being handled exclusively or shared. An application successfully obtaining exclusive access to an event results in all other applications loosing access to that event, whether the access of those applications was shared or exclusive.

Methods

addExclusiveAccessToAWTEvent(ResourceClient, UserEventRepository)

```
public boolean addExclusiveAccessToAWTEvent(org.davic.resources.ResourceClient client,
      UserEventRepository userEvents)
```

An application should use this method to express its intend to have exclusive access to some events, but for these events to be received through the java.awt mechanism. The events the application wishes to receive are defined by the means of the UserEventRepository class. This repository is resolved at the time when this method call is made and adding or removing events from the repository after this method call doesn't affect the subscription to those events. An exclusive event will be sent to the application if this latest is focused.

Parameters:

`client` - resource client.

`userEvents` - the user events the application wants to be inform of.

Returns:

true if the events defined in the repository have been acquired, false otherwise.

Throws:

`IllegalArgumentException` - if the client argument is set to null.

addResourceStatusEventListener(ResourceStatusListener)

```
public void addResourceStatusEventListener(org.davic.resources.ResourceStatusListener
      listener)
```

Adds the specified resource status listener so that an application can be aware of any changes regarding exclusive access to some events.

Specified By:

`org.davic.resources.ResourceServer.addResourceStatusEventListener(org.davic.resources.ResourceStatusListener)` in interface `org.davic.resources.ResourceServer`

Parameters:

`listener` - the resource status listener.

addUserEventListener(UserEventListener, ResourceClient, UserEventRepository)

```
public boolean addUserEventListener(UserEventListener listener,
    org.davic.resources.ResourceClient client, UserEventRepository userEvents)
```

Adds the specified listener to receive events coming from the user in an exclusive manner. The events the application wishes to receive are defined by the means of the `UserEventRepository` class. This repository is resolved at the time when this method call is made and adding or removing events from the repository after this method call doesn't affect the subscription to those events. The `ResourceClient` parameter indicates that the application wants to have an exclusive access to the user event defined in the repository.

Parameters:

`listener` - the listener to receive the user events.

`client` - resource client.

`userEvents` - a class which contains the user events it wants to be informed of.

Returns:

true if the events defined in the repository have been acquired, false otherwise.

Throws:

`IllegalArgumentException` - if the client argument is set to null.

addUserEventListener(UserEventListener, UserEventRepository)

```
public void addUserEventListener(UserEventListener listener,
    UserEventRepository userEvents)
```

Adds the specified listener to receive events coming from the user. The events the application wishes to receive are defined by the means of the `UserEventRepository` class. This repository is resolved at the time when this method call is made and adding or removing events from the repository after this method call doesn't affect the subscription to those events.

Parameters:

`listener` - the listener to receive the user events.

`userEvents` - a class which contains the user events it wants to be informed of.

getInstance()

```
public static EventManager getInstance()
```

This method returns the sole instance of the `EventManager` class. The `EventManager` class is a singleton.

Returns:

the instance of the `EventManager`.

removeExclusiveAccessToAWTEvent(ResourceClient)

```
public void removeExclusiveAccessToAWTEvent(org.davic.resources.ResourceClient client)
```

The application should use this method to release its exclusive access to user events defined by the means of the `addExclusiveAccessToAWTEvent` method.

Parameters:

`client` - the client that is no longer interested in events previously registered.

removeResourceStatusEventListener(ResourceStatusListener)

```
public void removeResourceStatusEventListener(org.davic.resources.ResourceStatusListener listener)
```

Removes the specified resource status listener.

Specified By:

`org.davic.resources.ResourceServer.removeResourceStatusEventListener(org.davic.resources.ResourceStatusListener)` in interface `org.davic.resources.ResourceServer`

Parameters:

`listener` - the listener to remove.

removeUserEventListener(UserEventListener)

```
public void removeUserEventListener(UserEventListener listener)
```

Removes the specified listener so that it will no longer receives user events. If it is appropriate (i.e. the application has asked for an exclusive access), the exclusive access is lost.

Parameters:

`listener` - the user event listener.

org.dvb.event OverallRepository

Syntax

```
public class OverallRepository extends UserEventRepository
```

```
java.lang.Object
|
+--UserEventRepository
|
+--org.dvb.event.OverallRepository
```

Description

This class defines a repository which contains all the user events defined in the UserEvent class. For example, this pre-defined repository could be used by an application, which requires a pin code from the user, in order to prevent another applications from receiving events.

See Also:

[UserEvent](#)

Constructors

OverallRepository()

```
public OverallRepository()
```

The constructor for the repository.

org.dvb.event RepositoryDescriptor

Syntax

```
public class RepositoryDescriptor implements org.davic.resources.ResourceProxy
```

```
java.lang.Object  
|  
+--org.dvb.event.RepositoryDescriptor
```

All Implemented Interfaces:

org.davic.resources.ResourceProxy

Description

An instance of this class will be sent to clients of the DVB event API to notify them (through the interface `org.davic.resources.ResourceClient`) when they are about to lose, or have lost, access to an event source. This object can be used by the application to get the name of the repository from which it will no longer be able to receive events.

Methods

getClient()

```
public org.davic.resources.ResourceClient getClient()
```

Return the object which asked to be notified about withdrawal of the event source. This is the object passed as the `ResourceClient` to whichever of the various 'add' methods on `ResourceManager` was used by the application to express interest in this repository.

Specified By:

`org.davic.resources.ResourceProxy.getClient()` in interface `org.davic.resources.ResourceProxy`

Returns:

the object which asked to be notified about withdrawal of the event source

getName()

```
public java.lang.String getName()
```

Returns the name of the repository to which the lost user event belongs.

Returns:

String the name of the repository.

org.dvb.event UserEvent

Syntax

```
public class UserEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.event.UserEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

Represents a user event. A user event is defined by a family, a type and either a code or a character. Unless stated otherwise, all constants used in this class are defined in `java.awt.event.KeyEvent` and its parent classes.

Fields

UEF_KEY_EVENT

```
public static final int UEF_KEY_EVENT
```

the family for events that are coming from the remote control or from the keyboard.

Constructors

UserEvent(Object, int, char)

```
public UserEvent(java.lang.Object source, int family, char keyChar)
```

Constructor for a new `UserEvent` object representing a key being typed. This is the combination of a key being pressed and then being released. The type of `UserEvents` created with this constructor shall be `KEY_TYPED`. Key combinations which do not result in characters, such as action keys like F1, shall not generate `KEY_TYPED` events.

Parameters:

`source` - the `EventManager` which is the source of the event

`family` - the event family.

`keyChar` - the character typed

Since:

MHP 1.0.1

UserEvent(Object, int, int, int, int)

```
public UserEvent(java.lang.Object source, int family, int type, int code, int modifiers)
```

Constructor for a new UserEvent object representing a key being pressed.

Parameters:

`source` - the `EventManager` which is the source of the event

`family` - the event family.

`type` - the event type. Either one of `KEY_PRESSED` or `KEY_RELEASED`.

`code` - the event code. One of the constants whose name begins in "VK_" defined in `java.ui.event.KeyEvent` or `org.havi.ui.event`.

`modifiers` - the modifiers active when the key was pressed. These have the same semantics as modifiers in `java.awt.event.KeyEvent`.

Methods

getCode()

```
public int getCode()
```

Returns the event code. For `KEY_TYPED` events, the code is `VK_UNDEFINED`.

Returns:

an int representing the event code.

getFamily()

```
public int getFamily()
```

Returns the event family. Could be `UEF_KEY_EVENT`.

Returns:

an int representing the event family.

getKeyChar()

```
public char getKeyChar()
```

Returns the character associated with the key in this event. If no valid Unicode character exists for this key event, `keyChar` is `CHAR_UNDEFINED`.

Returns:

a character

Since:

MHP 1.0.1

getModifiers()

```
public int getModifiers()
```

Returns the modifiers flag for this event.

Returns:

the modifiers flag for this event

Since:
MHP 1.0.1

getType()

```
public int getType()
```

Returns the event type. Could be KEY_PRESSED, KEY_RELEASED or KEY_TYPED.

Returns:
an int representing the event type.

isAltDown()

```
public boolean isAltDown()
```

Returns whether or not the Alt modifier is down on this event.

Returns:
whether the Alt modifier is down on this event

Since:
MHP 1.0.1

isControlDown()

```
public boolean isControlDown()
```

Returns whether or not the Control modifier is down on this event.

Returns:
whether the Control modifier is down on this event

Since:
MHP 1.0.1

isMetaDown()

```
public boolean isMetaDown()
```

Returns whether or not the Meta modifier is down on this event.

Returns:
whether the Meta modifier is down on this event

Since:
MHP 1.0.1

isShiftDown()

```
public boolean isShiftDown()
```

Returns whether or not the Shift modifier is down on this event.

Returns:
whether the Shift modifier is down on this event

Since:
MHP 1.0.1

org.dvb.event UserEventListener

Syntax

```
public interface UserEventListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

The listener interface for receiving user inputs.

Methods

userEventReceived(UserEvent)

```
public void userEventReceived(UserEvent e)
```

Called by the platform when a user input is received.

Parameters:

e - the user input event which was received

org.dvb.event UserEventRepository

Syntax

```
public class UserEventRepository  
  
java.lang.Object  
|  
+--org.dvb.event.UserEventRepository
```

Direct Known Subclasses:

[OverallRepository](#)

Description

The application will use this class to define the events that it wants to receive. Events that are able to be put in the repository are defined in the `UserEvent` class.

Where a repository includes a `KeyPressed` type event without the `KeyReleased` type event for the same key code or vice versa then exclusive reservations shall be made for both event types but only the one requested shall be received by the listener. Where a repository includes a `KEY_TYPED` event without the corresponding `KEY_PRESSED` and `KEY_RELEASED` events (excluding `KEY_PRESSED` or `KEY_RELEASED` events for modifiers), when an exclusive reservations is requested, it shall also be made for those corresponding `KEY_PRESSED` and `KEY_RELEASED` events but only the requested event shall be received by the listener.

Repositories do not keep a count of the number of times a particular user event is added or removed. Repeatedly adding an event to a repository has no effect. Removing an event removes it regardless of the number of times it has been added. For example, `org.dvb.event.UserEventRepository.addUserEvent(UserEvent event)` does nothing in case that the event is already in the repository. Events are considered to be already in the repository if an event with the same triplet of family, type and code is already in the repository.

Repositories are resolved when they are passed into the methods of `EventManager`. Adding or removing events from the repository after those method calls does not affect the subscription to those events.

See Also:

[UserEvent](#)

Constructors

UserEventRepository(String)

```
public UserEventRepository(java.lang.String name)
```

The method to construct a new `UserEventRepository`.

Parameters:

`name` - the name of the repository.

Methods

addAllArrowKeys()

```
public void addAllArrowKeys()
```

Adds the key codes for the arrow keys (VK_LEFT, VK_RIGHT, VK_UP, VK_DOWN). Any key codes already in the repository will not be added again.

addAllColourKeys()

```
public void addAllColourKeys()
```

Adds the key codes for the colour keys (VK_COLORED_KEY_0, VK_COLORED_KEY_1, VK_COLORED_KEY_2, VK_COLORED_KEY_3). Any key codes already in the repository will not be added again.

addAllNumericKeys()

```
public void addAllNumericKeys()
```

Adds the key codes for the numeric keys (VK_0, VK_1, VK_2, VK_3, VK_4, VK_5, VK_6, VK_7, VK_8, VK_9). Any key codes already in the repository will not be added again.

addKey(int)

```
public void addKey(int keycode)
```

A shortcut to create a new key event type entry in the repository. If a key is already in the repository, this method has no effect.

Parameters:

keycode - the key code.

addUserEvent(UserEvent)

```
public void addUserEvent(UserEvent event)
```

Adds the given user event to the repository.

Parameters:

event - the user event to be added in the repository.

getUserEvent()

```
public UserEvent[] getUserEvent()
```

Returns the list of the user events that are in the repository.

Returns:

an array which contains the user events that are in the repository.

removeAllArrowKeys()

```
public void removeAllArrowKeys()
```

Removes the key codes for the arrow keys (VK_LEFT, VK_RIGHT, VK_UP, VK_DOWN). Key codes from this set which are not present in the repository will be ignored.

removeAllColourKeys()

```
public void removeAllColourKeys()
```

Removes the key codes for the colour keys (VK_COLORED_KEY_0, VK_COLORED_KEY_1, VK_COLORED_KEY_2, VK_COLORED_KEY_3). Key codes from this set which are not present in the repository will be ignored.

removeAllNumericKeys()

```
public void removeAllNumericKeys()
```

Remove the key codes for the numeric keys (VK_0, VK_1, VK_2, VK_3, VK_4, VK_5, VK_6, VK_7, VK_8, VK_9). Key codes from this set which are not present in the repository will be ignored.

removeKey(int)

```
public void removeKey(int keycode)
```

The method to remove a key from the repository. Removing a key which is not in the repository has no effect.

Parameters:

`keycode` - the key code.

removeUserEvent(UserEvent)

```
public void removeUserEvent(UserEvent event)
```

Remove a user event from the repository. Removing a user event which is not in the repository shall have no effect.

Parameters:

`event` - the event to be removed from the repository.

Annex K (normative): DVB-J persistent storage API

Package org.dvb.io.persistent

Description

Provides extensions to the java.io package for access to files held in persistent storage.

Class Summary

Classes

<code>FileAccessPermissions</code>	This class encapsulates file access permissions, world, Organisation and owner.
<code>FileAttributes</code>	This class encapsulates the attributes of a file stored in persistent storage.

org.dvb.io.persistent FileAccessPermissions

Syntax

```
public class FileAccessPermissions
    java.lang.Object
    |
    +--org.dvb.io.persistent.FileAccessPermissions
```

Description

This class encapsulates file access permissions, world, Organisation and owner. World means all applications authorised to access persistent storage. Owner means the application which created the file. Organisation is defined as applications with the same organisation id as defined elsewhere in this specification.

Constructors

FileAccessPermissions(boolean, boolean, boolean, boolean, boolean, boolean)

```
public FileAccessPermissions(boolean readWorldAccessRight, boolean writeWorldAccessRight,
    boolean readOrganisationAccessRight, boolean writeOrganisationAccessRight,
    boolean readApplicationAccessRight, boolean writeApplicationAccessRight)
```

This constructor encodes all the file access permissions as a set of booleans.

Parameters:

readWorldAccessRight - read access for all applications
 writeWorldAccessRight - write access for all applications
 readOrganisationAccessRight - read access for organisation
 writeOrganisationAccessRight - write access for organisation
 readApplicationAccessRight - read access for the owner
 writeApplicationAccessRight - write access for the owner

Methods

hasReadApplicationAccessRight()

```
public boolean hasReadApplicationAccessRight()
```

Query whether this permission includes read access for the owning application

Returns:

true if the owning application can have read access, otherwise false.

hasReadOrganisationAccessRight()

```
public boolean hasReadOrganisationAccessRight()
```

Query whether this permission includes read access for the organisation

Returns:

true if applications in this organisation can have read access, otherwise false.

hasReadWorldAccessRight()

```
public boolean hasReadWorldAccessRight()
```

Query whether this permission includes read access for the world.

Returns:

true if all applications can have read access, otherwise false.

hasWriteApplicationAccessRight()

```
public boolean hasWriteApplicationAccessRight()
```

Query whether this permission includes write access for the owning application

Returns:

true if the owning application can have write access, otherwise false.

hasWriteOrganisationAccessRight()

```
public boolean hasWriteOrganisationAccessRight()
```

Query whether this permission includes write access for the organisation

Returns:

true if applications in this organisation can have read access, otherwise false.

hasWriteWorldAccessRight()

```
public boolean hasWriteWorldAccessRight()
```

Query whether this permission includes write access for the world.

Returns:

true if all applications can have write access, otherwise false.

setPermissions(boolean, boolean, boolean, boolean, boolean, boolean)

```
public void setPermissions(boolean ReadWorldAccessRight, boolean WriteWorldAccessRight,  
    boolean ReadOrganisationAccessRight, boolean WriteOrganisationAccessRight,  
    boolean ReadApplicationAccessRight, boolean WriteApplicationAccessRight)
```

This method allows to modify the permissions on this instance of the FileAccessPermission class.

Parameters:

ReadWorldAccessRight - read access for all applications

WriteWorldAccessRight - write access for all applications

ReadOrganisationAccessRight - read access for organisation

WriteOrganisationAccessRight - write access for organisation

ReadApplicationAccessRight - read access for the owner

WriteApplicationAccessRight - write access for the owner

org.dvb.io.persistent FileAttributes

Syntax

```
public class FileAttributes
|
|  java.lang.Object
|  |
|  |--org.dvb.io.persistent.FileAttributes
```

Description

This class encapsulates the attributes of a file stored in persistent storage. The default attributes for a file are low priority, owner read / write only permissions and null expiration date.

Fields

PRIORITY_HIGH

```
public static final int PRIORITY_HIGH
Value for use as a file priority.
```

PRIORITY_LOW

```
public static final int PRIORITY_LOW
Value for use as a file priority.
```

PRIORITY_MEDIUM

```
public static final int PRIORITY_MEDIUM
Value for use as a file priority.
```

Methods

getExpirationDate()

```
public java.util.Date getExpirationDate()
```

Returns the expiration date. It will return the value used by the platform, which need not be the same as the value set.

Returns:

the expiration date

getFileAttributes(File)

```
public static FileAttributes getFileAttributes(java.io.File f)
```

Get the attributes of a file.

Parameters:

`f` - the file to use

Returns:

a copy of the attributes of a file

Throws:

`SecurityException` - if the application is denied access to the file or to directories needed to reach the file by security policy

`IOException` - if access to the file fails due to an IO error or if the file reference is not to a valid location in persistent storage

getPermissions()

```
public FileAccessPermissions getPermissions()
```

Returns the file access permissions

Returns:

the file access permissions

getPriority()

```
public int getPriority()
```

Returns the priority to use in persistent storage

Returns:

the priority

setExpirationDate(Date)

```
public void setExpirationDate(java.util.Date d)
```

Sets the expiration date. This field is a hint to the platform to identify the date after which a file is no longer useful as perceived by the application. The platform may choose to use a different date than the one given as a parameter.

Parameters:

`d` - the expiration date

setFileAttributes(FileAttributes, File)

```
public static void setFileAttributes(FileAttributes p, java.io.File f)
```

Associate a set of file attributes with a file.

Parameters:

`p` - the file attributes to use

`f` - the file to use

Throws:

`SecurityException` - if the application is either denied access to the file or directories needed to reach the file by security policy or is not authorised to modify the attributes of the file.

`IOException` - if access to the file fails due to an IO error or if the file reference is not to a valid location in persistent storage

setPermissions(FileAccessPermissions)

```
public void setPermissions(FileAccessPermissions p)
```

Sets the file access permissions.

Parameters:

`p` - the file access permissions

setPriority(int)

```
public void setPriority(int priority)
```

Sets the priority to use in persistent storage

Parameters:

`priority` - the priority to set

Annex L (normative): User Settings and Preferences API

Package org.dvb.user

Description

Provides access to settings and preferences configured by the end-user.

Class Summary	
Interfaces	
<code>UserPreferenceChangeListener</code>	An application wishing to be informed of any change to a user preference implements this interface.
Classes	
<code>Facility</code>	A facility maps a preference's name to a single value or to an array of values.
<code>GeneralPreference</code>	This class defines a set of general preferences.
<code>Preference</code>	This abstract class defines the Preference object.
<code>UserPreferenceChangeEvent</code>	This class defines the event sent to appropriate listeners when a user preference has been changed.
<code>UserPreferenceManager</code>	The <code>UserPreferenceManager</code> class gives access to the user preference settings.
<code>UserPreferencePermission</code>	This class is for user preference and setting permissions.
Exceptions	
<code>UnsupportedPreferenceException</code>	Thrown when a non-supported preference is used.

org.dvb.user Facility

Syntax

```
public class Facility
```

```
java.lang.Object
```

```
|
```

```
+--org.dvb.user.Facility
```

Description

A facility maps a preference's name to a single value or to an array of values. A facility enables an application to define the list of values supported for a specified preference. For example, if an application is available in English or French then it can create a Facility ("User Language", {"English", "French"}). When the application will retrieve the "User Language" from the general preference it will specify the associated facility in order to get a Preference which will contain a set a values compatible with those supported by the application.

Constructors

Facility(String, String)

```
public Facility(java.lang.String preference, java.lang.String value)
```

Creates a Facility with a single value. This facility can be used by an application to retrieve a preference compatible with its capabilities.

Parameters:

`preference` - a String representing the name of the preference.

`value` - a String representing the value of the preference.

Facility(String, String[])

```
public Facility(java.lang.String preference, java.lang.String[] values)
```

Creates a Facility with a set of values. This facility can be used by an application to retrieve a preference compatible with its capabilities.

Parameters:

`preference` - a String representing the name of the preference.

`values` - an array of String representing the set of values.

org.dvb.user GeneralPreference

Syntax

```
public final class GeneralPreference extends Preference
```

```
java.lang.Object
|
+--Preference
|
+--org.dvb.user.GeneralPreference
```

Description

This class defines a set of general preferences. These preferences are read from the receiver and each application (downloaded or not) can access them through the `UserPreferenceManager.read` method. The standardized preferences are "User Language", "Parental Rating", "User Name", "User Address", "User @", "Country Code", "Default Font Size".

When constructed, objects of this class are empty and have no values defined. Values may be added using the `add` methods inherited from the `Preference` class or by calling `UserPreferenceManager.read`.

The encodings of these standardized preferences are as follows.

- User Language: 3 letter ISO 639 language codes;
- Parental rating: string using the same encoding as returned by `javax.tv.service.guide.ContentRatingAdvisory.getDisplayText`;
- User name: name of the user, first name(s) first and last name last;
- User Address: postal address of the user, may contain multiple lines separated by carriage return characters (as defined in table D-4).
- User @: e-mail address of the user in the SMTP form as defined in RFC821;
- Country Code: two letter ISO 3166-1 country code;
- Default font size: preferred font size for normal body text expressed in points, decimal integer value encoded as a string (26 is the default; differing size indicates a preference of different font size than usual)

Constructors

GeneralPreference(String)

```
public GeneralPreference(java.lang.String name)
```

Constructs a `GeneralPreference` object. A general preference maps a preference name to a list of strings.

Parameters:

`name` - the general preference name.

Throws:

`IllegalArgumentException` - if the preference's name is not supported.

org.dvb.user Preference

Syntax

```
public abstract class Preference  
  
java.lang.Object  
|  
+--org.dvb.user.Preference
```

Direct Known Subclasses:

[GeneralPreference](#)

Description

This abstract class defines the Preference object. A Preference maps a name to a list of favourite values. The first element in the list is the favourite value for this preference.

Constructors

Preference()

```
protected Preference()
```

This protected constructor is only present to enable sub-classes of this one to be defined by the platform. It is not intended to be used by inter-operable applications.

Preference(String, String)

```
public Preference(java.lang.String name, java.lang.String value)
```

Creates a new preference with the specified name and the specified value. This single value will be the favourite one for this preference.

Parameters:

`name` - a String object representing the name of the preference.

`value` - a String object representing the value of the preference.

Preference(String, String[])

```
public Preference(java.lang.String name, java.lang.String[] value)
```

Creates a new preference with the specified name and the specified value set.

Parameters:

`name` - a String object representing the name of the preference.

`value` - an array of String objects representing the set of values for this preference ordered from the most favourite to the least favourite.

Methods

add(int, String)

```
public void add(int position, java.lang.String value)
```

Adds a new value for this preference. The value is inserted at the specified position. If the value is already in the list then it is moved to the position specified. If the position is greater than the length of the list, then the value is added to the end of this list. If the position is negative, then the value is added to the beginning of this list.

Parameters:

`position` - an int representing the position in the list.
`value` - a String representing the new value to insert.

add(String)

```
public void add(java.lang.String value)
```

Adds a new value for this preference. The value is added to the end of the list. If the value is already in the list then it is moved to the end of the list.

Parameters:

`value` - a String object representing the new value.

add(String[])

```
public void add(java.lang.String[] values)
```

Adds several new values for this preferences. The values are added to the end of the list in the same order as they are found in the array passed to this method. Any values already in the list are moved to the position in the list which they would have if they were not already present.

Parameters:

`values` - an array of strings representing the values to add

Since:

MHP 1.0.1

getFavourites()

```
public java.lang.String[] getFavourites()
```

Returns the list of favourite values for this preference. Returns an empty array if no value sets are defined for this preference.

Returns:

an array of String representing the favourite values for this preference.

getMostFavourite()

```
public java.lang.String getMostFavourite()
```

Returns the most favourite value for this preference, that is, the first element of the list.

Returns:

a String representing the favourite values Returns null if no value is defined for this preference.

getName()

```
public java.lang.String getName()
```

Returns the name of the preference.

Returns:

a String object representing the name of the preference.

getPosition(String)

```
public int getPosition(java.lang.String value)
```

Returns the position in the list of the specified value.

Parameters:

`value` - a String representing the value to look for.

Returns:

an integer representing the position of the value in the list counting from zero. If the value is not found then it returns -1.

hasValue()

```
public boolean hasValue()
```

Tests if this preference has at least one value set.

Returns:

true if this preference has at least one value set, false otherwise.

remove(String)

```
public void remove(java.lang.String value)
```

Removes the specified value from the list of favourites. If the value is not in the list then the method call has no effect.

Parameters:

`value` - a String representing the value to remove.

removeAll()

```
public void removeAll()
```

Removes all the values of a preference

Since:

MHP 1.0.1

setMostFavourite(String)

```
public void setMostFavourite(java.lang.String value)
```

Sets the most favourite value for this preference. If the value is already in the list, then it is moved to the head. If the value is not already in the list then it is added at the head.

Parameters:

`value` - the most favourite value

toString()

```
public java.lang.String toString()
```

Convert name and favourites to a String.

Overrides:

`java.lang.Object.toString()` in class `java.lang.Object`

Returns:

the preference name and favourites

org.dvb.user

UnsupportedPreferenceException

Syntax

```
public class UnsupportedPreferenceException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--org.dvb.user.UnsupportedPreferenceException
```

All Implemented Interfaces:

java.io.Serializable

Description

Thrown when a non-supported preference is used.

Constructors

UnsupportedPreferenceException()

```
public UnsupportedPreferenceException()
```

Constructs a `UnsupportedPreferenceException` with no detail message.

UnsupportedPreferenceException(String)

```
public UnsupportedPreferenceException(java.lang.String a)
```

Constructs a `UnsupportedPreferenceException` with a detail message.

Parameters:

a - the detail message

org.dvb.user

UserPreferenceChangeEvent

Syntax

```
public class UserPreferenceChangeEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.user.UserPreferenceChangeEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This class defines the event sent to appropriate listeners when a user preference has been changed.

Constructors

UserPreferenceChangeEvent(String)

```
public UserPreferenceChangeEvent(java.lang.String preferenceName)
```

Constructs a new event.

Parameters:

preferenceName - the name of the modified preference.

Methods

getName()

```
public java.lang.String getName()
```

Returns the name of the modified Preference

Returns:

the Preference name.

org.dvb.user

UserPreferenceChangeListener

Syntax

```
public interface UserPreferenceChangeListener
```

Description

An application wishing to be informed of any change to a user preference implements this interface.

Methods

receiveUserPreferenceChangeEvent(UserPreferenceChangeEvent)

```
public void receiveUserPreferenceChangeEvent (UserPreferenceChangeEvent e)
```

This method is called when a user preference changes.

Parameters:

e - the event notifying this event.

org.dvb.user UserPreferenceManager

Syntax

```
public class UserPreferenceManager
    java.lang.Object
    |
    +--org.dvb.user.UserPreferenceManager
```

Description

The `UserPreferenceManager` class gives access to the user preference settings. This class provides a set of methods that allow an application to read or save user settings. It also provides a mechanism to notify applications when a preference has been modified. The value of a user setting, retrieved with the `read` method, is a copy of the value that is stored in the receiver. The `write` method, if authorized, overwrites the stored value.

Methods

addUserPreferenceChangeListener(UserPreferenceChangeListener)

```
public void addUserPreferenceChangeListener(UserPreferenceChangeListener l)
```

Adds a listener for changes in user preferences.

Parameters:

l - the listener to add.

getInstance()

```
public static UserPreferenceManager getInstance()
```

Return an instance of the `UserPreferenceManager` for this application. Repeated calls to this method by the same application shall return the same instance.

Returns:

an instance of `UserPreferenceManager`

read(Preference)

```
public void read(Preference p)
```

Allows an application to read a specified user preference.

Parameters:

p - an object representing the preference to read.

Throws:

`SecurityException` - if the calling application is denied access to this preference

read(Preference, Facility)

```
public void read(Preference p, Facility facility)
```

Allows an application to read a specified user preference taking into account the facility defined by the application. If the intersection between the two sets of values is empty then the preference will have no value. If there is a mis-match between the name of the preference used when constructing the facility and the name of the preference used in this method then the preference will have no value.

Parameters:

- `p` - an object representing the preference to read.
- `facility` - the preferred values the application for the preference

Throws:

- `SecurityException` - if the calling application is denied access to this preference

removeUserPreferenceChangeListener(UserPreferenceChangeListener)

```
public void removeUserPreferenceChangeListener(UserPreferenceChangeListener l)
```

Removes a listener for changes in user preferences.

Parameters:

- `l` - the listener to remove.

write(Preference)

```
public void write(Preference p)
```

Saves the specified user preference. If this method succeeds then it will change the value of this preference for all future MHP applications.

Parameters:

- `p` - the preference to save.

Throws:

- `UnsupportedPreferenceException` - if the preference provided is not a standardized preference as defined for use with `GeneralPreference`.

- `java.lang.SecurityException` - if the application does not have permission to call this method

- `IOException` - if saving the preference fails for other reasons

org.dvb.user UserPreferencePermission

Syntax

```
public class UserPreferencePermission extends java.security.BasicPermission
```

```
java.lang.Object
|
+--java.security.Permission
|
+--java.security.BasicPermission
|
+--org.dvb.user.UserPreferencePermission
```

All Implemented Interfaces:

java.security.Guard, java.io.Serializable

Description

This class is for user preference and setting permissions. A UserPreferencePermission contains a name, but no actions list.

The permission name can either be "read" or "write". The "read" permission allows an application to read the user preferences and settings (using `UserPreferenceManager.read`) for which read access is not always granted. Access to the following settings/preferences is always granted: "User Language", "Parental Rating", "Default Font Size" and "Country Code"

The "write" permission allows an application to modify user preferences and settings (using `UserPreferenceManager.write`).

Constructors

UserPreferencePermission(String)

```
public UserPreferencePermission(java.lang.String name)
```

Creates a new UserPreferencePermission with the specified name. The name is the symbolic name of the UserPreferencePermission.

Parameters:

`name` - the name of the UserPreferencePermission

UserPreferencePermission(String, String)

```
public UserPreferencePermission(java.lang.String name, java.lang.String actions)
```

Creates a new UserPreferencePermission object with the specified name. The name is the symbolic name of the UserPreferencePermission, and the actions String is unused and should be null. This constructor exists for use by the Policy object to instantiate new Permission objects.

Parameters:

`name` - the name of the UserPreferencePermission

`actions` - should be null.

Annex M (normative): SI Access API

Package org.dvb.si

Description

Provides access to DVB service information.

General Design

Many of the methods in this package use a common design template. Asynchronous method calls to retrieve data from the network all return an instance of the `SIRequest` class. Applications may use this to inquire about or terminate the retrieval operation. When the retrieval operation completes, an instance of a subclass of `SIRetrievalEvent` will be sent to the `SIRetrievalListener` which the application passed in as a parameter to the original method call to retrieve data from the network. When constructing these events, the platform shall provide as the request parameter to the event constructor, the same instance of the `SIRequest` class as was returned by the original method call which started the retrieval operation. This `SIRequest` instance shall be returned by the `getSource` method on such events.

Class Summary	
Interfaces	
<code>DescriptorTag</code>	This interface defines constants corresponding to the most common descriptor tags.
<code>PMTElementaryStream</code>	This interface represents an elementary stream of a service.
<code>PMTService</code>	This interface represents a particular service carried by a transport stream.
<code>PMTStreamType</code>	This interface defines the constants corresponding to the different stream types
<code>SIBouquet</code>	This interface (together with the <code>SITransportStreamBAT</code> interface) represents a sub-table of the Bouquet Association Table (BAT) describing a particular bouquet.
<code>SIEvent</code>	This interface represents a particular event within a service.
<code>SIInformation</code>	This interface groups the common features of <code>SIBouquet</code> , <code>SINetwork</code> , <code>SITransportStream</code> , <code>SIService</code> , <code>PMTService</code> , <code>SIEvent</code> , <code>SITime</code> and <code>PMTElementaryStream</code> .
<code>SIIterator</code>	Objects implementing <code>SIIterator</code> interface allow to browse through a set of SI objects.
<code>SIMonitoringListener</code>	This interface shall be implemented by using application classes in order to listen to changes in monitored SI objects.
<code>SIMonitoringType</code>	This interface defines the constants corresponding to the SI information type values in <code>SIMonitoringEvent</code> .
<code>SINetwork</code>	This interface (together with the <code>SITransportStreamNIT</code> interface) represents a sub-table of the Network Information Table (NIT) describing a particular network.
<code>SIRetrievalListener</code>	This interface shall be implemented by application classes in order to receive events about completion of SI requests.
<code>SIRunningStatus</code>	This interface defines the constants corresponding to the running status values for services and events.
<code>SIService</code>	This interface represents a particular service carried by a transport stream.

Class Summary	
<code>SIServiceType</code>	This interface defines constants corresponding to the different service types.
<code>SITime</code>	This interface represents the Time and Date Table (TDT) and the (optional) Time Offset Table (TOT).
<code>SITransportStream</code>	This interface is the base interface for representing information about transport streams.
<code>SITransportStreamBAT</code>	This interface represents information about transport streams that has been retrieved from a BAT table.
<code>SITransportStreamDescription</code>	This interface represents the Transport Stream Description Table (TSDT).
<code>SITransportStreamNIT</code>	This interface represents information about transport streams that has been retrieved from a NIT table.
<code>TextualServiceIdentifierQuery</code>	An interface that can be implemented by objects representing DVB services.
Classes	
<code>Descriptor</code>	This class represents a descriptor within a sub-table.
<code>SIDatabase</code>	This class represents the root of the SI information hierarchy.
<code>SILackOfResourcesEvent</code>	This event is sent in response to a SI retrieval request when the resources needed for retrieving the data are not available, e.g.
<code>SIMonitoringEvent</code>	Objects of this class are sent to listener objects of the using application to notify that a change in the monitored information has happened.
<code>SINotInCacheEvent</code>	This event is sent in response to a SI retrieval request when the request was made with the FROM_CACHE_ONLY mode and the requested data is not present in the cache.
<code>SIOBJECTNotInTableEvent</code>	This event is sent in response to a SI retrieval request when the SI table where the information about the requested object should be located has been retrieved but the requested object is not present in it.
<code>SIRequest</code>	Object instances of this class represent SI retrieval requests made by the application.
<code>SIRequestCancelledEvent</code>	This event is sent in response to a SI retrieval request when the request is cancelled with the <code>SIRequest.cancelRequest</code> method call.
<code>SIRetrievalEvent</code>	This class is the base class for events about completion of a SI retrieval request.
<code>SISuccessfulRetrieveEvent</code>	This event is sent in response to a SI retrieval request when the retrieve request was successfully completed.
<code>SITableNotFoundEvent</code>	This event is sent in response to a SI retrieval request when the SI table that should contain the requested information could not be retrieved.
<code>SITableUpdatedEvent</code>	This event is sent in response to a SI descriptor retrieval request when the table carrying the information about the object has been updated and the set of descriptors consistent with the old object can not be retrieved.
<code>SIUtil</code>	This class contains SI related utility functions.
Exceptions	
<code>SIException</code>	This class is the root of the SI exceptions hierarchy.
<code>SIIllegalArgumentException</code>	This exception is thrown when one or more of the arguments passed to a method are invalid (e.g.

Class Summary`SIInvalidPeriodException`

This exception is thrown when a specified period is invalid (for example, start time is after the end time)

org.dvb.si Descriptor

Syntax

```
public class Descriptor
{
    java.lang.Object
    |
    +--org.dvb.si.Descriptor
}
```

Description

This class represents a descriptor within a sub-table.

A descriptor consist of three fields: a tag, a contentLength and the content.

The tag uniquely identifies the descriptor type. The content length indicates the number of bytes in the content. The content consists of an array of bytes of length content length. The data represented by the content is descriptor type dependent.

See Also:

[DescriptorTag](#)

Methods

getBytesAt(int)

```
public byte getBytesAt(int index)
```

Get a particular byte within the descriptor content

Parameters:

`index` - index to the descriptor content. Value 0 corresponds to the first byte after the length field.

Returns:

The required byte

Throws:

`IndexOutOfBoundsException` - if `index < 0` or `index >= ContentLength`

getContent()

```
public byte[] getContent()
```

Get a copy of the content of this descriptor (everything after the length field).

Returns:

a copy of the content of the descriptor

getContentLength()

```
public short getContentLength()
```

This method returns the length of the descriptor content as coded in the length field of this descriptor.

Returns:

The length of the descriptor content.

getTag()

```
public short getTag()
```

Get the descriptor tag

Returns:

The descriptor tag (the most common values are defined in the DescriptorTag interface)

See Also:

[DescriptorTag](#)

org.dvb.si DescriptorTag

Syntax

```
public interface DescriptorTag
```

Description

This interface defines constants corresponding to the most common descriptor tags.

See Also:

[Descriptor](#)

Fields

BOUQUET_NAME

```
public static final short BOUQUET_NAME
```

Constant value for the descriptor tag as specified in EN 300 468

CA_IDENTIFIER

```
public static final short CA_IDENTIFIER
```

Constant value for the descriptor tag as specified in EN 300 468

CABLE_DELIVERY_SYSTEM

```
public static final short CABLE_DELIVERY_SYSTEM
```

Constant value for the descriptor tag as specified in EN 300 468

COMPONENT

```
public static final short COMPONENT
```

Constant value for the descriptor tag as specified in EN 300 468

CONTENT

```
public static final short CONTENT
```

Constant value for the descriptor tag as specified in EN 300 468

COUNTRY_AVAILABILITY

```
public static final short COUNTRY_AVAILABILITY
```

Constant value for the descriptor tag as specified in EN 300 468

DATA_BROADCAST

```
public static final short DATA_BROADCAST
```

Constant value for the descriptor tag as specified in EN 300 468

EXTENDED_EVENT

```
public static final short EXTENDED_EVENT
```

Constant value for the descriptor tag as specified in EN 300 468

FREQUENCY_LIST

```
public static final short FREQUENCY_LIST
```

Constant value for the descriptor tag as specified in EN 300 468

LINKAGE

```
public static final short LINKAGE
```

Constant value for the descriptor tag as specified in EN 300 468

LOCAL_TIME_OFFSET

```
public static final short LOCAL_TIME_OFFSET
```

Constant value for the descriptor tag as specified in EN 300 468

MOSAIC

```
public static final short MOSAIC
```

Constant value for the descriptor tag as specified in EN 300 468

MULTILINGUAL_BOUQUET_NAME

```
public static final short MULTILINGUAL_BOUQUET_NAME
```

Constant value for the descriptor tag as specified in EN 300 468

MULTILINGUAL_COMPONENT

```
public static final short MULTILINGUAL_COMPONENT
```

Constant value for the descriptor tag as specified in EN 300 468

MULTILINGUAL_NETWORK_NAME

```
public static final short MULTILINGUAL_NETWORK_NAME
```

Constant value for the descriptor tag as specified in EN 300 468

MULTILINGUAL_SERVICE_NAME

```
public static final short MULTILINGUAL_SERVICE_NAME
```

Constant value for the descriptor tag as specified in EN 300 468

NETWORK_NAME

public static final short NETWORK_NAME

Constant value for the descriptor tag as specified in EN 300 468

NVOD_REFERENCE

public static final short NVOD_REFERENCE

Constant value for the descriptor tag as specified in EN 300 468

PARENTAL_RATING

public static final short PARENTAL_RATING

Constant value for the descriptor tag as specified in EN 300 468

PARTIAL_TRANSPORT_STREAM

public static final short PARTIAL_TRANSPORT_STREAM

Constant value for the descriptor tag as specified in EN 300 468

PRIVATE_DATA_SPECIFIER

public static final short PRIVATE_DATA_SPECIFIER

Constant value for the descriptor tag as specified in EN 300 468

SATELLITE_DELIVERY_SYSTEM

public static final short SATELLITE_DELIVERY_SYSTEM

Constant value for the descriptor tag as specified in EN 300 468

SERVICE

public static final short SERVICE

Constant value for the descriptor tag as specified in EN 300 468

SERVICE_LIST

public static final short SERVICE_LIST

Constant value for the descriptor tag as specified in EN 300 468

SERVICE_MOVE

public static final short SERVICE_MOVE

Constant value for the descriptor tag as specified in EN 300 468

SHORT_EVENT

```
public static final short SHORT_EVENT
```

Constant value for the descriptor tag as specified in EN 300 468

SHORT_SMOOTHING_BUFFER

```
public static final short SHORT_SMOOTHING_BUFFER
```

Constant value for the descriptor tag as specified in EN 300 468

STREAM_IDENTIFIER

```
public static final short STREAM_IDENTIFIER
```

Constant value for the descriptor tag as specified in EN 300 468

STUFFING

```
public static final short STUFFING
```

Constant value for the descriptor tag as specified in EN 300 468

SUBTITLING

```
public static final short SUBTITLING
```

Constant value for the descriptor tag as specified in EN 300 468

TELEPHONE

```
public static final short TELEPHONE
```

Constant value for the descriptor tag as specified in EN 300 468

TELETEXT

```
public static final short TELETEXT
```

Constant value for the descriptor tag as specified in EN 300 468

TERRESTRIAL_DELIVERY_SYSTEM

```
public static final short TERRESTRIAL_DELIVERY_SYSTEM
```

Constant value for the descriptor tag as specified in EN 300 468

TIME_SHIFTED_EVENT

```
public static final short TIME_SHIFTED_EVENT
```

Constant value for the descriptor tag as specified in EN 300 468

TIME_SHIFTED_SERVICE

```
public static final short TIME_SHIFTED_SERVICE
```

Constant value for the descriptor tag as specified in EN 300 468

org.dvb.si PMTElementaryStream

Syntax

```
public interface PMTElementaryStream extends SIInformation
```

All Superinterfaces:

[SIInformation](#)

Description

This interface represents an elementary stream of a service.

For each running service there is a PMT describing the elementary streams of the service. An object that implements this interface represents one such elementary stream. Each object that implements the PMTElementaryStream interface is identified by the combination of the identifiers original_network_id, transport_stream_id, service_id, component_tag (or elementary_PID).

See Also:

[PMTService](#), [PMTStreamType](#)

Methods

getComponentTag()

```
public int getComponentTag()
```

Get the component tag identifier.

Returns:

The component tag. If the elementary stream does not have an associated component tag, this method returns -2.

getDvbLocator()

```
public org.davic.net.dvb.DvbLocator getDvbLocator()
```

Gets a DvbLocator that identifies this elementary stream

Returns:

The DvbLocator of this elementary stream

getElementaryPID()

```
public short getElementaryPID()
```

Get the elementary PID.

Returns:

The PID the data of elementary stream is sent on in the transport stream.

getOriginalNetworkID()

```
public int getOriginalNetworkID()
```

Get the original network identification identifier.

Returns:

The original network identification.

getServiceID()

```
public int getServiceID()
```

Get the service identification identifier.

Returns:

The service identification.

getStreamType()

```
public byte getStreamType()
```

Get the stream type of this elementary stream.

Returns:

The stream type (some of the possible values are defined in the PMTStreamType interface).

See Also:

[PMTStreamType](#)

getTransportStreamID()

```
public int getTransportStreamID()
```

Get the transport stream identification identifier.

Returns:

The transport stream identification.

org.dvb.si PMTService

Syntax

```
public interface PMTService extends SIInformation
```

All Superinterfaces:

`SIInformation`

Description

This interface represents a particular service carried by a transport stream. The information is retrieved from the PMT table.

Each object that implements the PMTService interface is identified by the combination of the following identifiers: original_network_id, transport_stream_id, service_id.

Methods

getDvbLocator()

```
public org.davic.net.dvb.DvbLocator getDvbLocator()
```

Gets a DvbLocator that identifies this service

Returns:

The DvbLocator of this service

getOriginalNetworkID()

```
public int getOriginalNetworkID()
```

Get the original network identification.

Returns:

The original network identification identifier.

getPcrPid()

```
public int getPcrPid()
```

Get the PCR pid.

Returns:

The PCR pid.

getServiceID()

```
public int getServiceID()
```

Get the service identification.

Returns:

The service identification identifier.

getTransportStreamID()

```
public int getTransportStreamID()
```

Get the transport stream identification.

Returns:

The transport stream identification identifier.

retrievePMTElementaryStreams(short, Object, SIRecoveryListener, short[])

```
public SIRequest retrievePMTElementaryStreams(short retrieveMode, java.lang.Object appData,  
      SIRecoveryListener listener, short[] somePMTDescriptorTags)
```

Retrieve information associated with the elementary streams which compose this service from the Program Map Table (PMT).

The SIIterator that is returned with the event when the request completes successfully will contain one or more objects that implement the PMTElementaryStream interface. If no matching object was found, the appropriate one of the following events is sent: ObjectNotInCacheEvent, ObjectNotInTableEvent or TableNotFoundEvent.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (FROM_CACHE_ONLY), from the cache if available and if not from the stream (FROM_CACHE_OR_STREAM), or always from the stream (FROM_STREAM_ONLY).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - SIRecoveryListener that will receive the event informing about the completion of the request.

`somePMTDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `somePMTDescriptorTags` is null, the application is not interested in descriptors. All non applicable tag values are ignored.

Returns:

An SIRequest object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRecoveryListener`, `PMTElementaryStream`

org.dvb.si PMTStreamType

Syntax

```
public interface PMTStreamType
```

Description

This interface defines the constants corresponding to the different stream types

See Also:

```
PMTElementaryStream, getStreamType()
```

Fields

MPEG1_AUDIO

```
public static final byte MPEG1_AUDIO
```

Constant value for the stream type as specified in ISO/IEC 13818-1

MPEG1_VIDEO

```
public static final byte MPEG1_VIDEO
```

Constant value for the stream type as specified in ISO/IEC 13818-1

MPEG2_AUDIO

```
public static final byte MPEG2_AUDIO
```

Constant value for the stream type as specified in ISO/IEC 13818-1

MPEG2_VIDEO

```
public static final byte MPEG2_VIDEO
```

Constant value for the stream type as specified in ISO/IEC 13818-1

org.dvb.si

SIBouquet

Syntax

```
public interface SIBouquet extends SIInformation
```

All Superinterfaces:

`SIInformation`

Description

This interface (together with the `SITransportStreamBAT` interface) represents a sub-table of the Bouquet Association Table (BAT) describing a particular bouquet.

Each object that implements the `SIBouquet` interface is identified by the identifier `bouquet_id`.

See Also:

`SITransportStreamBAT`

Methods

`getBouquetID()`

```
public int getBouquetID()
```

Get the identification.

Returns:

The bouquet identification of this bouquet.

`getDescriptorTags()`

```
public short[] getDescriptorTags()
```

This method defines extra semantics for the `SIInformation.getDescriptorTags` method. If the BAT sub-table on which this `SIBouquet` object is based consists of multiple sections, then this method returns the descriptor tags in the order they appear when concatenating the descriptor loops of the different sections.

Overrides:

`getDescriptorTags()` in interface `SIInformation`

Returns:

The tags of the descriptors actually broadcast for the object (identified by their tags).

See Also:

`SIInformation`, `getDescriptorTags()`

`getName()`

```
public java.lang.String getName()
```

This method returns the name of this bouquet. The name is extracted from the `bouquet_name_descriptor` or optionally from the `multilingual_bouquet_name_descriptor`. When this

information is not available "" is returned. All control characters as defined in ETR 211 are ignored. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation

Returns:

The bouquet name of this bouquet.

getShortBouquetName()

```
public java.lang.String getShortBouquetName()
```

This method returns the short name (ETR 211) of this bouquet without emphasis marks. The name is extracted from the bouquet_name_descriptor or optionally from the multilingual_bouquet_name_descriptor. When this information is not available "" is returned. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The short bouquet name of this bouquet.

getSIServiceLocators()

```
public org.davic.net.dvb.DvbLocator[] getSIServiceLocators()
```

Get a list of DvbLocators identifying the services that belong to the bouquet.

Returns:

An array of DvbLocators identifying the services

See Also:

`org.davic.net.dvb.DvbLocator`, `SIService`

retrieveDescriptors(short, Object, SIRetrievalListener)

```
public SIRequest retrieveDescriptors(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener)
```

This method defines extra semantics for the SIInformation.retrieveDescriptors method (first prototype). If the BAT sub-table on which this SIbouquet object is based consists of multiple sections, then this method returns the requested descriptors in the order they appear when concatenating the descriptor loops of the different sections.

Overrides:

`retrieveDescriptors(short, Object, SIRetrievalListener)` in interface `SIInformation`

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIInformation`, `retrieveDescriptors(short, Object, SIRetrievalListener)`

retrieveDescriptors(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveDescriptors(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags)
```

This method defines extra semantics for the `SIInformation.retrieveDescriptors` method (second prototype). If the BAT sub-table on which this `SIBouquet` object is based consists of multiple sections, then this method returns the requested descriptors in the order they appear when concatenating the descriptor loops of the different sections.

Overrides:

```
retrieveDescriptors(short, Object, SIRetrievalListener, short[]) in
interface SIInformation
```

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of tags for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIInformation`, `retrieveDescriptors(short, Object, SIRetrievalListener, short[])`

retrieveSIBouquetTransportStreams(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveSIBouquetTransportStreams(short retrieveMode,
    java.lang.Object appData, SIRetrievalListener listener,
    short[] someDescriptorTags)
```

Retrieve information associated with transport streams belonging to the bouquet.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `SITransportStreamBAT` interface.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SITransportStreamBAT`, `DescriptorTag`

org.dvb.si SIDatabase

Syntax

```
public class SIDatabase
    java.lang.Object
    |
    +--org.dvb.si.SIDatabase
```

Description

This class represents the root of the SI information hierarchy. There is one SIDatabase per network interface. In a system with a single network interface there is only one SIDatabase object.

Methods

addBouquetMonitoringListener(SIMonitoringListener, int)

```
public void addBouquetMonitoringListener(SIMonitoringListener listener, int bouquetId)
```

Initiate monitoring of the bouquet information. When the bouquet information changes, an event will be delivered to the registered listener object.

How the monitoring is performed is implementation dependent and especially does not necessarily need to be continuous. The event will be delivered as soon as the implementation notices the change which might have some delay relative to when the change was actually made in the stream due to resources for the monitoring being scheduled between the monitoring activities of different tables. This specification does not set any minimum requirements for monitoring of the SI tables. This is to be done at a best effort basis by the implementation and is entirely implementation dependent. The only requirement is that when an implementation detects a change, e.g. because a resident Navigator or an MHP application has retrieved some SI information from the stream, then these listeners are notified of the change.

The monitoring stops silently and permanently when the network interface with which this SIDatabase object is associated starts tuning to another transport stream.

Parameters:

`listener` - listener object that will receive events when a change in the information is detected.

`bouquetId` - bouquet identifier of the bouquet whose information will be monitored.

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

addEventPresentFollowingMonitoringListener(SIMonitoringListener, int, int, int)

```
public void addEventPresentFollowingMonitoringListener(SIMonitoringListener listener,
    int originalNetworkId, int transportStreamId, int serviceId)
```

Initiate monitoring of information in the EIT related to present and following events. When the information related to those events changes, an event will be delivered to the registered listener object.

The scope of the monitoring is determined by the original network identifier, transport stream identifier and service identifier. The listener will be notified about the change of the information in any present and following event within that scope.

How the monitoring is performed is implementation dependent and especially does not necessarily need to be continuous. The event will be delivered as soon as the implementation notices the change which might have some delay relative to when the change was actually made in the stream due to resources for the monitoring being scheduled between the monitoring activities of different tables. This specification does not set any minimum requirements for monitoring of the SI tables. This is to be done at a best effort basis by the implementation and is entirely implementation dependent. The only requirement is that when an implementation detects a change, e.g. because a resident Navigator or an MHP application has retrieved some SI information from the stream, then these listeners are notified of the change.

The monitoring stops silently and permanently when the network interface with which this SIDatabase object is associated starts tuning to another transport stream.

Parameters:

`listener` - listener object that will receive events when a change in the information is detected.
`originalNetworkId` - original network identifier specifying the scope of the monitoring.
`transportStreamId` - transport stream identifier specifying the scope of the monitoring.
`serviceId` - service identifier specifying the scope of the monitoring

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

addEventScheduleMonitoringListener(SIMonitoringListener, int, int, int, Date, Date)

```
public void addEventScheduleMonitoringListener(SIMonitoringListener listener,
        int originalNetworkId, int transportStreamId, int serviceId,
        java.util.Date startTime, java.util.Date endTime)
```

Initiate monitoring of information in the EIT related to scheduled events. When the information related to those events changes, an event will be delivered to the registered listener object.

The scope of the monitoring is determined by the original network identifier, transport stream identifier, service identifier, start time and end time of the schedule period. The listener will be notified about the change of the information in any scheduled event within that scope.

How the monitoring is performed is implementation dependent and especially does not necessarily need to be continuous. The event will be delivered as soon as the implementation notices the change which might have some delay relative to when the change was actually made in the stream due to resources for the monitoring being scheduled between the monitoring activities of different tables. This specification does not set any minimum requirements for monitoring of the SI tables. This is to be done at a best effort basis by the implementation and is entirely implementation dependent. The only requirement is that when an implementation detects a change, e.g. because a resident Navigator or an MHP application has retrieved some SI information from the stream, then these listeners are notified of the change.

The monitoring stops silently and permanently when the network interface with which this SIDatabase object is associated starts tuning to another transport stream.

Parameters:

`listener` - listener object that will receive events when a change in the information is detected.
`originalNetworkId` - original network identifier specifying the scope of the monitoring.
`transportStreamId` - transport stream identifier specifying the scope of the monitoring.

`serviceId` - service identifier specifying the scope of the monitoring

`startTime` - start time of the schedule period

`endTime` - end time of the schedule period

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

`SIInvalidPeriodException` - thrown if end time is before start time

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

addNetworkMonitoringListener(SIMonitoringListener, int)

```
public void addNetworkMonitoringListener(SIMonitoringListener listener, int networkId)
```

Initiate monitoring of the network information. When the network information changes, an event will be delivered to the registered listener object.

How the monitoring is performed is implementation dependent and especially does not necessarily need to be continuous. The event will be delivered as soon as the implementation notices the change which might have some delay relative to when the change was actually made in the stream due to resources for the monitoring being scheduled between the monitoring activities of different tables. This specification does not set any minimum requirements for monitoring of the SI tables. This is to be done at a best effort basis by the implementation and is entirely implementation dependent. The only requirement is that when an implementation detects a change, e.g. because a resident Navigator or an MHP application has retrieved some SI information from the stream, then these listeners are notified of the change.

The monitoring stops silently and permanently when the network interface with which this SIDatabase object is associated starts tuning to another transport stream.

Parameters:

`listener` - listener object that will receive events when a change in the information is detected.

`networkId` - network identifier of the network whose information will be monitored.

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

addPMTServiceMonitoringListener(SIMonitoringListener, int, int, int)

```
public void addPMTServiceMonitoringListener(SIMonitoringListener listener,
int originalNetworkId, int transportStreamId, int serviceId)
```

Initiate monitoring of information in the PMT related to a service. When the information related to a service changes, an event will be delivered to the registered listener object.

How the monitoring is performed is implementation dependent and especially does not necessarily need to be continuous. The event will be delivered as soon as the implementation notices the change which might have some delay relative to when the change was actually made in the stream due to resources for the monitoring being scheduled between the monitoring activities of different tables. This specification does not set any minimum requirements for monitoring of the SI tables. This is to be done at a best effort basis by the implementation and is entirely implementation dependent. The only requirement is that when an implementation detects a change, e.g. because a resident Navigator or an MHP application has retrieved some SI information from the stream, then these listeners are notified of the change.

The monitoring stops silently and permanently when the network interface with which this SIDatabase object is associated starts tuning to another transport stream.

Parameters:

`listener` - listener object that will receive events when a change in the information is detected.
`originalNetworkId` - original network identifier of the service
`transportStreamId` - transport stream identifier of the service
`serviceId` - service identifier specifying the service whose information will be monitored

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

addServiceMonitoringListener(SIMonitoringListener, int, int)

```
public void addServiceMonitoringListener(SIMonitoringListener listener,
    int originalNetworkId, int transportStreamId)
```

Initiate monitoring of information in the SDT related to services. When the information related to services changes, an event will be delivered to the registered listener object.

The scope of the monitoring is determined by the original network identifier and transport stream identifier. The listener will be notified about the change of the information in any service within that scope.

How the monitoring is performed is implementation dependent and especially does not necessarily need to be continuous. The event will be delivered as soon as the implementation notices the change which might have some delay relative to when the change was actually made in the stream due to resources for the monitoring being scheduled between the monitoring activities of different tables. This specification does not set any minimum requirements for monitoring of the SI tables. This is to be done at a best effort basis by the implementation and is entirely implementation dependent. The only requirement is that when an implementation detects a change, e.g. because a resident Navigator or an MHP application has retrieved some SI information from the stream, then these listeners are notified of the change.

The monitoring stops silently and permanently when the network interface with which this SIDatabase object is associated starts tuning to another transport stream.

Parameters:

`listener` - listener object that will receive events when a change in the information is detected.
`originalNetworkId` - original network identifier specifying the scope of the monitoring.
`transportStreamId` - transport stream identifier specifying the scope of the monitoring.

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

getSIDatabase()

```
public static SIDatabase[] getSIDatabase()
```

Return an array of SIDatabase objects (one object per network interface). In a system with one network interface, the length of this array will be one. The network interface of each SIDatabase is used as data source for all new data accessed by this SIDatabase or SIInformation instances obtained from it.

This is the first method to be called to access the DVB-SI API. The returned SIDatabase objects provide the access point to the DVB-SI information.

Returns:

An array of SIDatabase objects, one per network interface.

removeBouquetMonitoringListener(SIMonitoringListener, int)

```
public void removeBouquetMonitoringListener(SIMonitoringListener listener, int bouquetId)
```

Removes the registration of an event listener for bouquet information monitoring. If this method is called with a listener that is registered but not with the same identifiers of the SI objects as given in the parameters, the method shall fail silently and the listeners stays registered with those identifiers that it has been added.

Parameters:

`listener` - listener object that has previously been registered

`bouquetId` - bouquet identifier of the bouquet whose information has been requested to be monitored

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

removeEventPresentFollowingMonitoringListener(SIMonitoringListener, int, int, int)

```
public void removeEventPresentFollowingMonitoringListener(SIMonitoringListener listener,
    int originalNetworkId, int transportStreamId, int serviceId)
```

Removes the registration of an event listener for monitoring information related to present and following events. If this method is called with a listener that is registered but not with the same identifiers of the SI objects as given in the parameters, the method shall fail silently and the listeners stays registered with those identifiers that it has been added.

Parameters:

`listener` - listener object that has previously been registered

`originalNetworkId` - original network identifier specifying the scope of the monitoring.

`transportStreamId` - transport stream identifier specifying the scope of the monitoring.

`serviceId` - service identifier specifying the scope of the monitoring

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

removeEventScheduleMonitoringListener(SIMonitoringListener, int, int, int)

```
public void removeEventScheduleMonitoringListener(SIMonitoringListener listener,
    int originalNetworkId, int transportStreamId, int serviceId)
```

Removes the registration of an event listener for monitoring information related to scheduled events for all periods. If this method is called with a listener that is registered but not with the same identifiers of the SI objects as given in the parameters, the method shall fail silently and the listeners stays registered with those identifiers that it has been added.

Parameters:

`listener` - listener object that has previously been registered

originalNetworkId - original network identifier specifying the scope of the monitoring.
 transportStreamId - transport stream identifier specifying the scope of the monitoring.
 serviceId - service identifier specifying the scope of the monitoring

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

removeNetworkMonitoringListener(SIMonitoringListener, int)

```
public void removeNetworkMonitoringListener(SIMonitoringListener listener, int networkId)
```

Removes the registration of an event listener for network information monitoring. If this method is called with a listener that is registered but not with the same identifiers of the SI objects as given in the parameter, the method shall fail silently and the listeners stays registered with those identifiers that it has been added.

Parameters:

listener - listener object that has previously been registered

networkId - network identifier of the network which is no longer to be monitored by the listener

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

removePMTServiceMonitoringListener(SIMonitoringListener, int, int, int)

```
public void removePMTServiceMonitoringListener(SIMonitoringListener listener,
        int originalNetworkId, int transportStreamId, int serviceId)
```

Removes the registration of an event listener for monitoring information in the PMT related to a service. If this method is called with a listener that is registered but not with the same identifiers of the SI objects as given in the parameters, the method shall fail silently and the listeners stays registered with those identifiers that it has been added.

Parameters:

listener - listener object that has previously been registered

originalNetworkId - original network identifier of the service

transportStreamId - transport stream identifier of the service

serviceId - service identifier specifying the service whose information has been requested to be monitored

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

removeServiceMonitoringListener(SIMonitoringListener, int, int)

```
public void removeServiceMonitoringListener(SIMonitoringListener listener,
        int originalNetworkId, int transportStreamId)
```

Removes the registration of an event listener for monitoring information related to services. If this method is called with a listener that is registered but not with the same identifiers of the SI objects as

given in the parameters, the method shall fail silently and the listeners stays registered with those identifiers that it has been added.

Parameters:

`listener` - listener object that has previously been registered

`originalNetworkId` - original network identifier specifying the scope of the monitoring.

`transportStreamId` - transport stream identifier specifying the scope of the monitoring.

Throws:

`SIIllegalArgumentException` - thrown if the identifiers are invalid (e.g. out of range)

See Also:

`SIMonitoringListener`, `SIMonitoringEvent`

retrieveActualSINetwork(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveActualSINetwork(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve information associated with the actual network. The actual network is the network carrying the transport stream currently selected by the network interface connected to this SIDatabase.

The SIIterator that is returned with the event when the request completes successfully will contain an object that implements the SINetwork interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SINetwork`, `DescriptorTag`

retrieveActualSIServices(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveActualSIServices(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve information associated with the actual services. The actual services are the services in the transport stream currently selected by the network interface connected to this SIDatabase.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `SIService` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains `-1` as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. `0...255`) are ignored, except for the special meaning of `-1` as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SIService`, `DescriptorTag`

retrieveActualSITransportStream(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveActualSITransportStream(short retrieveMode,
        java.lang.Object appData, SIRetrievalListener listener,
        short[] someDescriptorTags)
```

Retrieve information associated with the actual transport stream. The actual transport stream is the transport stream currently selected by the network interface connected to this `SIDatabase`.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `SITransportStreamNIT` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent` `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains `-1` as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. `0...255`) are ignored, except for the special meaning of `-1` as the only element in the array.

Returns:

An SIRequest object

Throws:

[SIIllegalArgumentException](#) - thrown if the retrieveMode is invalid

See Also:

[SIRequest](#), [SIRetrievalListener](#), [SITransportStream](#), [DescriptorTag](#)

retrievePMTElementaryStreams(short, Object, SIRetrievalListener, DvbLocator, short[])

```
public SIRequest retrievePMTElementaryStreams(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, org.davic.net.dvb.DvbLocator dvbLocator,
    short[] someDescriptorTags)
```

Retrieve PMT elementary stream information associated with components of a service. The required component(s) can be specified by its DVB locator.

The SIIterator that is returned with the event when the request completes successfully will contain one or more objects that implement the PMTElementaryStream interface. If no matching object was found, the appropriate one of the following events is sent: [ObjectNotInCacheEvent](#), [ObjectNotInTableEvent](#) or [TableNotFoundEvent](#).

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache ([FROM_CACHE_ONLY](#)), from the cache if available and if not from the stream ([FROM_CACHE_OR_STREAM](#)), or always from the stream ([FROM_STREAM_ONLY](#)).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - [SIRetrievalListener](#) that will receive the event informing about the completion of the request.

`dvbLocator` - DVB Locator identifying the component(s) of a service. The locator may be more specific than identifying one or more service components, but this method will only use the parts starting from the beginning up to the component tags.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An SIRequest object

Throws:

[SIIllegalArgumentException](#) - thrown if the retrieveMode is invalid or if the locator is invalid and does not identify one or more service components

See Also:

[SIRequest](#), [SIRetrievalListener](#), [SIService](#), [DescriptorTag](#)

retrievePMTElementaryStreams(short, Object, SIRetrievalListener, int, int, short[])

```
public SIRequest retrievePMTElementaryStreams(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, int serviceId, int componentTag,
    short[] someDescriptorTags)
```

Retrieve PMT elementary stream information associated with components of a service from the actual transport stream of this SIDatabase object. The elementary streams can be specified by their

identification. When -1 is specified for `componentTag` then elementary streams shall be retrieved regardless of their component tag.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `PMTElementaryStream` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`serviceId` - Identification of the elementary streams to be retrieved: service identifier

`componentTag` - Identification of the elementary streams to be retrieved: component tag (-1 means return elementary streams regardless of their component tag)

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid or the numeric identifiers are out of range

See Also:

`SIRequest`, `SIRetrievalListener`, `SIService`, `DescriptorTag`

retrievePMTService(short, Object, SIRetrievalListener, DvbLocator, short[])

```
public SIRequest retrievePMTService(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, org.davic.net.dvb.DvbLocator dvbLocator,
    short[] someDescriptorTags)
```

Retrieve PMT information associated with a service. The required service can be specified by its DVB locator.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `PMTService` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent` `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`dvbLocator` - DVB Locator identifying the service. The locator may be more specific than identifying a service, but this method will only use the parts starting from the beginning up to the service id.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid or the locator is invalid and does not identify a service

See Also:

`SIRequest`, `SIRetrievalListener`, `SIService`, `DescriptorTag`

retrievePMTServices(short, Object, SIRetrievalListener, int, short[])

```
public SIRequest retrievePMTServices(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, int serviceId, short[] someDescriptorTags)
```

Retrieve PMT information associated with services from the actual transport stream of this `SIDatabase` object. The required services can be specified by their identification. When -1 is specified as `serviceId` then services shall be retrieved regardless of their service id.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `PMTService` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`serviceId` - Identification of the services to be retrieved: service identifier (-1 means return services regardless of their service id)

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid or the numeric identifiers are out of range

See Also:

`SIRequest`, `SIRetrievalListener`, `SIService`, `DescriptorTag`

retrieveSIBouquets(short, Object, SIRetrievalListener, int, short[])

```
public SIRequest retrieveSIBouquets(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, int bouquetId, short[] someDescriptorTags)
```

Retrieve information associated with bouquets. A bouquet can be specified by its identification. When `bouquetId` is set to -1, all bouquets signalled in the BAT of the currently received transport stream on that network interface are retrieved.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `SIBouquet` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`bouquetId` - Identifier of the bouquet to be retrieved or -1 for all bouquets signalled on the currently received transport stream.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid or the numeric identifiers are out of range

See Also:

`SIRequest`, `SIRetrievalListener`, `SIBouquet`, `DescriptorTag`

retrieveSINetworks(short, Object, SIRetrievalListener, int, short[])

```
public SIRequest retrieveSINetworks(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, int networkId, short[] someDescriptorTags)
```

Retrieve information associated with networks. A network can be specified by its identification. When `networkId` is set to -1, all networks signalled in NIT Actual and Other of the currently received `TransportStream` on that network interface shall be retrieved.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `SINetwork` interface. If no matching object was found, the

appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`networkId` - Identification of the network to be retrieved or -1 for all networks currently signalled.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid or the numeric identifiers are out of range

See Also:

`SIRequest`, `SIRetrievalListener`, `SINetwork`, `DescriptorTag`

retrieveSIService(short, Object, SIRetrievalListener, DvbLocator, short[])

```
public SIRequest retrieveSIService(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, org.davic.net.dvb.DvbLocator dvbLocator,
    short[] someDescriptorTags)
```

Retrieve information associated with a service. The required service can be specified by its DVB locator.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `SIService` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent` `ObjectNotInTableEvent` or `TableNotFoundEvent`"

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`dvbLocator` - DVB locator identifying the service. The locator may be more specific than identifying a service, but this method will only use the parts starting from the beginning up to the service id.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid or the locator is invalid and does not identify a service

See Also:

`SIRequest`, `SIRetrievalListener`, `SIService`, `DescriptorTag`

retrieveSIServices(short, Object, SIRetrievalListener, int, int, int, short[])

```
public SIRequest retrieveSIServices(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, int originalNetworkId, int transportStreamId,
    int serviceId, short[] someDescriptorTags)
```

Retrieve information associated with services. The required services can be specified by their identification. When -1 is specified for `transportStreamId` then services shall be retrieved regardless of their transport stream id. When -1 is specified for `serviceId` then services shall be retrieved regardless of their service id.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `SIService` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`originalNetworkId` - Identification of the services to be retrieved: original network identifier

`transportStreamId` - Identification of the services to be retrieved: transport stream identifier (-1 means return services regardless of their transport stream id)

`serviceId` - Identification of the services to be retrieved: service identifier (-1 means return services regardless of their service id)

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid or the numeric identifiers are out of range

See Also:

`SIRequest`, `SIRetrievalListener`, `SIService`, `DescriptorTag`

retrieveSITimeFromTDT(short, Object, SIRetrievalListener)

```
public SIRequest retrieveSITimeFromTDT(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener)
```

Retrieve information associated with time from the Time and Date Table (TDT) from the actual transport stream.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `SITime` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent` `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SITime`

retrieveSITimeFromTOT(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveSITimeFromTOT(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve information associated with time from the Time Offset Table (TOT) from the actual transport stream. The time information will be accompanied with offset information

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `SITime` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent` `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SITime`

retrieveSITransportStreamDescription(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveSITransportStreamDescription(short retrieveMode,
    java.lang.Object appData, SIRetrievalListener listener,
    short[] someDescriptorTags)
```

Retrieve the `SITransportStreamDescription` object representing the information of the TSDT table in the actual transport stream of this `SIDatabase` object.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `SITransportStreamDescription` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SITransportStreamDescription`, `DescriptorTag`

org.dvb.si

SIEvent

Syntax

```
public interface SIEvent extends SIInformation
```

All Superinterfaces:

[SIInformation](#)

Description

This interface represents a particular event within a service.

Each object that implements the SIEvent interface is defined by the combination of the identifiers original_network_id, transport_stream_id, service_id, event_id.

See Also:

[SIService](#)

Methods

getContentNibbles()

```
public byte[] getContentNibbles()
```

This method returns the content nibbles related to the event. This information is extracted from the content_descriptor. If this descriptor is not present an empty array is returned (array with length 0). The return value is an array, each array element describes one content nibble. In each nibble the level 1 content nibbles occupy the four most significant bits of the returned bytes, level 2 content nibbles the four least significant bits.

Returns:

The content nibbles related to the event; level 1 content nibbles occupy the four most significant bits of the returned bytes, level 2 content nibbles the four least significant bits.

getDuration()

```
public long getDuration()
```

Get the duration of this event.

Returns:

The duration in milliseconds.

getDvbLocator()

```
public org.davic.net.dvb.DvbLocator getDvbLocator()
```

Gets a DvbLocator that identifies this event.

Returns:

The DvbLocator of this event

getEventID()

```
public int getEventID()
```

Get the event identification.

Returns:

The event identification.

getFreeCAMode()

```
public boolean getFreeCAMode()
```

Get the free_CA_mode value for this event, false indicates none of the component streams of this event are scrambled.

Returns:

The free_CA_mode value.

getLevel1ContentNibbles()

```
public byte[] getLevel1ContentNibbles()
```

This method returns the level 1 content nibbles of this event. This information is extracted from the content_descriptor. If this descriptor is not present an empty array is returned (array with length 0). The return value is an array, each array element describes one content nibble. In each nibble the data occupies the four least significant bits of the returned bytes with the four most significant bits set to 0.

Returns:

All level 1 content nibbles related to the event.

getName()

```
public java.lang.String getName()
```

This method returns the name of this event. The name is extracted from a short_event_descriptor. When this information is not available "" is returned. All control characters as defined in ETR 211 are ignored. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The event name of this event.

getOriginalNetworkID()

```
public int getOriginalNetworkID()
```

Get the original network identification identifier.

Returns:

The original network identification.

getRunningStatus()

```
public byte getRunningStatus()
```

Get the running status of this event.

Returns:

The running status (the possible values are defined in the SIRunningStatus interface).

See Also:

`SIRunningStatus`

getServiceID()

```
public int getServiceID()
```

Get the service identification identifier.

Returns:

The service identification.

getShortDescription()

```
public java.lang.String getShortDescription()
```

This method returns the description of this event. The description is extracted from a `short_event_descriptor`. When this information is not available, "" is returned. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation

Returns:

The short description of this event.

getShortEventName()

```
public java.lang.String getShortEventName()
```

This method returns the short event name (ETR 211) of this event without emphasis marks. The name is extracted from a `short_event_descriptor`. When this information is not available "" is returned. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The short event name of this event.

getStartTime()

```
public java.util.Date getStartTime()
```

Get the start time of this event in UTC time.

Returns:

The start time of this event.

getTransportStreamID()

```
public int getTransportStreamID()
```

Get the transport stream identification identifier.

Returns:

The transport stream identification.

retrieveSIService(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveSIService(short retrieveMode, java.lang.Object appData,  
    SIRetrievalListener listener, short[] someDescriptorTags)
```

This method retrieves the SIService object representing the service the event, represented by this SIEvent, is part of.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `SIService` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains `-1` as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. `0...255`) are ignored, except for the special meaning of `-1` as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SIService`, `DescriptorTag`

org.dvb.si SIException

Syntax

```
public abstract class SIException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--org.dvb.si.SIException
```

Direct Known Subclasses:

```
SIIllegalArgumentException, SIInvalidPeriodException
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

This class is the root of the SI exceptions hierarchy.

Constructors

SIException()

```
public SIException()
```

Default constructor for the exception

SIException(String)

```
public SIException(java.lang.String reason)
```

Constructor for the SI exception with a specified reason

Parameters:

`reason` - the reason why the exception was raised

org.dvb.si SIIllegalArgumentException

Syntax

```
public class SIIllegalArgumentException extends SIIException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--SIIException
            |
            +--org.dvb.si.SIIllegalArgumentException
```

All Implemented Interfaces:

java.io.Serializable

Description

This exception is thrown when one or more of the arguments passed to a method are invalid (e.g. numeric identifiers out of range, etc.)

Constructors

SIIllegalArgumentException()

```
public SIIllegalArgumentException()
```

Default constructor for the exception

SIIllegalArgumentException(String)

```
public SIIllegalArgumentException(java.lang.String reason)
```

Constructor for the exception with a specified reason

Parameters:

`reason` - the reason why the exception was raised

org.dvb.si

SIInformation

Syntax

```
public interface SIInformation
```

All Known Subinterfaces:

```
PMTElementaryStream, PMTService, SIBouquet, SIEvent, SINetwork, SIService,
SITime, SITransportStream, SITransportStreamBAT,
SITransportStreamDescription, SITransportStreamNIT
```

Description

This interface groups the common features of SIBouquet, SINetwork, SITransportStream, SIService, PMTService, SIEvent, SITime and PMTElementaryStream.

Each SIInformation instance represents a sub-table (part). Any method accessing descriptors will retrieve descriptors from the same sub-table version as the SIInformation instance. When this version is no longer available, an SITableUpdatedEvent is returned.

See Also:

```
SIBouquet, SINetwork, SITransportStream, SIService, PMTService, SIEvent, SITime,
PMTElementaryStream
```

Fields

FROM_CACHE_ONLY

```
public static final short FROM_CACHE_ONLY
```

Constant for retrieve mode parameter of the retrieve methods. When FROM_CACHE_ONLY mode is specified, the data will be retrieved only if it is in the cache. Otherwise, SINotInCacheEvent will be delivered to the listener. No stream access is done in this case.

FROM_CACHE_OR_STREAM

```
public static final short FROM_CACHE_OR_STREAM
```

Constant for retrieve mode parameter of the retrieve methods. When FROM_CACHE_OR_STREAM mode is specified, the data will be retrieved from cache if it is present in the cache, otherwise it will be retrieved from the stream.

FROM_STREAM_ONLY

```
public static final short FROM_STREAM_ONLY
```

Constant for retrieve mode parameter of the retrieve methods. When FROM_STREAM_ONLY mode is specified, the data will be retrieved directly from the stream and no cache access is tried first. This mode is meaningful only if the application knows that the information is not in the cache or that the information in the cache is no longer valid, but the implementation of the SI database may not be aware of the invalidity of the cached data. If the application has got the notification of the existence of

an updated version through the listener mechanism in this API, the implementation of the SI database is aware of the version change and the application should specify the FROM_CACHE_OR_STREAM mode to be able to retrieve the data faster if the updated version has already been loaded to the cache by the SI database implementation.

Methods

fromActual()

```
public boolean fromActual()
```

Return true when the information contained in the object that implements this interface was filtered from an 'actual' table or from a table with no 'actual/other' distinction.

Returns:

true if the information comes from an 'actual' table or from a table with no 'actual/other' distinction, otherwise returns false

getDataSource()

```
public org.davic.mpeg.TransportStream getDataSource()
```

Return the org.davic.mpeg.TransportStream object the information contained in the object that implements that interface was filtered from.

Returns:

The org.davic.mpeg.TransportStream object the information was filtered from.

See Also:

org.davic.mpeg.TransportStream

getDescriptorTags()

```
public short[] getDescriptorTags()
```

Get the tags of all descriptors that are part of this version of this object. The tags are returned in the same order as the descriptors are broadcast. This method returns also the tags of descriptors that were not hinted at and that are not necessarily present in the cache. If there are no descriptors associated with this SIInformation object, this method returns an empty array whose length is 0.

Returns:

The tags of the descriptors actually broadcast for the object (identified by their tags).

See Also:

[DescriptorTag](#)

getSIDatabase()

```
public SIDatabase getSIDatabase()
```

Return the root of the hierarchy the object that implements this interface belongs to.

Returns:

The root of the hierarchy.

getUpdateTime()

```
public java.util.Date getUpdateTime()
```

Return the time when the information contained in the object that implements this interface was last updated.

Returns:

The date of the last update.

retrieveDescriptors(short, Object, SIRetrievalListener)

```
public SIRequest retrieveDescriptors(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener)
```

This method retrieves all descriptors in the order the descriptors are broadcast.

This method is asynchronous and the completion of the method will be signalled by an `SISuccessfulRetrieveEvent` being sent to listener. Any retrieved descriptors are found in the `SIIterator` returned by the `getResult` method of that event. If descriptors are found then this iterator will contain `Descriptor` objects. If there are no matching descriptors, this iterator will contain no objects.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentExcpion` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `Descriptor`, `SIIterator`

retrieveDescriptors(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveDescriptors(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve a set of descriptors. This method retrieves all or a set of descriptors in the order the descriptors are broadcast.

The tag values included in the `someDescriptorParameters` parameter are used for filtering the descriptors that are returned. Only those descriptors whose tag value is included in the `someDescriptorParameters` array are retrieved, unless the `someDescriptorParameters` array contains -1 as its one and only item in which case all descriptors related to this object are retrieved.

If the list of tags is a subset of the one hinted to the underlying implementation (in the request which created the object on which the method is called), this is likely to increase the efficiency of the (optional) caching mechanism

This method is asynchronous and the completion of the method will be signalled by an `SISuccessfulRetrieveEvent` being sent to listener. Any retrieved descriptors are found in the `SIIterator` returned by the `getResult` method of that event. If descriptors are found then this iterator will contain `Descriptor` objects. If there are no matching descriptors, this iterator will contain no objects.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - - Descriptor tag values of descriptors that are used for filtering descriptors from the descriptors included in the SI table item corresponding to this `SIInformation` object. If the array contains -1 as its one and only element, all descriptors related to this object are retrieved.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `Descriptor`, `SIIterator`, `DescriptorTag`

org.dvb.si SIInvalidPeriodException

Syntax

```
public class SIInvalidPeriodException extends SIException
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
       |
       +--SIException
           |
           +--org.dvb.si.SIInvalidPeriodException
```

All Implemented Interfaces:

java.io.Serializable

Description

This exception is thrown when a specified period is invalid (for example, start time is after the end time)

Constructors

SIInvalidPeriodException()

```
public SIInvalidPeriodException()
```

Default constructor for the exception

SIInvalidPeriodException(String)

```
public SIInvalidPeriodException(java.lang.String reason)
```

Constructor for the exception with a specified reason

Parameters:

`reason` - the reason why the exception was raised

org.dvb.si SIIterator

Syntax

```
public interface SIIterator extends java.util.Enumeration
```

All Superinterfaces:

java.util.Enumeration

Description

Objects implementing SIIterator interface allow to browse through a set of SI objects. In order to maintain consistency within the set of SI objects, this browsing does NOT initiate an actual access to the stream.

Methods

numberOfRemainingObjects()

```
public int numberOfRemainingObjects()
```

Get the number of remaining objects in the iterator.

Returns:

The number of remaining objects.

org.dvb.si SILackOfResourcesEvent

Syntax

```
public class SILackOfResourcesEvent extends SIRetrievalEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--SIRetrievalEvent
|
+--org.dvb.si.SILackOfResourcesEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent in response to a SI retrieval request when the resources needed for retrieving the data are not available, e.g. due to the necessary resources being all taken up by the calling application or other applications.

See Also:

[SIRetrievalListener](#)

Constructors

SILackOfResourcesEvent(Object, SIRequest)

```
public SILackOfResourcesEvent(java.lang.Object appData, SIRequest request)
```

The constructor for the event

Parameters:

`appData` - the application data passed in the request method call

`request` - the SIRequest instance which is the source of the event

org.dvb.si SIMonitoringEvent

Syntax

```
public class SIMonitoringEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.si.SIMonitoringEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

Objects of this class are sent to listener objects of the using application to notify that a change in the monitored information has happened.

See Also:

[SIMonitoringType](#), [SIMonitoringListener](#)

Constructors

SIMonitoringEvent(SIDatabase, byte, int, int, int, int, int, Date, Date)

```
public SIMonitoringEvent(SIDatabase source, byte objectType, int networkId, int bouquetId,
    int originalNetworkId, int transportStreamId, int serviceId,
    java.util.Date startTime, java.util.Date endTime)
```

Constructor for the event object

Parameters:

- source - the SIDatabase object which is the source of the event
- objectType - type of the SIInformation object (constants in SIMonitoringType)
- networkId - networkId
- bouquetId - bouquetId
- originalNetworkId - originalNetworkId
- transportStreamId - transportStreamId
- serviceId - serviceId
- startTime - start time of event schedule period
- endTime - end time of event schedule period

Methods

getBouquetID()

```
public int getBouquetID()
```

Returns the bouquetId of the bouquet. This method is only applicable if the SIInformation type returned with the getSIInformationType method is BOUQUET.

Returns:

the bouquetId or -2 if not applicable for this event

getEndTime()

```
public java.util.Date getEndTime()
```

Returns the end time of the schedule period whose event information has changed. This method is only applicable if the SIInformation type returned with the getSIInformationType method is SCHEDULED_EVENT.

Returns:

the end time or null if not applicable for this event

getNetworkID()

```
public int getNetworkID()
```

Returns the networkId of the network. This method is only applicable if the SIInformation type returned with the getSIInformationType method is NETWORK.

Returns:

the networkId or -2 if not applicable for this event

getOriginalNetworkID()

```
public int getOriginalNetworkID()
```

Returns the originalNetworkId of the SIInformation objects This method is only applicable if the SIInformation type returned with the getSIInformationType method is SERVICE, PMT_SERVICE, PRESENT_FOLLOWING_EVENT or SCHEDULED_EVENT.

Returns:

the originalNetworkId or -2 if not applicable for this event

getServiceID()

```
public int getServiceID()
```

Returns the serviceId of the SIInformation objects This method is only applicable if the SIInformation type returned with the getSIInformationType method is PMT_SERVICE, PRESENT_FOLLOWING_EVENT or SCHEDULED_EVENT.

Returns:

the serviceId or -2 if not applicable for this event

getSIInformationType()

```
public byte getSIInformationType()
```

Get the SIInformation type of the information that has changed

Returns:

The SIInformation type (the possible values are defined in the SIMonitoringType interface).

See Also:

`SIMonitoringType`

getSource()

```
public java.lang.Object getSource()
```

Gets the SI`Database` instance that is sending the event.

Overrides:

`java.util.EventObject.getSource()` in class `java.util.EventObject`

Returns:

the SI`Database` instance that is the source of this event.

getStartTime()

```
public java.util.Date getStartTime()
```

Returns the start time of the schedule period whose event information has changed. This method is only applicable if the SI`Information` type returned with the `getSIInformationType` method is `SCHEDULED_EVENT`.

Returns:

the start time or null if not applicable for this event

getTransportStreamID()

```
public int getTransportStreamID()
```

Returns the `transportStreamId` of the SI`Information` objects. This method is only applicable if the SI`Information` type returned with the `getSIInformationType` method is `SERVICE`, `PMT_SERVICE`, `PRESENT_FOLLOWING_EVENT` or `SCHEDULED_EVENT`.

Returns:

the `transportStreamId` or -2 if not applicable for this event

org.dvb.si SIMonitoringListener

Syntax

```
public interface SIMonitoringListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

This interface shall be implemented by using application classes in order to listen to changes in monitored SI objects.

See Also:

[SIMonitoringEvent](#)

Methods

postMonitoringEvent(SIMonitoringEvent)

```
public void postMonitoringEvent(SIMonitoringEvent anEvent)
```

This method is called back by the SI API implementation to notify the listener about an event.

Parameters:

`anEvent` - The notified event.

See Also:

[SIMonitoringEvent](#)

org.dvb.si

SIMonitoringType

Syntax

```
public interface SIMonitoringType
```

Description

This interface defines the constants corresponding to the SI information type values in SIMonitoringEvent.

See Also:

[SIMonitoringListener](#), [SIMonitoringEvent](#)

Fields

BOUQUET

```
public static final byte BOUQUET
```

Constant for the type of SIInformation object: Bouquet

NETWORK

```
public static final byte NETWORK
```

Constant for the type of SIInformation object: Network

PMT_SERVICE

```
public static final byte PMT_SERVICE
```

Constant for the type of SIInformation object: PMTService

PRESENT_FOLLOWING_EVENT

```
public static final byte PRESENT_FOLLOWING_EVENT
```

Constant for the type of SIInformation object: Present or following event

SCHEDULED_EVENT

```
public static final byte SCHEDULED_EVENT
```

Constant for the type of SIInformation object: Scheduled event

SERVICE

```
public static final byte SERVICE
```

Constant for the type of SIInformation object: Service

org.dvb.si

SINetwork

Syntax

```
public interface SINetwork extends SIInformation
```

All Superinterfaces:

```
SIInformation
```

Description

This interface (together with the SITransportStreamNIT interface) represents a sub-table of the Network Information Table (NIT) describing a particular network.

Each object that implements the SINetwork interface is identified by the identifier `network_id`.

See Also:

```
SITransportStream, SITransportStreamNIT
```

Methods

getDescriptorTags()

```
public short[] getDescriptorTags()
```

This method defines extra semantics for the SIInformation.getDescriptorTags method. If the NIT sub-table on which this SINetwork object is based consists of multiple sections, then this method returns the descriptor tags in the order they appear when concatenating the descriptor loops of the different sections.

Overrides:

```
getDescriptorTags() in interface SIInformation
```

Returns:

The tags of the descriptors actually broadcast for the object (identified by their tags).

See Also:

```
SIInformation, getDescriptorTags()
```

getName()

```
public java.lang.String getName()
```

This method returns the name of this network. The name is extracted from the `network_name_descriptor` or optionally from the `multilingual_network_name_descriptor`. When this information is not available "" is returned. All control characters as defined in ETR 211 are ignored. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The network name of this network.

getNetworkID()

```
public int getNetworkID()
```

Get the identification of this network.

Returns:

The network identification identifier.

getShortNetworkName()

```
public java.lang.String getShortNetworkName()
```

This method returns the short name (ETR 211) of this network without emphasis marks. The name is extracted from the `network_name_descriptor` or optionally from the `multilingual_network_name_descriptor`. When this information is not available "" is returned. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The short network name of this network.

retrieveDescriptors(short, Object, SIReivalListener)

```
public SIRequest retrieveDescriptors(short retrieveMode, java.lang.Object appData,
    SIReivalListener listener)
```

This method defines extra semantics for the `SIInformation.retrieveDescriptors` method (first prototype). If the NIT sub-table on which this `SINetwork` object is based consists of multiple sections, then this method returns the requested descriptors in the order they appear when concatenating the descriptor loops of the different sections.

Overrides:

```
retrieveDescriptors(short, Object, SIReivalListener) in interface
SIInformation
```

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIReivalListener` that will receive the event informing about the completion of the request.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIInformation`, `retrieveDescriptors(short, Object, SIReivalListener)`

retrieveDescriptors(short, Object, SIReivalListener, short[])

```
public SIRequest retrieveDescriptors(short retrieveMode, java.lang.Object appData,
    SIReivalListener listener, short[] someDescriptorTags)
```

This method defines extra semantics for the `SIInformation.retrieveDescriptors` method (second prototype). If the NIT sub-table on which this `SINetwork` object is based consists of multiple sections, then this method returns the requested descriptors in the order they appear when concatenating the descriptor loops of the different sections.

Overrides:

```
retrieveDescriptors(short, Object, SIRetrievalListener, short[]) in
interface SIInformation
```

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of tags for descriptors (identified by their tags) the application is interested in. If the array contains `-1` as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. `0...255`) are ignored, except for the special meaning of `-1` as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

```
SIInformation, retrieveDescriptors(short, Object, SIRetrievalListener,
short[])
```

retrieveSITransportStreams(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveSITransportStreams(short retrieveMode, java.lang.Object appData,
SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve information associated with transport streams carried via the network.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `SITransportStreamNIT` interface.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains `-1` as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All

values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An SIRequest object

Throws:

`SIIllegalArgumentException` - thrown if the retrieveMode is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SITransportStreamNIT`, `DescriptorTag`

org.dvb.si SINotInCacheEvent

Syntax

```
public class SINotInCacheEvent extends SIRetrievalEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--SIRetrievalEvent
        |
        +--org.dvb.si.SINotInCacheEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent in response to a SI retrieval request when the request was made with the FROM_CACHE_ONLY mode and the requested data is not present in the cache.

See Also:

[SIRetrievalListener](#)

Constructors

SINotInCacheEvent(Object, SIRequest)

```
public SINotInCacheEvent(java.lang.Object appData, SIRequest request)
```

The constructor for the event

Parameters:

`appData` - the application data passed in the request method call

`request` - the SIRequest instance which is the source of the event

org.dvb.si SIOBJECTNOTINTABLEEVENT

Syntax

```
public class SIOBJECTNOTINTABLEEVENT extends SIRETRIEVALEVENT
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--SIRETRIEVALEVENT
|
+--org.dvb.si.SIOBJECTNOTINTABLEEVENT
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent in response to a SI retrieval request when the SI table where the information about the requested object should be located has been retrieved but the requested object is not present in it. The reason may be that the object corresponding to the requested identifiers does not exist.

See Also:

[SIRETRIEVALLISTENER](#)

Constructors

SIOBJECTNOTINTABLEEVENT(Object, SIREQUEST)

```
public SIOBJECTNOTINTABLEEVENT(java.lang.Object appData, SIREQUEST request)
```

The constructor for the event

Parameters:

`appData` - the application data passed in the request method call

`request` - the SIREQUEST instance which is the source of the event

org.dvb.si SIRequest

Syntax

```
public class SIRequest
    java.lang.Object
    |
    +--org.dvb.si.SIRequest
```

Description

Object instances of this class represent SI retrieval requests made by the application. The application may cancel the request using this object.

Methods

cancelRequest()

```
public boolean cancelRequest()
```

Cancels the retrieval request.

Returns:

true if the request was cancelled and an SIRequestCancelledEvent will be delivered to the listener, false if the request has already completed (either successfully, with an error or due to a prior cancel method call)

isAvailableInCache()

```
public boolean isAvailableInCache()
```

Returns whether the information will be returned from cache or from the stream

Returns:

true if the information will be returned from cache, false if the information will be retrieved from the stream

org.dvb.si SIRequestCancelledEvent

Syntax

```
public class SIRequestCancelledEvent extends SIRetrievalEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--SIRetrievalEvent
        |
        +--org.dvb.si.SIRequestCancelledEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent in response to a SI retrieval request when the request is cancelled with the `SIRequest.cancelRequest` method call.

See Also:

`SIRequest`, `SIRetrievalListener`

Constructors

SIRequestCancelledEvent(Object, SIRequest)

```
public SIRequestCancelledEvent(java.lang.Object appData, SIRequest request)
```

The constructor for the event

Parameters:

`appData` - the application data passed in the request method call

`request` - the `SIRequest` instance which is the source of the event

org.dvb.si

SIRetrievalEvent

Syntax

```
public abstract class SIRetrievalEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.si.SIRetrievalEvent
```

Direct Known Subclasses:

```
SILackOfResourcesEvent, SINotInCacheEvent, SIOBJECTNotInTableEvent,
SIRequestCancelledEvent, SISuccessfulRetrieveEvent, SITableNotFoundEvent,
SITableUpdatedEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

This class is the base class for events about completion of a SI retrieval request. Exactly one event will be returned in response to an SI retrieval request.

See Also:

```
SIRetrievalListener
```

Constructors

SIRetrievalEvent(Object, SIRequest)

```
public SIRetrievalEvent(java.lang.Object appData, SIRequest request)
```

The constructor for the event

Parameters:

`appData` - the application data passed in the request method call

`request` - the SIRequest instance which is the source of the event

Methods

getAppData()

```
public java.lang.Object getAppData()
```

Returns the application data that was passed to the retrieve method

Returns:

the application data

getSource()

```
public java.lang.Object getSource()
```

Returns the SIRequest object that is the source of this event

Overrides:

java.util.EventObject.getSource() in class java.util.EventObject

Returns:

the SIRequest object

org.dvb.si

SIRetrievalListener

Syntax

```
public interface SIRetrievalListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

This interface shall be implemented by application classes in order to receive events about completion of SI requests.

See Also:

[SIRetrievalEvent](#)

Methods

postRetrievalEvent(SIRetrievalEvent)

```
public void postRetrievalEvent(SIRetrievalEvent event)
```

This method is called by the SI API implementation to notify the listener about completion of an SI request.

Parameters:

`event` - The event object.

See Also:

[SIRetrievalEvent](#)

org.dvb.si

SIRunningStatus

Syntax

```
public interface SIRunningStatus
```

Description

This interface defines the constants corresponding to the running status values for services and events.

Fields

NOT_RUNNING

```
public static final byte NOT_RUNNING
```

Constant value for the running status as specified in EN 300 468

PAUSING

```
public static final byte PAUSING
```

Constant value for the running status as specified in EN 300 468

RUNNING

```
public static final byte RUNNING
```

Constant value for the running status as specified in EN 300 468

STARTS_IN_A_FEW_SECONDS

```
public static final byte STARTS_IN_A_FEW_SECONDS
```

Constant value for the running status as specified in EN 300 468

UNDEFINED

```
public static final byte UNDEFINED
```

Constant value for the running status as specified in EN 300 468

org.dvb.si

SIService

Syntax

```
public interface SIService extends SIInformation, TextualServiceIdentifierQuery
```

All Superinterfaces:

```
SIInformation, TextualServiceIdentifierQuery
```

Description

This interface represents a particular service carried by a transport stream. Information that can be obtained through the methods of this interface is retrieved from the SDT table.

Each object that implements the SIService interface is identified by the combination of the following identifiers: original_network_id, transport_stream_id, service_id.

Methods

getDvbLocator()

```
public org.davic.net.dvb.DvbLocator getDvbLocator()
```

Gets a DvbLocator that identifies this service.

Returns:

The DvbLocator of this service

getEITPresentFollowingFlag()

```
public boolean getEITPresentFollowingFlag()
```

Get the EIT_present_following_flag value, true indicates this service has present and/or following event information.

Returns:

The EIT_present_following_flag value.

getEITScheduleFlag()

```
public boolean getEITScheduleFlag()
```

Get the EIT_schedule_flag value, true indicates this services has scheduled event information.

Returns:

The EIT_schedule_flag value.

getFreeCAMode()

```
public boolean getFreeCAMode()
```

Retrieve the free_CA_mode value of this service, false indicates none of the components of this service are scrambled.

Returns:

The free_CA_mode value of this service.

getName()

```
public java.lang.String getName()
```

This method returns the name of the service represented by this service. The name is extracted from the service_descriptor or optionally from the multilingual_service_name_descriptor. If this descriptor is not present "" is returned. All control characters as defined in ETR 211 are ignored. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The name of this service.

getOriginalNetworkID()

```
public int getOriginalNetworkID()
```

Get the original network identification.

Returns:

The original network identification identifier.

getProviderName()

```
public java.lang.String getProviderName()
```

This method returns the service provider name of this service. The service provider name is extracted from the service_descriptor or optionally from the multilingual_service_name_descriptor. If this descriptor is not present "" is returned. All control characters as defined in ETR 211 are ignored. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The service provider name of this service.

getRunningStatus()

```
public byte getRunningStatus()
```

Retrieve the running status of this service.

Returns:

The running status (the possible values are defined in the SIRunningStatus interface)

See Also:

[SIRunningStatus](#)

getServiceID()

```
public int getServiceID()
```

Get the service identification.

Returns:

The service identification identifier.

getShortProviderName()

```
public java.lang.String getShortProviderName()
```

This method returns the short name (ETR 211) of the service provider of this service without emphasis marks. The name is extracted from the `service_descriptor` or optionally from the `multilingual_service_name_descriptor`. When this information is not available "" is returned. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The short service provider name of this service.

getShortServiceName()

```
public java.lang.String getShortServiceName()
```

This method returns the short name (ETR 211) of this service without emphasis marks. The name is extracted from the `service_descriptor` or optionally from the `multilingual_service_name_descriptor`. When this information is not available "" is returned. For each character the DVB-SI 8 bit character code is mapped to the appropriate Unicode representation.

Returns:

The short name of this service.

getSIServiceType()

```
public short getSIServiceType()
```

Get the service type. The service type is extracted from the `service_descriptor`.

Returns:

The service type. (Some of the possible values are defined in the `SIServiceType` interface.)

See Also:

[SIServiceType](#)

getTextualServiceIdentifiers()

```
public java.lang.String[] getTextualServiceIdentifiers()
```

Returns the textual service identifiers related to this object.

Overrides:

`getTextualServiceIdentifiers()` in interface `TextualServiceIdentifierQuery`

Returns:

an array of String objects containing the textual service identifiers or null if none are present.

Since:

MHP1.0.1

getTransportStreamID()

```
public int getTransportStreamID()
```

Get the transport stream identification.

Returns:

The transport stream identification identifier.

retrieveFollowingSIEvent(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveFollowingSIEvent(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve information associated with the following event from the EIT-present/following.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `SIEvent` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains `-1` as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. `0...255`) are ignored, except for the special meaning of `-1` as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SIEvent`, `DescriptorTag`

retrievePMTService(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrievePMTService(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve the `PMTService` information associated with this service.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `PMTService` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains `-1` as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. `0...255`) are ignored, except for the special meaning of `-1` as the only element in the array.

Returns:

An SIRequest object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `PMTService`, `DescriptorTag`

retrievePresentSIEvent(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrievePresentSIEvent(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve information associated with the present event from the EIT-present/following.

The `SIIterator` that is returned with the event when the request completes successfully will contain an object that implements the `SIEvent` interface. If no matching object was found, the appropriate one of the following events is sent: `ObjectNotInCacheEvent`, `ObjectNotInTableEvent` or `TableNotFoundEvent`.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SIEvent`, `DescriptorTag`

retrieveScheduledSIEvents(short, Object, SIRetrievalListener, short[], Date, Date)

```
public SIRequest retrieveScheduledSIEvents(short retrieveMode, java.lang.Object appData,
    SIRetrievalListener listener, short[] someDescriptorTags,
    java.util.Date startTime, java.util.Date endTime)
```

Retrieve information associated with the scheduled events within the service for a requested period from the EIT-schedule. The events are presented in the order they are present in the EIT-schedule.

The `SIIterator` that is returned with the event when the request completes successfully will contain one or more objects that implement the `SIEvent` interface.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (`FROM_CACHE_ONLY`), from the cache if available and if not from the stream (`FROM_CACHE_OR_STREAM`), or always from the stream (`FROM_STREAM_ONLY`).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - `SIRetrievalListener` that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If `someDescriptorTags` is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

`startTime` - The beginning of the required period in UTC time.

`endTime` - The end of the required period in UTC time.

Returns:

An `SIRequest` object

Throws:

`SIIllegalArgumentException` - thrown if the `retrieveMode` is invalid

`SIInvalidPeriodException` - When no valid period is indicated.

See Also:

`SIRequest`, `SIRetrievalListener`, `SIEvent`, `DescriptorTag`

org.dvb.si SIServiceType

Syntax

```
public interface SIServiceType
```

Description

This interface defines constants corresponding to the different service types.

See Also:

```
getSIServiceType()
```

Fields

D_D2_MAC

```
public static final short D_D2_MAC
```

Constant value for the service type as specified in EN 300 468

DATA_BROADCAST

```
public static final short DATA_BROADCAST
```

Constant value for the service type as specified in EN 300 468

DIGITAL_RADIO_SOUND

```
public static final short DIGITAL_RADIO_SOUND
```

Constant value for the service type as specified in EN 300 468

DIGITAL_TELEVISION

```
public static final short DIGITAL_TELEVISION
```

Constant value for the service type as specified in EN 300 468

FM_RADIO

```
public static final short FM_RADIO
```

Constant value for the service type as specified in EN 300 468

MHP_APPLICATION

```
public static final short MHP_APPLICATION
```

Constant value for the service type as specified in EN 300 468

MOSAIC

public static final short MOSAIC

Constant value for the service type as specified in EN 300 468

NTSC

public static final short NTSC

Constant value for the service type as specified in EN 300 468

NVOD_REFERENCE

public static final short NVOD_REFERENCE

Constant value for the service type as specified in EN 300 468

NVOD_TIME_SHIFTED

public static final short NVOD_TIME_SHIFTED

Constant value for the service type as specified in EN 300 468

PAL

public static final short PAL

Constant value for the service type as specified in EN 300 468

SECAM

public static final short SECAM

Constant value for the service type as specified in EN 300 468

TELETEXT

public static final short TELETEXT

Constant value for the service type as specified in EN 300 468

UNKNOWN

public static final short UNKNOWN

Constant value for the service type as specified in EN 300 468

org.dvb.si

SISuccessfulRetrieveEvent

Syntax

```
public class SISuccessfulRetrieveEvent extends SIRetrievealEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--SIRetrievealEvent
|
+--org.dvb.si.SISuccessfulRetrieveEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent in response to a SI retrieval request when the retrieve request was successfully completed. The result of the request can be obtained from the getResult method.

See Also:

[SIRetrievealListener](#)

Constructors

SISuccessfulRetrieveEvent(Object, SIRequest, SIIterator)

```
public SISuccessfulRetrieveEvent(java.lang.Object appData, SIRequest request,
    SIIterator result)
```

The constructor for the event

Parameters:

- appData - the application data passed in the request method call
- request - the SIRequest instance which is the source of the event
- result - an SIIterator containing the retrieved objects

Methods

getResult()

```
public SIIterator getResult()
```

Returns the requested data in an SIIterator object.

Returns:

An SIIterator containing the requested objects

See Also:

[SIObjectNotInTableEvent](#)

org.dvb.si SITableNotFoundEvent

Syntax

```
public class SITableNotFoundEvent extends SIRetrievalEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--SIRetrievalEvent
|
+--org.dvb.si.SITableNotFoundEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent in response to a SI retrieval request when the SI table that should contain the requested information could not be retrieved. The reason may be that the requested table is not broadcast in the transport stream currently associated with the SI database.

See Also:

[SIRetrievalListener](#)

Constructors

SITableNotFoundEvent(Object, SIRequest)

```
public SITableNotFoundEvent(java.lang.Object appData, SIRequest request)
```

The constructor for the event

Parameters:

`appData` - the application data passed in the request method call

`request` - the SIRequest instance which is the source of the event

org.dvb.si SITableUpdatedEvent

Syntax

```
public class SITableUpdatedEvent extends SIRetrievalEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--SIRetrievalEvent
|
+--org.dvb.si.SITableUpdatedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent in response to a SI descriptor retrieval request when the table carrying the information about the object has been updated and the set of descriptors consistent with the old object can not be retrieved. The application should in this case first update the SIInformation object and then request the descriptors again.

See Also:

[SIRetrievalListener](#)

Constructors

SITableUpdatedEvent(Object, SIRequest)

```
public SITableUpdatedEvent(java.lang.Object appData, SIRequest request)
```

The constructor for the event

Parameters:

`appData` - the application data passed in the request method call

`request` - the SIRequest instance which is the source of the event

org.dvb.si

SITime

Syntax

```
public interface SITime extends SIInformation
```

All Superinterfaces:

[SIInformation](#)

Description

This interface represents the Time and Date Table (TDT) and the (optional) Time Offset Table (TOT). When it represents a TDT table, the `retrieveDescriptors` and `getDescriptorTags` methods behave as documented in the case when there are no descriptors, because the TDT does not contain any descriptors.

See Also:

[SIDatabase](#)

Methods

getUTCtime()

```
public java.util.Date getUTCtime()
```

Get the UTC time as coded in the TDT or TOT table.

Returns:

The UTC as coded in the TDT or TOT table.

org.dvb.si

SITransportStream

Syntax

```
public interface SITransportStream extends SIInformation
```

All Known Subinterfaces:

```
SITransportStreamBAT, SITransportStreamNIT
```

All Superinterfaces:

```
SIInformation
```

Description

This interface is the base interface for representing information about transport streams.

Transport stream retrieval methods in the SIDatabase class and the SINetwork interface use the NIT table and will return objects that implement the SITransportStreamNIT interface.

Transport stream retrieval methods in the SIBouquet interface use the BAT table and will return objects that implement the SITransportStreamBAT interface.

Methods

getDvbLocator()

```
public org.davic.net.dvb.DvbLocator getDvbLocator()
```

Gets a DvbLocator that identifies this transport stream.

Returns:

The DvbLocator of this transport stream.

getOriginalNetworkID()

```
public int getOriginalNetworkID()
```

Get the original network identification.

Returns:

The original network identification identifier.

getTransportStreamID()

```
public int getTransportStreamID()
```

Get the transport stream identification.

Returns:

The transport stream identification identifier.

retrieveSIServices(short, Object, SIRetrievalListener, short[])

```
public SIRequest retrieveSIServices(short retrieveMode, java.lang.Object appData,  
    SIRetrievalListener listener, short[] someDescriptorTags)
```

Retrieve information associated with services carried via the transport stream. This method works in the same way for objects that implement the SITransportStreamNIT and SITransportStreamBAT interfaces.

The SIIterator that is returned with the event when the request completes successfully will contain objects that implement the SIService interface.

Parameters:

`retrieveMode` - Mode of retrieval indicating whether the data should be retrieved only from the cache (FROM_CACHE_ONLY), from the cache if available and if not from the stream (FROM_CACHE_OR_STREAM), or always from the stream (FROM_STREAM_ONLY).

`appData` - An object supplied by the application. This object will be delivered to the listener when the request completes. The application can use this objects for internal communication purposes. If the application does not need any application data, the parameter can be null.

`listener` - SIRetrievalListener that will receive the event informing about the completion of the request.

`someDescriptorTags` - A list of hints for descriptors (identified by their tags) the application is interested in. If the array contains -1 as its one and only element, the application is interested in all descriptors. If someDescriptorTags is null, the application is not interested in descriptors. All values that are out of the valid range for descriptor tags (i.e. 0...255) are ignored, except for the special meaning of -1 as the only element in the array.

Returns:

An SIRequest object

Throws:

`SIIllegalArgumentException` - thrown if the retrieveMode is invalid

See Also:

`SIRequest`, `SIRetrievalListener`, `SIService`, `DescriptorTag`

org.dvb.si

SITransportStreamBAT

Syntax

```
public interface SITransportStreamBAT extends SITransportStream
```

All Superinterfaces:

`SIIInformation`, `SITransportStream`

Description

This interface represents information about transport streams that has been retrieved from a BAT table. All descriptor accessing methods return descriptors retrieved from a BAT table. Methods in `SIBouquet` for retrieving transport streams return objects that implement this interface.

Methods

getBouquetID()

```
public int getBouquetID()
```

Get the identification of the bouquet this transport stream is part of.

Returns:

The bouquet identification identifier.

org.dvb.si

SITransportStreamDescription

Syntax

```
public interface SITransportStreamDescription extends SIInformation
```

All Superinterfaces:

[SIInformation](#)

Description

This interface represents the Transport Stream Description Table (TSDT).

It defines no methods of its own other than those inherited from [SIInformation](#).

See Also:

[SIDatabase](#), [SITransportStream](#)

org.dvb.si

SITransportStreamNIT

Syntax

```
public interface SITransportStreamNIT extends SITransportStream
```

All Superinterfaces:

`SIInformation`, `SITransportStream`

Description

This interface represents information about transport streams that has been retrieved from a NIT table. All descriptor accessing methods return descriptors retrieved from a NIT table. Methods in `SIDatabase` and `SINetwork` for retrieving transport streams return objects that implement this interface.

Methods

getNetworkID()

```
public int getNetworkID()
```

Get the identification of the network this transport stream is part of.

Returns:

The network identification identifier.

org.dvb.si SIUtil

Syntax

```
public class SIUtil
|
| java.lang.Object
|   |--org.dvb.si.SIUtil
```

Description

This class contains SI related utility functions.

Methods

convertSIStringToJavaString(byte[], int, int, boolean)

```
public static java.lang.String convertSIStringToJavaString(byte[] dvbSIText, int offset,
int length, boolean emphasizedPartOnly)
```

This method converts a text string that is coded according to annex A of the DVB-SI specification (EN 300 468) to a Java String object.

The text that must be converted is contained in 'dvbSIText' from index 'offset' to index 'offset+length-1' (inclusive).

If the text that must be converted is not validly coded according to annex A of the DVB-SI specification, then the result is undefined.

Parameters:

`dvbSIText` - The byte array that contains the string that must be converted.

`offset` - The offset indicates the start of the DVB-SI text in `dvbSIText`.

`length` - Length of the DVB-SI text in bytes.

`emphasizedPartOnly` - If `emphasizedPartOnly` is true, then only the text that is marked as emphasized (using the character emphasis on [0x86] and character emphasis off [0x87] control codes) will be returned. Otherwise, the character emphasis codes will be ignored, and all of the converted text will be returned.

Returns:

The converted text.

Throws:

`SIIllegalArgumentException` - thrown if `offset` and/or `offset+length-1` is not a valid index in `dvbSIText`.

org.dvb.si

TextualServiceIdentifierQuery

Syntax

```
public interface TextualServiceIdentifierQuery
```

All Known Subinterfaces:

`SIService`

Description

An interface that can be implemented by objects representing DVB services. Allows applications to obtain the textual service identifiers related to a service.

Since:

MHP1.0.1

Methods

`getTextualServiceIdentifiers()`

```
public java.lang.String[] getTextualServiceIdentifiers()
```

Returns the textual service identifiers related to this object.

Returns:

an array of String objects containing the textual service identifiers or null if none are present.

Since:

MHP1.0.1

Annex N (normative): Streamed Media API Extensions

Package org.dvb.media

Description

Provides DVB specific extensions to the Java Media Framework.

Class Summary	
Interfaces	
<code>BackgroundVideoPresentationControl</code>	A control to support the setting and querying of the video presentation for background players.
<code>SubtitleListener</code>	Report that a subtitle event has happened.
<code>SubtitlingEventControl</code>	Allow applications to register and unregister their interest in events related to the availability and presentation of subtitles.
<code>VideoFormatControl</code>	This provides a means for applications to get information associated with the format and aspect ratio of the video being presented to the user.
<code>VideoFormatListener</code>	The listener used to receive video format events
<code>VideoPresentationControl</code>	A control to support setting and querying the video presentation.
Classes	
<code>ActiveFormatDescriptionChangedEvent</code>	Event signalling that the transmitted active format definition has changed
<code>AspectRatioChangedEvent</code>	Event signalling that the aspect ratio of the transmitted video has changed
<code>CASStopEvent</code>	This event is generated whenever access to a service is withdrawn by the CA system, e.g.
<code>DFCChangedEvent</code>	Event signalling that the decoder format conversion being used has changed
<code>DripFeedDataSource</code>	This class allows to create a source for a JMF player to be able to feed the decoder progressively with parts of a clip (e.g.
<code>DripFeedPermission</code>	This class represents a permission to access the drip feed mode.
<code>NoComponentSelectedEvent</code>	This event is generated whenever presentation of a stream stops because there are no selected components to present.
<code>PresentationChangedEvent</code>	This event is generated whenever the content being presented by a player changes for reasons outside the control of the application.
<code>ServiceRemovedEvent</code>	This event is generated whenever access to a service stops because the service concerned has been removed from the network.
<code>StopByResourceLossEvent</code>	This event is generated whenever presentation of a stream stops because the player has lost so many resources that it cannot continue.
<code>SubtitleAvailableEvent</code>	Report that subtitles are available to be presented having been unavailable.
<code>SubtitleNotAvailableEvent</code>	Inform an application that a subtitle stream has vanished from the network.
<code>SubtitleNotSelectedEvent</code>	Report that subtitles are not now selected.
<code>SubtitleSelectedEvent</code>	Report that subtitles are now selected.

Class Summary

<code>VideoFormatEvent</code>	The base class for all other events relating to changes in video format
<code>VideoTransformation</code>	<code>VideoTransformation</code> objects express video transformations, i.e.
Exceptions	
<code>CAException</code>	This exception is thrown when access to a media stream is denied by the CA system.

org.dvb.media

ActiveFormatDescriptionChangedEvent

Syntax

```
public class ActiveFormatDescriptionChangedEvent extends VideoFormatEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--VideoFormatEvent
|
+--org.dvb.media.ActiveFormatDescriptionChangedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Event signalling that the transmitted active format definition has changed

Constructors

ActiveFormatDescriptionChangedEvent(Object, int)

```
public ActiveFormatDescriptionChangedEvent(java.lang.Object source, int newFormat)
```

Construct the event

Parameters:

`source` - the source of the event

`newFormat` - the new active format description

Methods

getNewFormat()

```
public int getNewFormat()
```

Get the new active format description

Returns:

the new active format description. The value of this is represented by one of the constants from the VideoFormatControl class

org.dvb.media AspectRatioChangedEvent

Syntax

```
public class AspectRatioChangedEvent extends VideoFormatEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|   |
|   +--VideoFormatEvent
|       |
|       +--org.dvb.media.AspectRatioChangedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Event signalling that the aspect ratio of the transmitted video has changed

Constructors

AspectRatioChangedEvent(Object, int)

```
public AspectRatioChangedEvent(java.lang.Object source, int newRatio)
```

Construct the event

Parameters:

`source` - the source of the event

`newRatio` - the new aspect ratio of the transmitted video

Methods

getNewRatio()

```
public int getNewRatio()
```

Get the new aspect ratio of the transmitted video

Returns:

the new aspect ratio of the video. The value of this is represented by one of the constants from the VideoFormatControl class

org.dvb.media

BackgroundVideoPresentationControl

Syntax

```
public interface BackgroundVideoPresentationControl extends VideoPresentationControl
```

All Superinterfaces:

`javax.media.Control`, `VideoPresentationControl`

Description

A control to support the setting and querying of the video presentation for background players.

Methods

getClosestMatch(VideoTransformation)

```
public VideoTransformation getClosestMatch(VideoTransformation t)
```

This method takes a video transformation and returns the closest match of that video transformation that can be supported for the currently selected video. If the input video transformation can be supported, then the output video transformation will have the same parameters as the input video transformation. The definition of 'closest match' is implementation dependent.

Parameters:

`t` - the input video transformation

Returns:

the closest match to the input video transformation. If the input video transformation is supported, then the input video transformation will be returned (the same instance), otherwise a newly created instance will be returned.

getVideoTransformation()

```
public VideoTransformation getVideoTransformation()
```

Return the current video transformation

Returns:

the video transformation (clipping/scaling/positioning) that is currently used for displaying the video.

setVideoTransformation(VideoTransformation)

```
public boolean setVideoTransformation(VideoTransformation t)
```

Sets a new video transformation (clipping/scaling/positioning). If the new video transformation is not supported, then the video transformation will not be changed at all (no best effort attempt is made).

Parameters:

`t` - the new video transformation

Returns:

true if the video transformation is supported and has been set, false otherwise.

org.dvb.media CAException

Syntax

```
public class CAException extends java.io.IOException
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--java.io.IOException
         |
         +--org.dvb.media.CAException
```

All Implemented Interfaces:

java.io.Serializable

Description

This exception is thrown when access to a media stream is denied by the CA system. It will typically be thrown by calls to `DataSource.start()` when access to the stream accessed by the `DataSource` is denied.

Constructors

CAException()

```
public CAException()
```

Constructor without a reason

CAException(String)

```
public CAException(java.lang.String reason)
```

Constructor with a reason

Parameters:

`reason` - the reason why access to the stream failed

org.dvb.media CAStopEvent

Syntax

```
public class CAStopEvent extends javax.media.StopEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--javax.media.ControllerEvent
|
+--javax.media.TransitionEvent
|
+--javax.media.StopEvent
|
+--org.dvb.media.CAStopEvent
```

All Implemented Interfaces:

javax.media.MediaEvent, java.io.Serializable

Description

This event is generated whenever access to a service is withdrawn by the CA system, e.g. at the end of a free preview period. It is not generated when an attempt to construct a Player or DataSource fails due to CA restrictions, or when only some of the presented content is not available or alternate content is presented. Generation of this event informs the application that the Player is no longer presenting any content.

Constructors

CAStopEvent(Controller)

```
public CAStopEvent(javax.media.Controller source)
```

Construct an event.

Parameters:

`source` - the controller which was presenting the service

CAStopEvent(Controller, MediaLocator)

```
public CAStopEvent(javax.media.Controller source, javax.media.MediaLocator stream)
```

Construct an event.

Parameters:

`source` - the controller which was presenting the service

`stream` - the URL of the stream from which access has been withdrawn.

Methods

getStream()

```
public javax.media.MediaLocator getStream()
```

This method returns the stream from which access has been withdrawn.

Returns:

the stream concerned

org.dvb.media DFCChangedEvent

Syntax

```
public class DFCChangedEvent extends VideoFormatEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--VideoFormatEvent
|
+--org.dvb.media.DFCChangedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Event signalling that the decoder format conversion being used has changed

Constructors

DFCChangedEvent(Object, int)

```
public DFCChangedEvent(java.lang.Object source, int newDFC)
```

Construct the event

Parameters:

`source` - the source of the event

`newDFC` - the new decoder format conversion being used

Methods

getNewDFC()

```
public int getNewDFC()
```

Get the new decoder format conversion

Returns:

the new decoder format conversion. The value of this is represented by one of the constants from the VideoFormatControl class

org.dvb.media DripFeedDataSource

Syntax

```
public class DripFeedDataSource extends javax.media.protocol.DataSource
```

```
java.lang.Object
|
+-- javax.media.protocol.DataSource
|
+-- org.dvb.media.DripFeedDataSource
```

All Implemented Interfaces:

javax.media.protocol.Controls, javax.media.Duration

Description

This class allows to create a source for a JMF player to be able to feed the decoder progressively with parts of a clip (e.g. I or P MPEG-2 frame) according to the drip-fed mode format defined in the MHP content format chapter.

To start using the drip-feed mode, the application needs to instantiate a player representing a MPEG-2 video decoder and have its source be a DripFeedDataSource instance.

A DripFeedDataSource instance can be obtained by calling the default constructor of the class.

A player that will be bound to a MPEG-2 video decoder (when realized) can be created with the following special URL (locator): "dripfeed://". It is also possible to use a decoder that was instantiated to play a broadcast MPEG-2 stream.

After having the DripFeedDataSource connected to a Player representing a MPEG-2 video decoder, the following rules applies:

- If the feed method is called when the player is in the "prefetched" state the image will be stored so that when the player goes in the "started" state it will be automatically displayed.
- If the feed method is called when the player is in the "started" mode, the frame shall be displayed immediately. In particular it is not required to feed a second frame to the decoder to display the first frame.
- If the feed method is called when the player is in any other state (or if the DripFeedDataSource is not connected to a player), it will be ignored by the platform implementation.

Constructors

DripFeedDataSource()

```
public DripFeedDataSource()
```

Constructor. A call to the constructor will throw a security exception if the application is not granted the right to use this mode.

Methods

connect()

```
public void connect()
```

This method shall not be used and has no effect. This source is considered as always connected.

Overrides:

`javax.media.protocol.DataSource.connect()` in class `javax.media.protocol.DataSource`

Throws:

`IOException` - never thrown in this sub-class

disconnect()

```
public void disconnect()
```

This method shall not be used and has no effect. This source is considered as always connected.

Overrides:

`javax.media.protocol.DataSource.disconnect()` in class `javax.media.protocol.DataSource`

feed(byte[])

```
public void feed(byte[] clip_part)
```

This method allows an application to feed the decoder progressively with parts of a clip (e.g. I or P MPEG-2 frame) according to the drip-fed mode format defined in the MHP content format chapter.

The feed method shall not be called more often than every 500ms. If this rule is not respected, display is not guaranteed.

While in the prefetch state the drip feed data source is only required to correctly process a single invocation of this method where the data consists only of a single I frame. Possible additional invocations while in the prefetch state shall have implementation specific results.

Parameters:

`clip_part` - Chunk of bytes compliant with the drip-fed mode format defined in the MHP content format chapter (i.e. one MPEG-2 frame with optional syntactic MPEG-2 elements).

getContentType()

```
public java.lang.String getContentType()
```

This method shall return the content type for mpeg-2 video "drips"

Overrides:

`javax.media.protocol.DataSource.getContentType()` in class `javax.media.protocol.DataSource`

Returns:

the content type for MPEG-2 video drips

getControl(String)

```
public java.lang.Object getControl(java.lang.String controlType)
```

Obtain the object that implements the specified Class or Interface. The full class or interface name must be used. If the control is not supported then null is returned.

Overrides:

`javax.media.protocol.DataSource.getControl(java.lang.String)` in class `javax.media.protocol.DataSource`

Parameters:

`controlType` - the full class or interface name of the requested control

Returns:

the object that implements the control, or null.

getControls()

```
public java.lang.Object[] getControls()
```

Obtain the collection of objects that control this object. If no controls are supported, a zero length array is returned.

Overrides:

`javax.media.protocol.DataSource.getControls()` in class `javax.media.protocol.DataSource`

Returns:

the collection of object controls

getDuration()

```
public javax.media.Time getDuration()
```

This method shall not be used and has no effect.

Overrides:

`javax.media.protocol.DataSource.getDuration()` in class `javax.media.protocol.DataSource`

Returns:

DURATION_UNKNOWN.

getStreams()

```
public javax.media.protocol.PullSourceStream[] getStreams()
```

This method is not used and shall return null.

Returns:

always returns null in this sub-class

start()

```
public void start()
```

This method shall not be used and has no effect. This source is considered as always started.

Overrides:

`javax.media.protocol.DataSource.start()` in class `javax.media.protocol.DataSource`

Throws:

`IOException` - never thrown in this sub-class

stop()

```
public void stop()
```

This method shall not be used and has no effect. This source is considered as always started.

Overrides:

`javax.media.protocol.DataSource.stop()` in class `javax.media.protocol.DataSource`

Throws:

`IOException` - never thrown in this sub-class

org.dvb.media DripFeedPermission

Syntax

```
public class DripFeedPermission extends java.security.BasicPermission
```

```
java.lang.Object
|
+--java.security.Permission
    |
    +--java.security.BasicPermission
        |
        +--org.dvb.media.DripFeedPermission
```

All Implemented Interfaces:

java.security.Guard, java.io.Serializable

Description

This class represents a permission to access the drip feed mode.

Constructors

DripFeedPermission(String)

```
public DripFeedPermission(java.lang.String name)
```

Create a new DripFeedPermission.

Parameters:

`name` - the name string is currently unused and should be empty

DripFeedPermission(String, String)

```
public DripFeedPermission(java.lang.String name, java.lang.String actions)
```

Create a new DripFeedPermission. This constructor is used by the policy class to instantiate new permission objects.

Parameters:

`name` - The name string is currently unused and should be empty

`actions` - The actions string is currently unused and should be null.

org.dvb.media

NoComponentSelectedEvent

Syntax

```
public class NoComponentSelectedEvent extends javax.media.StopEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--javax.media.ControllerEvent
|
+--javax.media.TransitionEvent
|
+--javax.media.StopEvent
|
+--org.dvb.media.NoComponentSelectedEvent
```

All Implemented Interfaces:

javax.media.MediaEvent, java.io.Serializable

Description

This event is generated whenever presentation of a stream stops because there are no selected components to present. One example of this would be use of the `javax.tv.media.MediaSelectControl.remove` method to remove all components of a service. Generation of this event informs the application that the Player is no longer presenting any content.

Since:

MHP 1.0.1

Constructors

NoComponentSelectedEvent(Controller)

```
public NoComponentSelectedEvent(javax.media.Controller source)
```

Construct an event.

Parameters:

`source` - the controller which was presenting the service

NoComponentSelectedEvent(Controller, MediaLocator)

```
public NoComponentSelectedEvent(javax.media.Controller source,
    javax.media.MediaLocator stream)
```

Construct an event.

Parameters:

`source` - the controller which was presenting the service

`stream` - the locator of the stream whose presentation has stopped

Methods

getStream()

```
public javax.media.MediaLocator getStream()
```

This method returns the stream whose presentation has stopped

Returns:

the stream concerned

org.dvb.media PresentationChangedEvent

Syntax

```
public class PresentationChangedEvent extends javax.media.ControllerEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|   |
|   +--javax.media.ControllerEvent
|       |
|       +--org.dvb.media.PresentationChangedEvent
```

All Implemented Interfaces:

javax.media.MediaEvent, java.io.Serializable

Description

This event is generated whenever the content being presented by a player changes for reasons outside the control of the application. The state of the player does not change - only the content being presented.

Fields

CA_FAILURE

```
public static final int CA_FAILURE
```

Presentation changed due an action by the CA subsystem. Alternate content is being played, not the content selected by the user (e.g. adverts in place of a scrambled service)

See Also:

[getReason\(\)](#)

CA_RETURNED

```
public static final int CA_RETURNED
```

Presentation changed due to an action by the CA subsystem. Normal content is now being presented as requested by the user. This reason code is used when the CA subsystem commands the MHP terminal to switch back to the normal presentation after having previously selected an alternate content.

See Also:

[getReason\(\)](#)

STREAM_UNAVAILABLE

```
public static final int STREAM_UNAVAILABLE
```

The stream being presented is no longer available in the transport stream.

See Also:

[getReason\(\)](#)

Constructors

PresentationChangedEvent(Controller, MediaLocator, int)

```
public PresentationChangedEvent(javax.media.Controller source,  
                               javax.media.MediaLocator stream, int reason)
```

Constructor for the event

Parameters:

`source` - the controller whose presentation changed

`stream` - the stream now being presented.

`reason` - the reason for the change encoded as one of the constants in this class

Methods

getReason()

```
public int getReason()
```

This method returns the reason why access has been withdrawn.

Returns:

the reason for the change specified when the event was constructed

getStream()

```
public javax.media.MediaLocator getStream()
```

This method returns the locator for the stream now being presented.

Returns:

the stream now being presented

org.dvb.media ServiceRemovedEvent

Syntax

```
public class ServiceRemovedEvent extends javax.media.StopEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--javax.media.ControllerEvent
|
+--javax.media.TransitionEvent
|
+--javax.media.StopEvent
|
+--org.dvb.media.ServiceRemovedEvent
```

All Implemented Interfaces:

javax.media.MediaEvent, java.io.Serializable

Description

This event is generated whenever access to a service stops because the service concerned has been removed from the network. Generation of this event informs the application that the Player is no longer presenting any content.

Since:

MHP 1.0.1

Constructors

ServiceRemovedEvent(Controller)

```
public ServiceRemovedEvent(javax.media.Controller source)
```

Construct an event.

Parameters:

`source` - the controller which was presenting the service

ServiceRemovedEvent(Controller, MediaLocator)

```
public ServiceRemovedEvent(javax.media.Controller source, javax.media.MediaLocator stream)
```

Construct an event.

Parameters:

`source` - the controller which was presenting the service

`stream` - the locator of the stream which was removed from the network

Methods

getStream()

```
public javax.media.MediaLocator getStream()
```

This method returns the stream which was removed from the network

Returns:

the stream concerned

org.dvb.media StopByResourceLossEvent

Syntax

```
public class StopByResourceLossEvent extends javax.media.StopEvent
```

```

java.lang.Object
|
+--java.util.EventObject
    |
    +--javax.media.ControllerEvent
        |
        +--javax.media.TransitionEvent
            |
            +--javax.media.StopEvent
                |
                +--org.dvb.media.StopByResourceLossEvent

```

All Implemented Interfaces:

javax.media.MediaEvent, java.io.Serializable

Description

This event is generated whenever presentation of a stream stops because the player has lost so many resources that it cannot continue. Generation of this event informs the application that the Player is no longer presenting any content.

Since:

MHP 1.0.1

Constructors

StopByResourceLossEvent(Controller)

```
public StopByResourceLossEvent(javax.media.Controller source)
```

Construct an event.

Parameters:

`source` - the controller which was presenting the service

StopByResourceLossEvent(Controller, MediaLocator)

```
public StopByResourceLossEvent(javax.media.Controller source,
    javax.media.MediaLocator stream)
```

Construct an event.

Parameters:

`source` - the controller which was presenting the service

`stream` - the locator of the stream which was being presented

Methods

getStream()

```
public javax.media.MediaLocator getStream()
```

This method returns the stream which was being presented

Returns:

the stream concerned

org.dvb.media SubtitleAvailableEvent

Syntax

```
public class SubtitleAvailableEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.media.SubtitleAvailableEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Report that subtitles are available to be presented having been unavailable. This event is not generated on service selection or other forms of 'zapping'. Its generation is restricted to changes in the composition of the subtitle aspects of the same broadcast stream.

Constructors

SubtitleAvailableEvent(SubtitleLanguageControl)

```
public SubtitleAvailableEvent(org.davic.media.SubtitlingLanguageControl source)
```

Constructor.

Parameters:

source - the source of the event

Methods

getSource()

```
public java.lang.Object getSource()
```

Return the control which was the source of the event.

Overrides:

java.util.EventObject.getSource() in class java.util.EventObject

Returns:

the source of the event

org.dvb.media SubtitleListener

Syntax

```
public interface SubtitleListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

Report that a subtitle event has happened.

Methods

subtitleStatusChanged(EventObject)

```
public void subtitleStatusChanged(java.util.EventObject event)
```

Report a subtitle event has happened.

Parameters:

`event` - the event which happened

org.dvb.media SubtitleNotAvailableEvent

Syntax

```
public class SubtitleNotAvailableEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.media.SubtitleNotAvailableEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Inform an application that a subtitle stream has vanished from the network. This event is not generated on service selection or other forms of 'zapping'. Its generation is restricted to changes in the composition of the subtitle aspects of the same broadcast stream.

Constructors

SubtitleNotAvailableEvent(SubtitleLanguageControl)

```
public SubtitleNotAvailableEvent(org.davic.media.SubtitlingLanguageControl source)
```

Constructor.

Parameters:

source - the source of the event

Methods

getSource()

```
public java.lang.Object getSource()
```

Return the source of the event.

Overrides:

java.util.EventObject.getSource() in class java.util.EventObject

Returns:

the source of the event

org.dvb.media SubtitleNotSelectedEvent

Syntax

```
public class SubtitleNotSelectedEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.media.SubtitleNotSelectedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Report that subtitles are not now selected. Even if subtitles are available in the network, they will not be presented. This event is generated when the combination of end user control of subtitles through the navigator and application control of subtitles through `SubtitlingLanguageControl.setSubtitling` changes whether subtitles are to be presented if they are available. It is not generated for changes in the underlying availability of subtitles even if those cause changes in whether subtitles are presented or not.

Constructors

SubtitleNotSelectedEvent(SubtitlingLanguageControl)

```
public SubtitleNotSelectedEvent(org.davic.media.SubtitlingLanguageControl source)
```

Constructor

Parameters:

`source` - the source of the event

Methods

getSource()

```
public java.lang.Object getSource()
```

Return the source of the event

Overrides:

`java.util.EventObject.getSource()` in class `java.util.EventObject`

Returns:

the source of the event

org.dvb.media SubtitleSelectedEvent

Syntax

```
public class SubtitleSelectedEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.media.SubtitleSelectedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Report that subtitles are now selected. If subtitles are also available then they will be presented. This event is generated when the combination of end user control of subtitles through the navigator and application control of subtitles through `SubtitlingLanguageControl.setSubtitling` changes whether subtitles are to be presented if they are available. It is not generated for changes in the underlying availability of subtitles even if those cause changes in whether subtitles are presented or not.

Constructors

SubtitleSelectedEvent(SubtitlingLanguageControl)

```
public SubtitleSelectedEvent(org.davic.media.SubtitlingLanguageControl source)
```

Constructor

Parameters:

`source` - the source of the event

Methods

getSource()

```
public java.lang.Object getSource()
```

Return the source of the event

Overrides:

`java.util.EventObject.getSource()` in class `java.util.EventObject`

Returns:

the source of the event

org.dvb.media SubtitlingEventControl

Syntax

```
public interface SubtitlingEventControl extends org.davic.media.SubtitlingLanguageControl
```

All Superinterfaces:

javax.media.Control, org.davic.media.LanguageControl, org.davic.media.SubtitlingLanguageControl

Description

Allow applications to register and unregister their interest in events related to the availability and presentation of subtitles.

Methods

addSubtitleListener(SubtitleListener)

```
public void addSubtitleListener(SubtitleListener l)
```

Add a listener for subtitle events

Parameters:

l - the listener to report the events to

removeSubtitleListener(SubtitleListener)

```
public void removeSubtitleListener(SubtitleListener l)
```

Remove a listener for subtitle events

Parameters:

l - the listener to remove

org.dvb.media VideoFormatControl

Syntax

```
public interface VideoFormatControl extends javax.media.Control
```

All Superinterfaces:

javax.media.Control

Description

This provides a means for applications to get information associated with the format and aspect ratio of the video being presented to the user. This control will only be available for Players presenting MPEG-2 video streams.

It is important to note that due to different video and display formats (and user preferences), not all of the full video frame may be displayed. Similarly, it may not always be possible to map video and graphics with perfect accuracy.

Fields

AFD_14_9

```
public static final int AFD_14_9
```

Constant representing an MPEG active format description of 14:9 (centre)

AFD_14_9_TOP

```
public static final int AFD_14_9_TOP
```

Constant representing an MPEG active format description of 14:9 (top)

AFD_16_9

```
public static final int AFD_16_9
```

Constant representing an MPEG active format description of 16:9 (centre)

AFD_16_9_SP_14_9

```
public static final int AFD_16_9_SP_14_9
```

Constant representing an MPEG active format description of 16:9 (with shoot & protect 14:9 centre)

AFD_16_9_SP_4_3

```
public static final int AFD_16_9_SP_4_3
```

Constant representing an MPEG active format description of 16:9 (with shoot & protect 4:3 centre)

AFD_16_9_TOP

```
public static final int AFD_16_9_TOP
```

Constant representing an MPEG active format description of 16:9 (top)

AFD_4_3

```
public static final int AFD_4_3
```

Constant representing an MPEG active format description of 4:3 (centre)

AFD_4_3_SP_14_9

```
public static final int AFD_4_3_SP_14_9
```

Constant representing an MPEG active format description of 4:3 (with shoot & protect 14:9 centre)

AFD_GT_16_9

```
public static final int AFD_GT_16_9
```

Constant representing an MPEG active format description of greater than 16:9 (centre)

AFD_NOT_PRESENT

```
public static final int AFD_NOT_PRESENT
```

Constant showing an MPEG active format description is not present

AFD_SAME

```
public static final int AFD_SAME
```

Constant representing an MPEG active format description that is the same as the coded frame

ASPECT_RATIO_16_9

```
public static final int ASPECT_RATIO_16_9
```

Constant representing an aspect ratio of 16:9

ASPECT_RATIO_2_21_1

```
public static final int ASPECT_RATIO_2_21_1
```

Constant representing an aspect ratio of 2.21:1

ASPECT_RATIO_4_3

```
public static final int ASPECT_RATIO_4_3
```

Constant representing an aspect ratio of 4:3

ASPECT_RATIO_UNKNOWN

```
public static final int ASPECT_RATIO_UNKNOWN
```

Constant representing an unknown aspect ratio

DAR_16_9

```
public static final int DAR_16_9
```

Constant representing a display aspect ratio of 16:9

DAR_4_3

```
public static final int DAR_4_3
```

Constant representing a display aspect ratio of 4:3

DFC_PLATFORM

```
public static final int DFC_PLATFORM
```

Control over the decoder format conversions is returned to being managed by the platform. This is the same as the value used if no MHP application has set a video transformation. It is not required to correspond to a single decoder format conversion and may change over time as the video input format & signalling change. This constant can only be used to set the decoder format conversion. Reading the decoder format conversion shall always return the DFC used at the time concerned.

DFC_PROCESSING_CCO

```
public static final int DFC_PROCESSING_CCO
```

A 4:3 central part out of the 720x576 input 16:9 frame is transferred into a 720x576 4:3 output frame

DFC_PROCESSING_FULL

```
public static final int DFC_PROCESSING_FULL
```

The full 720x576 frame is transferred (this may be either 4:3 or 16:9; part of this may be black, e.g. in the "pillar box" cases)

DFC_PROCESSING_LB_14_9

```
public static final int DFC_PROCESSING_LB_14_9
```

The 720x576 input grid is transferred into a 14:9 LB in a 4:3 frame

DFC_PROCESSING_LB_16_9

```
public static final int DFC_PROCESSING_LB_16_9
```

The 720x576 input grid is transferred into a 16:9 letterbox in a 4:3 frame

DFC_PROCESSING_LB_2_21_1_ON_16_9

```
public static final int DFC_PROCESSING_LB_2_21_1_ON_16_9
```

The 720x576 input grid is transferred into a 2.21:1 letterbox in a 16:9 frame.

DFC_PROCESSING_LB_2_21_1_ON_4_3

```
public static final int DFC_PROCESSING_LB_2_21_1_ON_4_3
```

The 720x576 input grid is transferred into a 2.21:1 letterbox in a 4:3 frame.

DFC_PROCESSING_NONE

```
public static final int DFC_PROCESSING_NONE
```

Decoder format conversion is inactive

DFC_PROCESSING_PAN_SCAN

```
public static final int DFC_PROCESSING_PAN_SCAN
```

A 4:3 part out of the 720x576 input 16:9 or 2.21:1 frame is transferred into a 720x576 4:3 output frame. The horizontal position of this part is determined by pan&scan vectors from the MPEG video stream.

DFC_PROCESSING_UNKNOWN

```
public static final int DFC_PROCESSING_UNKNOWN
```

Constant representing an unknown format conversion being performed by the decoder

Methods

addVideoFormatListener(VideoFormatListener)

```
public void addVideoFormatListener(VideoFormatListener l)
```

Add a listener for VideoFormatChangedEvents

Parameters:

l - the listener to add

getActiveFormatDefinition()

```
public int getActiveFormatDefinition()
```

Return the value of the active_format field of the MPEG Active Format Description of the video if it is transmitted (one of the constants AFD_* above). If this field is not available then AFD_NOT_PRESENT is returned. The constant values for the constants representing the Active Format Description should be identical to the values specified in ETR154, annex B.

Returns:

the value of the active_format field of the MPEG Active Format Description of the video if it is transmitted. If this field is not available, or the video is not MPEG, then AFD_NOT_PRESENT is returned.

getAspectRatio()

```
public int getAspectRatio()
```


Return the aspect ratio of the video as it is transmitted. If the aspect ratio is not known, ASPECT_RATIO_UNKNOWN is returned

Returns:

the aspect ratio of the video

getDecoderFormatConversion()

```
public int getDecoderFormatConversion()
```

Return a value representing what format conversion is being done by the decoder in the platform (one of the constants DFC_* above). A receiver may implement only a subset of the available options. This decoder format conversion may be active or not depending upon the mode of operation.

Returns:

the decoder format conversion being performed or DFC_PROCESSING_UNKNOWN if this is not known

getDisplayAspectRatio()

```
public int getDisplayAspectRatio()
```

Return the aspect ratio of the display device connected to this MHP decoder (one of the constants DAR_* above)

Returns:

the aspect ratio of the display device connected to the decoder

getVideoTransformation(int)

```
public VideoTransformation getVideoTransformation(int dfc)
```

This method returns a VideoTransformation object that corresponds with the specified Decoder Format Conversion when applied to the currently selected video. If the specified Decoder Format Conversion is not supported for the currently selected video, then this method returns null.

Parameters:

dfc - the Decoder Format Conversion (one of the DFC_* constants specified in this interface)

Returns:

the video transformation, or null if the specified Decoder Format Conversion is not supported for the currently selected video.

removeVideoFormatListener(VideoFormatListener)

```
public void removeVideoFormatListener(VideoFormatListener l)
```

Remove a listener for VideoFormatChangedEvents

Parameters:

l - the listener to remove

org.dvb.media VideoFormatEvent

Syntax

```
public abstract class VideoFormatEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.media.VideoFormatEvent
```

Direct Known Subclasses:

```
ActiveFormatDescriptionChangedEvent, AspectRatioChangedEvent,
DFCCChangedEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

The base class for all other events relating to changes in video format

Constructors

VideoFormatEvent(Object)

```
public VideoFormatEvent(java.lang.Object source)
```

Constructor

Parameters:

source - the source of the event

org.dvb.media

VideoFormatListener

Syntax

```
public interface VideoFormatListener
```

Description

The listener used to receive video format events

Methods

receiveVideoFormatEvent(VideoFormatEvent)

```
public void receiveVideoFormatEvent(VideoFormatEvent anEvent)
```

receive a VideoFormatEvent

Parameters:

`anEvent` - the VideoFormatEvent that has been received

org.dvb.media VideoPresentationControl

Syntax

```
public interface VideoPresentationControl extends javax.media.Control
```

All Known Subinterfaces:

[BackgroundVideoPresentationControl](#)

All Superinterfaces:

[javax.media.Control](#)

Description

A control to support setting and querying the video presentation.

Note: For a component-based player the scaling and positioning of the video is done by manipulating the corresponding AWT component. The VideoPresentationControl only allows for the setting of the clipping region.

Note: If the hardware supports the positioning of interlaced video on even lines only (when counting from 0), then a component-based player is allowed to position the top of the video one line below where it should be.

For a background player there is the BackgroundVideoPresentationControl that allows for the setting of the clipping region, the position and the scaling of the video in one atomic action.

Fields

POS_CAP_FULL

```
public static final byte POS_CAP_FULL
```

Constant representing that the video can be positioned anywhere on the screen, even if a part of the video is off screen as a result of that.

POS_CAP_FULL_EVEN_LINES

```
public static final byte POS_CAP_FULL_EVEN_LINES
```

n Constant representing that the video can be positioned anywhere on the screen, even if a part of the video is off screen as a result of that, with the restriction that the field order is respected. This implies that interlaced video can be positioned on even lines only (when counting from 0).

POS_CAP_FULL_EVEN_LINES_IF_ENTIRE_VIDEO_ON_SCREEN

```
public static final byte POS_CAP_FULL_EVEN_LINES_IF_ENTIRE_VIDEO_ON_SCREEN
```

Constant representing that the video can be positioned anywhere on screen as long as all the video is on screen, with the restriction that the field order is respected. This implies that interlaced video can be positioned on even lines only (when counting from 0).

POS_CAP_FULL_IF_ENTIRE_VIDEO_ON_SCREEN

```
public static final byte POS_CAP_FULL_IF_ENTIRE_VIDEO_ON_SCREEN
```

Constant representing that the video can be positioned anywhere on screen as long as all the video is on screen.

POS_CAP_OTHER

```
public static final byte POS_CAP_OTHER
```

Constant representing that the video positioning capability cannot be expressed by another POS_CAP_* constant.

Methods

getActiveVideoArea()

```
public org.havi.ui.HScreenRectangle getActiveVideoArea()
```

This method returns the size and location of the active video area. The active video area excludes any "bars" used for letterboxing or pillarboxing that the receiver knows about. Bars that are included in the broadcast stream and not signalled by active format descriptors are included in the active video area. The active video area may be larger/smaller than the screen, and may possibly be offset. The offsets will be negative if the origin of the active video area is above/left of the top, left corner of the screen. In case of pan&scan, the value returned may vary over time. This method only describes the relationship between the active video and the screen. It does not describe which portion of the screen is displaying the video.

Note: This method includes any video scaling.

Returns:

an HScreenRectangle representing the active video area in the normalised coordinate space.

getActiveVideoAreaOnScreen()

```
public org.havi.ui.HScreenRectangle getActiveVideoAreaOnScreen()
```

This method returns the size and location of the active video area on-screen. The active video area excludes any "bars" used for letterboxing or pillarboxing that the receiver knows about. Bars that are included in the broadcast stream and not signalled by active format descriptors are included in the active video area. The active video area on-screen may be smaller than the area of the screen, and may possibly be offset a positive amount. This method only describes the area on-screen where active video is being presented. It does not really describe which part of the video is being shown on-screen. This is especially true for pan&scan.

Note: This method includes any video scaling.

Returns:

an HScreenRectangle representing the active video area on-screen in the normalised coordinate space.

getClipRegion()

```
public java.awt.Rectangle getClipRegion()
```

This method returns the area of the decoded video that will be displayed. If clipping is not supported, the dimensions of the bounding box will be the same as the displayed video.

Returns:

area of the decoded video that will be displayed. The coordinate space used to express the region is that of the decoded video after possible ETR154 up-sampling.

getHorizontalScalingFactors()

```
public float[] getHorizontalScalingFactors()
```

This method gives information about the supported discrete horizontal scaling factors in case arbitrary horizontal scaling is not supported.

Returns:

an array with the supported discrete horizontal scaling factors (including the scaling factor 1), sorted in ascending order. null is returned when arbitrary horizontal scaling is supported.

getInputVideoSize()

```
public java.awt.Dimension getInputVideoSize()
```

This method returns the dimensions of the video before any scaling has taken place (but after ETR154 up-sampling). On 50Hz standard definition systems this method always returns 720x576.

Returns:

the size of the decoded video before any scaling has taken place (but after ETR154 up-sampling)

getPositioningCapability()

```
public byte getPositioningCapability()
```

This method gives information about how the video can be positioned on screen.

Returns:

the positioning capability for the currently selected video as one of the POS_CAP_* constants.

getTotalVideoArea()

```
public org.havi.ui.HScreenRectangle getTotalVideoArea()
```

This method returns a relative size and location of the total video area, including any "bars" used for letterboxing or pillarboxing that are included in the broadcast stream, but excluding any "bars" introduced as a result of video filtering. This may be larger or smaller than the size of the physical display device. This method only describes the relationship between the total video and the screen. It does not describe which portion of the screen is displaying the video.

Note: This method includes any video scaling.

Returns:

an HScreenRectangle representing the total video area in the normalised coordinate space.

getTotalVideoAreaOnScreen()

```
public org.havi.ui.HScreenRectangle getTotalVideoAreaOnScreen()
```

This method returns a relative size and location of the total video area on-screen, including any "bars" used for letterboxing or pillarboxing that are included in the broadcast stream, but excluding any "bars" introduced as a result of video filtering. This method only describes the area on-screen

where total video is being presented. This does not really describe which part of the video is being shown on-screen. This is especially true for pan&scan.

Note: This method includes any video scaling.

Returns:

an HScreenRectangle representing the total video area on-screen in the normalised coordinate space.

getVerticalScalingFactors()

```
public float[] getVerticalScalingFactors()
```

This method gives information about the supported discrete vertical scaling factors in case arbitrary vertical scaling is not supported.

Returns:

an array with the supported discrete vertical scaling factors (including the scaling factor 1), sorted in ascending order. null is returned when arbitrary vertical scaling is supported.

getVideoSize()

```
public java.awt.Dimension getVideoSize()
```

This method returns the size of the decoded video as it is being presented to the user. It takes scaling and clipping into account.

Returns:

the size of the decoded video as it is being presented to the user

setClipRegion(Rectangle)

```
public java.awt.Rectangle setClipRegion(java.awt.Rectangle clipRect)
```

Set the region of the decoded video that will be displayed. If clipping is not supported, this method has no effect. If the bounding box extends beyond the decoded video, the area not containing video will be filled with the background. By default, the clipping region is set to the dimensions of the decoded video. This method returns the bounding box of the clipping region that was actually set. Implementations may approximate the requested rectangle if they have restrictions on video clipping.

If the player is a component-based player (as opposed to a background player), then the top left corner of the clip region will be aligned with the top left corner of the `java.awt.Component` returned by the method `javax.media.Player.getVisualComponent()`. Hence changing the position of the clip region within the video moves the video with respect to the coordinate space used by `java.awt`.

Parameters:

`clipRect` - the bounding box of the clipping region. The coordinate space used to express the region is that of the decoded video after possible ETR154 up-sampling.

Returns:

the set clipping region. If the requested clipping region is supported exactly, then the input parameter `clipRect` is returned, otherwise a newly created object will be returned.

supportsArbitraryHorizontalScaling()

```
public float[] supportsArbitraryHorizontalScaling()
```

This method gives information about whether arbitrary horizontal scaling is supported for the currently playing video. If arbitrary horizontal scaling is supported, then an array with two elements is returned. The first element returns the smallest allowed scaling factor (e.g. 0.5) and the second element returns the largest allowed scaling factor (e.g. 4). If arbitrary horizontal scaling is not

supported, null is returned. In that case the method `getHorizontalScalingFactors` can be used to query which discrete scaling factors are supported.

Returns:

an array with the minimum and maximum allowed horizontal scaling factor, or null if arbitrary horizontal scaling is not supported.

supportsArbitraryVerticalScaling()

```
public float[] supportsArbitraryVerticalScaling()
```

This method gives information about whether arbitrary vertical scaling is supported for the currently playing video. If arbitrary vertical scaling is supported, then an array with two elements is returned. The first element returns the smallest allowed scaling factor (e.g. 0.5) and the second element returns the largest allowed scaling factor (e.g. 2). If arbitrary vertical scaling is not supported, null is returned. In that case the method `getVerticalScalingFactors` can be used to query which discrete scaling factors are supported.

Returns:

an array with the minimum and maximum allowed vertical scaling factor, or null if arbitrary vertical scaling is not supported.

supportsClipping()

```
public boolean supportsClipping()
```

Test if the decoder supports clipping

Returns:

true if and only if the decoder supports displaying only a section of the decoded video.

org.dvb.media VideoTransformation

Syntax

```
public class VideoTransformation

java.lang.Object
|
+--org.dvb.media.VideoTransformation
```

Description

VideoTransformation objects express video transformations, i.e. the clipping, the horizontal and vertical scaling and the position of the video. All transformations are to be applied after possible ETR154 up-sampling.

Note: Instances of VideoTransformation can represent pan and scan, but an application cannot create such instances itself. An application can get a VideoTransformation representing pan and scan, by calling the VideoFormatControl.getVideoTransformation() method with the pan and scan Decoder Format Conversion constant.

Constructors

VideoTransformation()

```
public VideoTransformation()
```

Creates a VideoTransformation object with default parameters. Clipping is disabled, both the horizontal and the vertical scaling factors are 1, and the video position is (0, 0) in the normalised coordinate space.

VideoTransformation(Rectangle, float, float, HScreenPoint)

```
public VideoTransformation(java.awt.Rectangle clipRect, float horizontalScalingFactor,
    float verticalScalingFactor, org.havi.ui.HScreenPoint location)
```

Creates a VideoTransformation object with the supplied parameters.

Parameters:

`clipRect` - the bounding box of the clipping region. The coordinate space used to express the region is that of the decoded video after possible ETR154 up-sampling.

`horizontalScalingFactor` - the horizontal scaling factor.

`verticalScalingFactor` - the vertical scaling factor.

`location` - the location of the video on the screen in the normalised coordinate space.

Methods

getClipRegion()

```
public java.awt.Rectangle getClipRegion()
```

Gets the clipping region.

Returns:

the bounding box of the clipping region. The coordinate space used to express the region is that of the decoded video after possible ETR154 up-sampling. null is returned if this video transformation represents pan and scan.

getScalingFactors()

```
public float[] getScalingFactors()
```

Gets the horizontal and vertical scaling factors.

Returns:

an array with two elements. The first element contains the horizontal scaling factor, the second element the vertical scaling factor.

getVideoPosition()

```
public org.havi.ui.HScreenPoint getVideoPosition()
```

Returns the video position.

Returns:

the location of the video on the screen in the normalised coordinate space.

isPanAndScan()

```
public boolean isPanAndScan()
```

Returns whether this video transformation represents pan and scan.

Returns:

true is this video transformation represents pan and scan, false otherwise.

setClipRegion(Rectangle)

```
public void setClipRegion(java.awt.Rectangle clipRect)
```

Sets the clipping region.

If this video transformation represents pan and scan, then it will no longer represent pan and scan when this method is called.

Parameters:

`clipRect` - the bounding box of the clipping region. The coordinate space used to express the region is that of the decoded video after possible ETR154 up-sampling.

setScalingFactors(float, float)

```
public void setScalingFactors(float horizontalScalingFactor, float verticalScalingFactor)
```

Sets the horizontal and vertical scaling factors.

Parameters:

`horizontalScalingFactor` - the horizontal scaling factor.

`verticalScalingFactor` - the vertical scaling factor.

setVideoPosition(HScreenPoint)

```
public void setVideoPosition(org.havi.ui.HScreenPoint location)
```

Sets the video position.

Parameters:

`location` - the location of the video on the screen in the normalised coordinate space.

Annex O (normative): Integration of the JavaTV SI API and DVB SI

O.1 Introduction

This section describes how the JavaTV Service Information API as described in [51] can be mapped to the data structures of DVB Service Information as defined in EN 300 468 [4]. Secondly this document describes how the JavaTV API and the DVB SI API (as described in annex M, "(normative): SI Access API" on page 329) can be integrated.

O.2 Mapping of the JavaTV SI API to DVB SI

This section describes for every relevant Java interface and method in the JavaTV SI API how it is mapped to the DVB Service Information.

O.2.1 `javax.tv.service.Service`

The Service interface represents a DVB Service as stored in the MHP terminal as "installed services".

Depending on the MHP terminal implementation, the objects implementing this interface may or may not implement the ServiceNumber interface as well. Furthermore, it is allowed that even within the same MHP terminal implementation, some objects implementing the Service interface implement the ServiceNumber while other objects implement only the Service interface.

Objects implementing this interfaces and representing DVB services shall also implement the `org.dvb.si.TextualServiceIdentifiersQuery` interface.

The methods are mapped as follows:

O.2.1.1 `getName`

Returns the name of the service as stored in the MHP terminal. Depending on the MHP terminal implementation, the end user may have the possibility to edit these names according to his preferences. If the contents of this field are retrieved by the MHP terminal by default from DVB SI, it is recommended that the MHP terminal uses the abbreviated form of the service name from the Service descriptor.

O.2.1.2 `getServiceType`

Returns the ServiceType according to the mapping defined in section O.2.3, "`javax.tv.service.ServiceType`" on page 457.

O.2.2 `javax.tv.service.ServiceComponent`

The ServiceComponent interface provides the information contained in the Component descriptors, Multilingual component descriptors or Data broadcast descriptors in the EIT.

O.2.2.1 `getComponentName`

Returns the component description from the Component descriptor or from the Multilingual component descriptor using the language preference, or from the Data broadcast descriptor.

O.2.2.2 `getAssociatedLanguage`

Returns the ISO 639.2 [66] language code indicating the language of the component (i.e. not necessarily the selected language for the name returned by `getName()`) from the Component descriptor or from the Data broadcast descriptor.

O.2.2.3 `getStreamType`

Returns the stream type according to the mapping from the `stream_content` field and the `component_type` field of the Component descriptor or the Data broadcast descriptor to the JavaTV stream types according to O.2.4, "`javax.tv.service.StreamType`" on page 457.

O.2.3 javax.tv.service.ServiceType

The DVB SI service types are defined in Table 61 of EN 300 468 [4]. These should be mapped to the JavaTV service types as follows.

Table O.1 : Mapping DVB to JavaTV service types

DVB Service type code	DVB Service Type Description	JavaTV Service Type
0x01	Digital television service	DIGITAL_TV
0x02	Digital radio sound service	DIGITAL_RADIO
0x03	Teletext service	DATA_BROADCAST
0x04	NVOD Reference service	NVOD_REFERENCE
0x05	NVOD time-shifted service	NVOD_TIME_SHIFTED
0x06	Mosaic service	DIGITAL_TV
0x07	PAL coded signal	ANALOG_TV
0x08	SECAM coded signal	ANALOG_TV
0x09	D/D2-MAC	ANALOG_TV
0x0A	FM Radio	ANALOG_RADIO
0x0B	NTSC coded signal	ANALOG_TV
0x0C	Data broadcast service	DATA_BROADCAST
0x10	MHP application service	DATA_APPLICATION
0x00, 0x0D...0x0F, 0x11...0xFF		UNKNOWN

O.2.4 javax.tv.service.StreamType

The DVB SI stream_content and component_type values are defined in Table 15 of EN 300 468 [4]. These should be mapped to the JavaTV Stream types as follows. If the component does not have an associated Component descriptor, but a Data broadcast descriptor, the stream type DATA shall be used.

Table O.2 : Mapping DVB stream & component types to JavaTV

DVB stream_content	DVB component_type	JavaTV Stream type
0x01	0x00...0xff	VIDEO
0x02	0x00...0xff	AUDIO
0x03	0x01, 0x10...0x13, 0x20...0x23	SUBTITLES
0x03	0x02	DATA
0x03	0x00, 0x14...0x1F, 0x23...0xFF	UNKNOWN
0x04...0x0F	0x00...0xFF	UNKNOWN

O.2.5 javax.tv.service.SIElement

This interface is implemented by objects implementing the Network, Bouquet, TransportStream, ServiceDetails, ServiceComponent and ProgramEvent interfaces.

O.2.5.1 getServiceInformationType

This method shall return the DVB_SI ServiceInformationType.

O.2.6 javax.tv.service.SIManager

O.2.6.1 getSupportedDimensions

The parental rating descriptor defined in DVB SI standardizes one rating scheme that is based on age. To describe this DVB defined rating scheme, the `getSupportedDimensions` shall return an array that contains the string "DVB Age based rating".

O.2.6.2 getRatingDimension

When given the string "DVB Age based rating", this method shall return an object implementing the `RatingDimension` interface as described in section O.2.10, "[javax.tv.service.navigation.RatingDimension](#)" on page 459.

O.2.6.3 retrieveSIElement

When passed a locator that points to a service, an object implementing the `ServiceDetails` interface shall be returned. Other types of locators are not supported.

O.2.6.4 getTransports

The object returned by this method shall implement the `Transport` interface as described in O.2.12, "[javax.tv.service.transport.Transport](#)" on page 459.

O.2.6.5 filterServices

Filtering of Services shall be supported with `ServiceFilters`. The `SIElementFilter` is required to be supported as defined in O.2.7, "[javax.tv.service.navigation.SIElementFilter](#)" on page 458

O.2.7 javax.tv.service.navigation.SIElementFilter

The `SIElementFilter` allows filtering of Services based on another `SIElement`. This filter type shall be supported for the `Network` and `TransportStream` objects. For other `SIElement` objects, the constructor may throw `FilterNotSupportedException`.

O.2.8 javax.tv.service.navigation.ServiceDetails

The `ServiceDetails` interface represents the information regarding the service as retrieved from the broadcast DVB SI. The object implementing this interface for DVB SI implements the `CAIdentification` interface according to the mapping defined in section O.2.9, "[javax.tv.service.navigation.CAIdentification](#)" on page 459. These objects shall not implement the `ServiceNumber` interface.

O.2.8.1 getLongName

Returns the full name of the service from the Service descriptor or from the Multilingual service name descriptor using the language preference.

O.2.8.2 getServiceType

Returns the `ServiceType` according to the mapping defined in section O.2.3, "[javax.tv.service.ServiceType](#)" on page 457.

O.2.8.3 retrieveServiceDescription

Shall always result in a `notifyFailure` of the `SIRequestor` object being called with the `DATA_UNAVAILABLE` `SIRequestFailureType`, as DVB SI does not include a service description.

O.2.8.4 retrieveComponents

The information for the `ServiceComponents` shall be retrieved from `Component` descriptors (or their multilingual variants or the `Data` broadcast descriptor for data components) of the present event in the EIT present/following table.

O.2.9 javax.tv.service.navigation.CAIdentification

This interface shall be implemented by objects implementing the ServiceDetails, ProgramEvent or Bouquet interface.

O.2.9.1 getCASystemIds

Returns the array of integer values containing the CA_system_ids from the CA identifier descriptor. If the CA identifier descriptor is not present, returns an empty array.

O.2.9.2 isFree

When implemented in an object implementing the ServiceDetails or ProgramEvent interface, this method shall return true if and only if the free_CA_mode bit is set to "0" in the SDT or EIT entry, respectively.

When implemented in an object implementing the Bouquet interface, this method shall return true if and only if there is no CA identifier descriptor present in the BAT.

O.2.10 javax.tv.service.navigation.RatingDimension

The Parental rating descriptor defined in DVB SI standardizes one rating scheme that is based on age. This rating scheme contains 15 distinct age rating levels from 4 to 18 years.

An object that describes this DVB defined rating scheme shall implement the methods as follows.

O.2.10.1 getDimensionName

Returns the string "DVB Age based rating".

O.2.10.2 getNumberOfLevels

Returns 15.

O.2.10.3 getRatingLevelDescription

Returns an array of 2 strings of the form:

```
{"Over n", "Recommended minimum age: n years"}
```

where n is the input parameter + 4.

O.2.11 javax.tv.service.navigation.ServiceProviderInformation

This interface shall be implemented by objects implementing the ServiceDetails interface.

O.2.11.1 getProviderName

Returns the service provider name from the Service descriptor or from the Multilingual service name descriptor using the language preference.

O.2.12 javax.tv.service.transport.Transport

The object implementing the Transport interface shall also implement the interfaces NetworkCollection and BouquetCollection.

O.2.13 javax.tv.service.transport.Bouquet

The Bouquet interface is implemented by an object that represents a DVB SI Bouquet.

Objects implementing this interface shall also implement the CAIdentification interface. See O.2.9, "javax.tv.service.navigation.CAIdentification" on page 459.

O.2.13.1 `getBouquetID`

Returns the integer DVB SI Bouquet ID value.

O.2.13.2 `getName`

Returns the name of the bouquet from the Bouquet name descriptor or from the Multilingual bouquet name descriptor using the language preference.

O.2.13.3 `getLocator`

Returns an implementation dependent `javax.tv.locator.Locator` object that does not have a standardized external representation and might not be a `org.davic.net.dvb.DvbLocator`.

O.2.14 `javax.tv.service.transport.Network`

The Network interface is implemented by an object that represents a DVB SI Network.

O.2.14.1 `getNetworkID`

Returns the integer DVB SI Network ID value.

O.2.14.2 `getName`

Returns the name of the network from the Network name descriptor or from the Multilingual network name descriptor using the language preference.

O.2.14.3 `getLocator`

Returns an implementation dependent `javax.tv.locator.Locator` object that does not have a standardized external representation and might not be a `org.davic.net.dvb.DvbLocator`.

O.2.15 `javax.tv.service.transport.TransportStream`

The TransportStream interface is implemented by an object that represents a transport stream.

O.2.15.1 `getTransportStreamID`

Returns the integer DVB SI transport stream ID value.

O.2.15.2 `getDescription`

Transport streams do not have descriptions in DVB SI, so this method shall return an empty string.

O.2.16 `javax.tv.service.guide.ProgramEvent`

This interface is implemented by objects representing DVB SI Events.

Objects implementing this interface shall also implement the `CAIdentification` interface. See O.2.9, "[javax.tv.service.navigation.CAIdentification](#)" on page 459.

O.2.16.1 `getDuration`

Returns the duration value from the event entry in the body of the EIT.

O.2.16.2 `getStartTime`

Returns the start time value from the event entry in the body of the EIT.

O.2.16.3 `getEndTime`

Returns the end time value calculated from the start time and duration in the body of the EIT.

O.2.16.4 getName

Returns the event name from one of the Short event descriptors in the event using the language preference.

O.2.16.5 retrieveDescription

Returns the event description from one of the Short event descriptors in the event using the language preference.

The description text in the `ProgramEventDescription` object is just passed through as a `String` containing the description as it was transmitted in the EIT table with just a character set mapping performed.

Codes 0x8a and 0xe08a defined in tables A.1 and A.2 of EN 300 468 [4] shall be mapped to the Java newline character, '\n'.

O.2.16.6 getRating

Returns the rating from the Parental rating descriptor according to the mapping defined in section O.2.17, "[javax.tv.service.guide.ContentRatingAdvisory](#)" on page 461.

O.2.17 javax.tv.service.guide.ContentRatingAdvisory

O.2.17.1 getDimensionNames

Returns an array containing the string "DVB Age based rating" as one of the elements in the array.

O.2.17.2 getRatingLevel

When the parameter is "DVB Age based rating" and the parental rating descriptor contains a rating value between 0x01 and 0x0F for the current region, returns the integer rating value contained in the parental rating descriptor decremented by one (i.e. the value in the descriptor - 1). In other cases when the parameter is "DVB Age based rating" returns -1.

O.2.17.3 getRatingText

When the parameter is "DVB Age based rating" and the parental rating descriptor contains a rating value between 0x01 and 0x0F for the current region, returns a string of the form "Recommended minimum age: n years" where n is the rating value in the descriptor incremented by 4 (i.e. the value in the descriptor + 4). In other cases when the parameter is "DVB Age based rating" returns an empty string.

O.2.17.4 getDisplayText

When the parental rating descriptor contains a rating value between 0x01 and 0x0F for the current region, returns a string that contains the string "Over n", where n is the rating value in the descriptor incremented by 4 (i.e. the value in the descriptor + 4), as its substring.

O.3 Integration of the JavaTV SI API and the DVB SI API

In order for the protocol independent service information API to be useful, there needs to be an easy and convenient way for applications to use the DVB specific parts when they are needed. The information provided in the protocol independent API is quite minimal and does not cover all the aspects of the standardized DVB Service Information nor access to the private extensions carried in the standard protocol. If there is no integration between these APIs and the application programmer needs to use a completely different API to retrieve additional information on the object retrieved from the protocol independent API, the usefulness of the protocol independent API is very questionable. In this case, the application programmer will start using only the protocol dependent API, as it provides the complete information and is as easy to use as the other API.

To overcome these problems and make the protocol independent API somehow useful, it needs to be well integrated with the protocol dependent API, so that if an application uses first the protocol independent API for browsing the information, it can easily get additional, protocol dependent information on the objects of interest.

The Java language provides an easy way to achieve this integration: the same objects can implement both the protocol independent interface as well as the protocol dependent interface. This way the application programmer only needs to cast the object to the protocol dependent interface and can directly call methods from the protocol specific API.

Objects implementing the following interfaces of the DVB SI API should implement also the corresponding JavaTV SI API interfaces. When retrieving SI objects through the JavaTV APIs, they shall also implement the corresponding DVB SI API interfaces.

The interfaces of both APIs shall be implemented on the objects as follows:

Table O.3 :

org.dvb.si.SINetwork	objects implement also	javax.tv.service.transport.Network
org.dvb.si.SIBouquet	objects implement also	javax.tv.service.transport.Bouquet
org.dvb.si.SITransportStreamNIT	objects implement also	javax.tv.service.transport.TransportStream
org.dvb.si.SIService	objects implement also	javax.tv.service.navigation.ServiceDetails
org.dvb.si.SIEvent	objects implement also	javax.tv.service.guide.ProgramEvent

Annex P (normative): Broadcast Transport Protocol Access

The Object Carousel represents the best suited protocol to carry a structure of objects. Thus, the Object Carousel "mimics" a remote server.

The structure of the objects carried in an Object Carousel is identical to the structure of UU-Objects located on a remote DSMCC-UU Server.

The aim of this API is to enable an application to access files encapsulated in an object carousel or accessible through a DSMCC interactive network. Note that the protocol is abstracted from the application viewpoint, so, objects accessible through this API are either objects encapsulated in an Object Carousel, or Objects located in an interactive DSMCC network on a remote server.

To benefit from the fact that most of the functionalities are already covered by the java.io package, this API inherits from java.io and only defines the extra-functionalities pertaining to:

- a) the nature of the network (broadcast or DSMCC remote server) and its latency (e.g. possibility to asynchronously load the objects)
- b) the type of the objects that can be encapsulated in a carousel and that do not exist in a classical File structure. These are: ServiceGateway, Directory, File, Stream and StreamEvent.
- c) Definition of ServiceGateway, which defines a new namespace corresponding to the new Domain, and enables the mounting of a new volume.

An application can optionally use only the classes of java.io. Alternatively/additionally applications can use additional classes and methods adapted to the specific nature and latency of the network (such as for example, the asynchronous loading of objects).

The following, briefly explains the functionalities offered by this API

The ServiceDomain class enables attaching to a ServiceDomain. Attachment to a serviceDomain corresponds to the mounting of a volume in the file hierarchy system and the loading of the Service Gateway.

When attached to a Service Domain the DSM-CC UU-File, UU-Stream, UU-Directory and UU-StreamEvent objects are accessible through this API.

The class DSMCCObject represents a UU-object. Due to the close relationship between resident files and downloaded files, this class inherits from the java.io.File class. The DSMCCObject class just defines the additional methods specific to DSMCC-UU that basically deal with asynchronous or synchronous loading of Objects.

For the UU-Files or UU-Directory Objects, their content is accessible as it would be for a classical file system, that means through the classical JDK java.io package (e.g., for listing the objects pointed to by a Directory object, you invoke the list() method of the java.io.File class, or to access the content of a UU-File, you can instantiate a FileInputStream to read the File, etc...).

Additionally, the DSMCCStream and DSMCCStreamEvent classes define functionalities specific to the respective types of Objects (Stream and StreamEvent), which basically consists in accessing the attributes of these Objects.

The DSMCCStream class provides access to the following attributes Duration, current NPT. In addition, an application can retrieve the list of Taps (modeled by the 'Locator' class), in order for a Player to be able to control and play that Stream.

The DSMCCStreamEvent class inherits from the DSMCCStream class, and provides access to the event list attributes of a StreamEvent Object. In addition, the application has the possibility to subscribe the events which are present in the eventList.

The AsynchronousLoadingEvent class and its subclasses represent events that are sent to a listener to notify it of the loading of an Object that had been activated by the application (asynchronous loading mode).

The StreamEvent class represents an abstraction of the real event that is generated, i.e. the streameventdescriptor, which enables the broadcaster to synchronize the application with the stream. This class enables the access to the content of an event, the content of the event being described by the StreamEventDescriptor, which is inserted in the stream in DSMCC sections at the transport level.

Finally, the StreamEventListener and AsynchronousLoadingEventListener are interfaces that must be implemented by the application, in order for it to receive the respective StreamEvents and AsynchronousLoadingEvents.

Package org.dvb.dsmcc

Description

Provides extended access to files carried in the broadcast stream. It includes some extensions to java.io which are generic to (possibly) long-latency file systems and some concepts which are specific to the DSMCC object carousel.

Class Summary	
Interfaces	
<code>AsynchronousLoadingEventListener</code>	Listener for applications which perform asynchronous loading, in order to be informed if the loading is done or if an error has occurred.
<code>NPTListener</code>	Objects that implement the <code>NPTListener</code> interface can receive <code>NPTEvent</code> events.
<code>ObjectChangeEventListener</code>	The objects that implements the <code>ObjectChangeEventListener</code> interface can receive <code>ObjectChangeEvent</code> event.
<code>StreamEventListener</code>	Objects that implement the <code>StreamEventListener</code> interface can receive <code>StreamEvent</code> event.
Classes	
<code>AsynchronousLoadingEvent</code>	This class described an Object event which is used to notify the loading of a DSMCC object.
<code>DSMCCObject</code>	A <code>DSMCCObject</code> is an object which belongs to a DSMCC ServiceDomain.
<code>DSMCCStream</code>	The <code>Stream</code> class is used to manage DSMCC Stream Objects.
<code>DSMCCStreamEvent</code>	The <code>DSMCCStreamEvent</code> class is used to manage DSMCC StreamEvent Objects.
<code>InvalidFormatEvent</code>	This event is generated if the format of the data received is inconsistent.
<code>InvalidPathnameEvent</code>	The pathname does not exist or the ServiceDomain has been detached.
<code>LoadingAbortedEvent</code>	This event will be sent to the <code>AsynchronousEventListener</code> when an asynchronous loading operation is aborted.
<code>MPEGDeliveryErrorEvent</code>	An <code>MPEGDeliveryErrorEvent</code> indicates that an error (for instance, a time out or accessing the data would require tuning) has occurred while loading data from an MPEG Stream.
<code>NotEntitledEvent</code>	This event is sent when an attempt to asynchronously load an object has failed because the elementary stream carrying the object is scrambled and the user is not entitled to access the content of the object.
<code>NPTDiscontinuityEvent</code>	Sent when an MHP terminal detects a permanent discontinuity in NPT as defined in the main body of this specification.
<code>NPTPresentEvent</code>	Sent when NPT newly appears in a stream where it was not previously present.
<code>NPTRate</code>	Represents the rate at which an NPT time-base progresses.
<code>NPTRateChangeEvent</code>	Sent only when the rate of an NPT time-base changes value.
<code>NPTRemovedEvent</code>	Sent when NPT which was present is removed from a stream.

Class Summary	
<code>NPTStatusEvent</code>	Sent when an MHP terminal detects a change of status in the NPT of a stream.
<code>ObjectChangeEvent</code>	This class describes an object change event that is used to monitor the arrival of a new version of a <code>DSMCCObject</code> .
<code>ServerDeliveryErrorEvent</code>	The local machine can not communicate with the server.
<code>ServiceDomain</code>	A <code>ServiceDomain</code> represents a group of DSMCC objects.
<code>ServiceXFRErrorEvent</code>	The object requested is available in an alternate <code>ServiceDomain</code> .
<code>ServiceXFRReference</code>	A <code>ServiceXFRReference</code> object is used when a DSMCC Object can not be loaded in the current <code>ServiceDomain</code> but is available in an alternate <code>ServiceDomain</code> .
<code>StreamEvent</code>	This class describes a Stream event which is used to synchronize an application with an MPEG Stream.
<code>SuccessEvent</code>	This event indicates that the asynchronous loading was successful.
Exceptions	
<code>DSMCCException</code>	The <code>DSMCCException</code> is the root class of all DSMCC related exceptions
<code>IllegalObjectTypeException</code>	This Exception is thrown when the application attempted to create a <code>DSMCCStream</code> or <code>DSMCCStreamEvent</code> object with an object or a path that did not correspond to a DSMCC Stream or DSMCC StreamEvent respectively
<code>InsufficientResourcesException</code>	This exception gets thrown when a request to subscribe to a stream event can not be completed due to resource limitations.
<code>InvalidAddressException</code>	An <code>InvalidAddressException</code> is thrown when the format of an NSAP address is not recognized.
<code>InvalidFormatException</code>	An <code>InvalidFormatException</code> is thrown when an inconsistent DSMCC message is received.
<code>InvalidPathNameException</code>	The <code>InvalidPathNameException</code> is thrown when the path name to a DSMCCObject does not exist or if the <code>ServiceDomain</code> has been detached.
<code>MPEGDeliveryException</code>	An <code>MPEGDeliveryException</code> is thrown when an error (for instance, a time out or accessing the data would require tuning) occurs while loading data from an MPEG Stream.
<code>NotEntitledException</code>	This Exception is thrown when the user is not entitled to access the content of the object (the Elementary Stream is scrambled and the user is not entitled).
<code>NothingToAbortException</code>	A <code>NothingToAbortException</code> is thrown when the abort method is called and there is no loading in progress.
<code>NotLoadedException</code>	A <code>NotLoadedException</code> is thrown when the Stream object constructor is called with a DSMCC Object which is not loaded.
<code>ServerDeliveryException</code>	A <code>ServerDeliveryException</code> is thrown when the local machine can not communicate with the server.
<code>ServiceXFRException</code>	A <code>ServiceXFRException</code> is thrown when a DSMCC Object can not be loaded in the current <code>ServiceDomain</code> but is available in an alternate <code>ServiceDomain</code> (i.e.
<code>UnknownEventException</code>	The <code>UnknownEventException</code> is thrown when a method tries to access to an unknown event.

org.dvb.dsmcc

AsynchronousLoadingEvent

Syntax

```
public abstract class AsynchronousLoadingEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.dsmcc.AsynchronousLoadingEvent
```

Direct Known Subclasses:

```
InvalidFormatEvent, InvalidPathnameEvent, LoadingAbortedEvent,
MPEGDeliveryErrorEvent, NotEntitledEvent, ServerDeliveryErrorEvent,
ServiceXFRErrorEvent, SuccessEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

This class described an Object event which is used to notify the loading of a DSMCC object.

Constructors

AsynchronousLoadingEvent(DSMCCObject)

```
public AsynchronousLoadingEvent(DSMCCObject o)
```

Creates an AsynchronousLoadingEvent.

Parameters:

o - the DSMCCObject that generated the event.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the DSMCCObject that generated the event.

Overrides:

java.util.EventObject.getSource() in class java.util.EventObject

Returns:

the DSMCCObject that generated the event.

org.dvb.dsmcc

AsynchronousLoadingEventListener

Syntax

```
public interface AsynchronousLoadingEventListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

Listener for applications which perform asynchronous loading, in order to be informed if the loading is done or if an error has occurred.

Methods

receiveEvent(AsynchronousLoadingEvent)

```
public void receiveEvent(AsynchronousLoadingEvent e)
```

Method called when an event is sent to the application.

Parameters:

e - an AsynchronousLoadingEvent event.

org.dvb.dsmcc DSMCCEXception

Syntax

```
public class DSMCCEXception extends java.io.IOException
```

```

java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--java.io.IOException
            |
            +--org.dvb.dsmcc.DSMCCEXception

```

Direct Known Subclasses:

IllegalObjectTypeException, InsufficientResourcesException,
 InvalidAddressException, InvalidFormatException, InvalidPathNameException,
 MPEGDeliveryException, NotEntitledException, NothingToAbortException,
 NotLoadedException, ServerDeliveryException, ServiceXFRException,
 UnknownEventException

All Implemented Interfaces:

java.io.Serializable

Description

The DSMCCEXception is the root class of all DSMCC related exceptions

Constructors

DSMCCEXception()

```
public DSMCCEXception()
```

Construct a DSMCCEXception with no detail message

DSMCCEXception(String)

```
public DSMCCEXception(java.lang.String s)
```

Construct a DSMCCEXception with the specified detail message

Parameters:

s - the detail message

org.dvb.dsmcc

DSMCCObject

Syntax

```
public class DSMCCObject extends java.io.File
```

```
java.lang.Object
|
+--java.io.File
|
+--org.dvb.dsmcc.DSMCCObject
```

All Implemented Interfaces:

java.io.Serializable

Description

A DSMCCObject is an object which belongs to a DSMCC ServiceDomain. As soon as a ServiceDomain has been attached to the file system hierarchy, DSMCCObject objects can be created to access the ServiceDomain objects. Paths used to create a DSMCCObject can be either absolute or relative as defined in detail in the main body of this specification. To access the content of the object:

- For a Directory, the method list of the java.io.File class has to be used to get the entries of the directory.
- For a Stream object, the class DSMCCStream has to be used.
- For a File, the java.io.FileInputStream class or the java.io.RandomAccessFile has to be used.

NB:

- Obviously, for the Object Carousel, the write mode of java.io.RandomAccessFile is not allowed.

See Also:

[ServiceDomain](#)

Fields

FROM_CACHE

```
public static final int FROM_CACHE
```

Constant to indicate that the data for an object shall only be retrieved where it is already in cache and meets the requirements of cache priority signaling. Where data is not in the cache, or the contents don't meet the requirements of the of cache priority signaling, attempts to load a DSMCCObject shall fail.

Since:

MHP 1.0.1

FROM_CACHE_OR_STREAM

```
public static final int FROM_CACHE_OR_STREAM
```

Constant to indicate that the data for an object shall be automatically be retrieved from the network where the data is not already cached. Note that this method does not modify the caching policy controlled by the signaling in the OC. So, if the data is signalled as requiring transparent caching then data will be retrieved from the network if required.

Since:
MHP 1.0.1

FROM_STREAM_ONLY

```
public static final int FROM_STREAM_ONLY
```

Constant to indicate that the data for an object shall always be retrieved from the network even if the data has already been cached.

Since:
MHP 1.0.1

Constructors

DSMCCObject(DSMCCObject, String)

```
public DSMCCObject(DSMCCObject dir, java.lang.String name)
```

Create a DSMCCObject object.

Parameters:
dir - the directory object.
name - the filename.

DSMCCObject(String)

```
public DSMCCObject(java.lang.String path)
```

Create a DSMCCObject object.

Parameters:
path - the path to the file.

DSMCCObject(String, String)

```
public DSMCCObject(java.lang.String path, java.lang.String name)
```

Create a DSMCCObject object.

Parameters:
path - the directory Path.
name - the filename.

Methods

abort()

```
public void abort()
```

This method is used to abort a load in progress. It can be used to abort either a synchronousLoad or an asynchronousLoad.

Throws:

`NothingToAbortException` - There is no loading in progress.

addObjectChangeListener(ObjectChangeListener)

```
public void addObjectChangeListener(ObjectChangeListener listener)
```

Subscribes an `ObjectChangeListener` to receive notifications of version changes of `DSMCCObject`.

This listener shall never be fired until after the object has successfully entered the loaded state for the first time. Hence objects which never successfully enter the loaded state (e.g. because the object cannot be found) shall never have this listener fire. Once an object has successfully entered the loaded state once, this event shall continue to be fired when changes are detected by the MHP regardless of further transitions in or out of the loaded state.

Parameters:

`listener` - the `ObjectChangeListener` to be notified .

asynchronousLoad(AsynchronousLoadingEventListener)

```
public void asynchronousLoad(AsynchronousLoadingEventListener l)
```

This method is used to asynchronously load a carousel object. For each call to this method which returns without throwing an exception, one of the following events will be sent to the application (by a listener mechanism) as soon as the loading is done or if an error has occurred: `SuccessEvent`, `InvalidFormatEvent`, `InvalidPathNameEvent`, `MPEGDeliveryErrorEvent`, `ServerDeliveryErrorEvent`, `ServiceXFRErrorEvent`, `NotEntitledEvent`

Parameters:

`l` - an `AsynchronousLoadingEventListener` to receive events related to asynchronous loading.

Throws:

`InvalidPathNameException` - the object can not be found.

getSigners()

```
public java.security.cert.X509Certificate[][] getSigners()
```

This method will return the lists of certificate chains that can authenticate the `DSMCCObject`. If the `DSMCCObject` is not loaded, this method will return null. If the `DSMCCObject` is loaded but not authenticated this method will return an outer array of size zero.

Returns:

a two-dimensional array of X.509 certificates, where the first index of the array determines a certificate chain and the second index identifies the certificate within the chain. Within one certificate chain the leaf certificate is first followed by any intermediate certificate authorities in the order of the chain with the root CA certificate as the last item.

Since:

MHP 1.0.1

getURL()

```
public java.net.URL getURL()
```

Returns a URL identifying this carousel object. If the directory entry for the object has not been loaded then null shall be returned.

Returns:

a URL identifying the carousel object or null

Since:
MHP 1.0.1

isLoading()

```
public boolean isLoading()
```

Returns a boolean indicating whether or not the DSMCCObject has been loaded.

Returns:
true if the file is already loaded, false otherwise.

isObjectKindKnown()

```
public boolean isObjectKindKnown()
```

Returns a boolean indicating if the kind of the object is known. (The kind of an object is known if the directory containing it is loaded).

Returns:
true if the type of the object is known, false otherwise.

isStream()

```
public boolean isStream()
```

Returns a boolean indicating whether or not the DSMCCObject is a DSMCC Stream object.

Returns:
true if the file is a stream, false if the object is not a stream or if the object kind is unknown.

isStreamEvent()

```
public boolean isStreamEvent()
```

Returns a boolean indicating whether or not the DSMCCObject is a DSMCC StreamEvent object.
NB: If isStreamEvent is true then isStream is true also.

Returns:
true if the file is a stream event, false if the object is not a stream event or if the object kind is unknown.

loadDirectoryEntry(AsynchronousLoadingEventListener)

```
public void loadDirectoryEntry(AsynchronousLoadingEventListener l)
```

Asynchronous loading of the directory entry information. Calling this is equivalent of calling the method asynchronousLoad on the parent directory of a DSMCCObject.

Parameters:
l - a listener which will be called when the loading is done.

Throws:
`InvalidPathNameException` - if the object cannot be found.

prefetch(DSMCCObject, String, byte)

```
public static boolean prefetch(DSMCCObject dir, java.lang.String path, byte priority)
```

Calling this method will issue a hint to the MHP for pre-fetching the object data for that DSMCC object into cache.

Parameters:

`dir` - the directory object in which to pre-fetch the data.

`path` - the relative path name of object to pre-fetch, starting from the directory object passes as parameter.

`priority` - the relative priority of this pre-fetch request (higher = more important)

Returns:

true if the MHP supports pre-fetching (i.e. will try to process the request) and false otherwise.

Note that a return value of 'true' is only an indication that the MHP receiver supports pre-fetching.

It is not a guarantee that the requested data will actually be loaded into cache as the receiver may decide to drop the request in order to make resources available for regular load requests.

prefetch(String, byte)

```
public static boolean prefetch(java.lang.String path, byte priority)
```

Calling this method will issue a hint to the MHP for pre-fetching the object data for that DSMCC object into cache.

Parameters:

`path` - the absolute pathname of the object to pre-fetch.

`priority` - the relative priority of this pre-fetch request (higher = more important)

Returns:

true if the MHP supports pre-fetching (i.e. will try to process the request) and false otherwise.

Note that a return value of 'true' is only an indication that the MHP receiver supports pre-fetching.

It is not a guarantee that the requested data will actually be loaded into cache as the receiver may decide to drop the request in order to make resources available for regular load requests.

removeObjectChangeListener(ObjectChangeListener)

```
public void removeObjectChangeListener(ObjectChangeListener listener)
```

Unsubscribes an ObjectChangeListener to receive notifications of version changes of DSMCCObject.

Parameters:

`listener` - a previously registered ObjectChangeListener.

setRetrievalMode(int)

```
public void setRetrievalMode(int retrieval_mode)
```

Set the retrieval mode for a DSMCCObject. The default retrieval mode is FROM_CACHE_OR_STREAM. The retrieval mode state is sampled when the object is loaded (whether explicitly or as described in "Constraints on the java.io.File methods for broadcast carousels"). Changing the retrieval mode for a loaded object has no effect until the object is unloaded and loaded again.

Parameters:

`retrieval_mode` - the retrieval mode to be used for the object specified as one of the public static final constants in this class.

Throws:

`IllegalArgumentException` - if the `retrieval_mode` specified is not one listed defined for use with this method.

Since:

MHP 1.0.1

synchronousLoad()

```
public void synchronousLoad()
```

This method is used to load a DSMCCObject. This method blocks until the file is loaded. It can be aborted from another thread with the abort method. In this case the InterruptedIOException is thrown. If the IOR of the object itself or one of its parent directories is a Lite Option Profile Body, the MHP implementation will not attempt to resolve it: a ServiceXFRException is thrown to indicate to the application where the DSMCCObject is actually located.

Throws:

`InterruptedIOException` - the loading has been aborted.

`InvalidPathNameException` - the Object can not be found.

`NotEntitledException` - the stream carrying the object is scrambled and the user has no entitlements to descramble the stream.

`ServiceXFRException` - the IOR of the object or one of its parent directories is a Lite Option Profile Body.

`InvalidFormatException` - an inconsistent DSMCC message has been received.

`MPEGDeliveryException` - an error has occurred while loading data from MPEG stream such as a timeout

`ServerDeliveryException` - when an MHP terminal cannot communicate with the server for files delivered over a bi-directional IP connection.

unload()

```
public void unload()
```

When calling this method, the applications gives a hint to the MHP that if this object is not consumed by another application/thread, the system can free all the resources allocated to this object. It is worth noting that if other clients use this object (e.g. a file input stream is opened on this object or if the corresponding stream or stream event is being consumed) the system resources allocated to this object will not be freed.

Throws:

`NotLoadedException` - the carousel object is not loaded.

org.dvb.dsmcc DSMCCStream

Syntax

```
public class DSMCCStream
|
| java.lang.Object
| |
| | |--org.dvb.dsmcc.DSMCCStream
```

Direct Known Subclasses:

[DSMCCStreamEvent](#)

Description

The Stream class is used to manage DSMCC Stream Objects.

See Also:

[DSMCCObject](#)

Constructors

DSMCCStream(DSMCCObject)

```
public DSMCCStream(DSMCCObject aDSMCCObject)
```

Creates a Stream Object from a DSMCC Object. The BIOP message referenced by the DSMCCObject has to be a Stream or StreamEvent BIOP message.

Parameters:

`aDSMCCObject` - the DSMCC object which describes the stream

Throws:

[NotLoadedException](#) - the DSMCCObject is not loaded.

[IllegalObjectTypeException](#) - the DSMCCObject is neither a DSMCC Stream nor a DSMCCStreamEvent

DSMCCStream(String)

```
public DSMCCStream(java.lang.String path)
```

Create a Stream Object from its pathname. For an object Carousel, this method will block until the module which contains the object is loaded. The BIOP message referenced by the DSMCCObject pointed to by the parameter `path` has to be a Stream or StreamEvent BIOP message. The path has to lead to a DSMCCStream (or a DSMCCStreamEvent)

Parameters:

`path` - the pathname of the DSMCCStream Object.

Throws:

[IOException](#) - If an IO error occurred.

[IllegalObjectTypeException](#) - the DSMCCObject is neither a DSMCC Stream nor a DSMCCStreamEvent

DSMCCStream(String, String)

```
public DSMCCStream(java.lang.String path, java.lang.String name)
```

Create a DSMCCStream from its pathname. For an object Carousel, this method will block until the module which contains the object is loaded. The BIOP message referenced by the DSMCCObject pointed to be the parameters path and name has to be a Stream or StreamEvent BIOP message. The path has to lead to a DSMCCStream (or a DSMCCStreamEvent)

Parameters:

path - the directory path.

name - the name of the DSMCCStream Object.

Throws:

`IOException` - If an IO error occurred.

`IllegalObjectTypeException` - the DSMCCObject is neither a DSMCC Stream nor a DSMCCStreamEvent

Methods

addNPTListener(NPTListener)

```
public void addNPTListener(NPTListener l)
```

Add a listener to NPT events on the `DSMCCStream` object. Adding the same listener a second time has no effect.

Parameters:

l - the listener

Since:

MHP 1.0.1

getDuration()

```
public long getDuration()
```

This function returns the duration in milliseconds of the DSMCC Stream. If the DSMCCStream BIOP message doesn't specify duration, zero will be returned.

Returns:

The duration in milliseconds of the DSMCC Stream.

getNPT()

```
public long getNPT()
```

This function is used to get the current NPT in milliseconds.

Returns:

the current NPT in milliseconds or zero if DSMCC Stream object BIOP message doesn't contain any taps pointing to NPT reference descriptors.

Throws:

`MPEGDeliveryException` - if there's an error in retrieving NPT reference descriptors

getNPTRate()

```
public NPTRate getNPTRate()
```

Get the NPT rate for the `DSMCCStream` object. Returns null if the DSMCC stream has no associated NPT rate (i.e. no `STR_NPT_USE` tap in the list of taps).

Returns:

the NPT rate or null

Since:

MHP 1.0.1

getStreamLocator()

```
public org.davic.net.Locator getStreamLocator()
```

This function returned a `Locator` referencing the streams of this collection. The interpretation of the return value is determined by the `isMPEGProgram` method.

Returns:

a locator.

isAudio()

```
public boolean isAudio()
```

This function returns a boolean indicating if the Stream Object refers to an audio stream. This is the case if the `audio` field in the `Stream(Event)` BIOP message has a value different from zero.

Returns:

true only if the Stream object refers to an audio stream

isData()

```
public boolean isData()
```

This function returns a boolean indicating if the Stream Object refers to a data stream. This is the case if the `data` field in the `Stream(Event)` BIOP message has a value different from zero.

Returns:

true only if the Stream object refers to a data stream

isMPEGProgram()

```
public boolean isMPEGProgram()
```

This method will return true if the `Stream(Event)` BIOP message contains a tap with use field `BIOP_PROGRAM_USE`, otherwise it will return false.

Returns:

true only if the `Stream(Event)` BIOP message is as described above

isVideo()

```
public boolean isVideo()
```

This function returns a boolean indicating if the Stream Object refers to an video stream. This is the case if the `video` field in the `Stream(Event)` BIOP message has a value different from zero otherwise false is returned.

Returns:

true only if the Stream object refers to an video stream

removeNPTListener(NPTListener)

```
public void removeNPTListener(NPTListener l)
```

Remove a listener to NPT events on the `DSMCCStream` object. Removing a non-subscribed listener has no effect.

Parameters:

l - the listener to remove

Since:

MHP 1.0.1

org.dvb.dsmcc DSMCCStreamEvent

Syntax

```
public class DSMCCStreamEvent extends DSMCCStream
```

```
java.lang.Object
|
+--DSMCCStream
|
+--org.dvb.dsmcc.DSMCCStreamEvent
```

Description

The DSMCCStreamEvent class is used to manage DSMCC StreamEvent Objects. Applications wishing to monitor changes in the list of events which are part of this stream event should use `DSMCCObject.addObjectChangeListener` on the `DSMCCObject` representing which describes this set of stream events.

Constructors

DSMCCStreamEvent(DSMCCObject)

```
public DSMCCStreamEvent(DSMCCObject aDSMCCObject)
```

Create a `DSMCCStreamEvent` from a `DSMCCObject`. The Object has to be a `DSMCCStreamEvent`.

Parameters:

`aDSMCCObject` - the DSMCC object which describes the stream.

Throws:

`NotLoadedException` - the `DSMCCObject` is not loaded.

`IllegalObjectTypeException` - the `DSMCCObject` does not lead to a `DSMCCStreamEvent`.

DSMCCStreamEvent(String)

```
public DSMCCStreamEvent(java.lang.String path)
```

Create a `DSMCCStreamEvent` Object from its pathname. The path has to lead to a `DSMCCStreamEvent`.

Parameters:

`path` - the pathname of the `DSMCCStreamEvent` object

Throws:

`IOException` - An IO error has occurred.

`IllegalObjectTypeException` - the path does not lead to a `DSMCCStreamEvent`.

DSMCCStreamEvent(String, String)

```
public DSMCCStreamEvent(java.lang.String path, java.lang.String name)
```

Create a DSMCCStreamEvent from its pathname. For an object Carousel, this method will block until the module which contains the object is loaded. The path has to lead to a DSMCC Stream Event

Parameters:

path - the directory path.

name - the name of the DSMCCStreamEvent Object.

Throws:

IOException - If an IO error occurred.

IllegalObjectTypeException - the path does not lead to a DSMCC StreamEvent.

Methods

getEventList()

```
public java.lang.String[] getEventList()
```

This function is used to get the list of the events of the DSMCCStreamEvent object.

Returns:

The list of the eventName.

subscribe(String, StreamEventListener)

```
public synchronized int subscribe(java.lang.String eventName, StreamEventListener l)
```

This function is used to subscribe to an event of a DSMCC StreamEvent object.

Parameters:

eventName - the name of the event.

l - an object that implements the StreamEventListener Interface.

Returns:

The event Identifier.

Throws:

UnknownEventException - the event cannot be found at this time

InsufficientResourcesException - if resources needed to perform the subscription are not available

unsubscribe(int, StreamEventListener)

```
public synchronized void unsubscribe(int eventId, StreamEventListener l)
```

This function is used to cancel the subscription to an event of a DSMCCEvent object.

Parameters:

eventId - Identifier of the event.

l - an object that implements the StreamEventListener Interface.

Throws:

UnknownEventException - The event can not be found.

unsubscribe(String, StreamEventListener)

```
public synchronized void unsubscribe(java.lang.String eventName, StreamEventListener l)
```

This function is used to cancel the subscription to an event of a DSMCCEvent object.

Parameters:

`eventName` - the name of the event.

`l` - an object that implements the StreamEventListener Interface.

Throws:

`UnknownEventException` - The event can not be found.

org.dvb.dsmcc

IllegalObjectTypeException

Syntax

```
public class IllegalObjectTypeException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
|
+--java.lang.Exception
|
+--java.io.IOException
|
+--DSMCCException
|
+--org.dvb.dsmcc.IllegalObjectTypeException
```

All Implemented Interfaces:

java.io.Serializable

Description

This Exception is thrown when the application attempted to create a DSMCCStream or DSMCCStreamEvent object with an object or a path that did not correspond to a DSMCC Stream or DSMCC StreamEvent respectively

Constructors

IllegalObjectTypeException()

```
public IllegalObjectTypeException()
```

constructor of the exception with no detail message

IllegalObjectTypeException(String)

```
public IllegalObjectTypeException(java.lang.String s)
```

constructor of the exception

Parameters:

s - detail message

org.dvb.dsmcc

InsufficientResourcesException

Syntax

```
public class InsufficientResourcesException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--java.io.IOException
            |
            +--DSMCCException
                |
                +--org.dvb.dsmcc.InsufficientResourcesException
```

All Implemented Interfaces:

java.io.Serializable

Description

This exception gets thrown when a request to subscribe to a stream event cannot be completed due to resource limitations. For example, no section filters or system timers may be available. This exception will not get thrown when there is not enough memory available to complete the request - this will get signalled by a `java.lang.OutOfMemoryError`

Since:

MHP 1.0.1

Constructors

InsufficientResourcesException()

```
public InsufficientResourcesException()
```

Construct an `InsufficientResourcesException` with no detail message

InsufficientResourcesException(String)

```
public InsufficientResourcesException(java.lang.String message)
```

Construct an `InsufficientResourcesException` with the specified detail message

Parameters:

`message` - the message for the exception

org.dvb.dsmcc InvalidAddressException

Syntax

```
public class InvalidAddressException extends DSMCCEException
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--java.io.IOException
         |
         +--DSMCCEException
            |
            +--org.dvb.dsmcc.InvalidAddressException
```

All Implemented Interfaces:

java.io.Serializable

Description

An InvalidAddressException is thrown when the format of an NSAP address is not recognized.

Constructors

InvalidAddressException()

```
public InvalidAddressException()
```

Construct a InvalidAddressException with no detail message

InvalidAddressException(String)

```
public InvalidAddressException(java.lang.String s)
```

Construct a InvalidAddressException with the specified detail message

Parameters:

s - the detail message

org.dvb.dsmcc InvalidFormatEvent

Syntax

```
public class InvalidFormatEvent extends AsynchronousLoadingEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--AsynchronousLoadingEvent
        |
        +--org.dvb.dsmcc.InvalidFormatEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is generated if the format of the data received is inconsistent.

Constructors

InvalidFormatEvent(DSMCCObject)

```
public InvalidFormatEvent(DSMCCObject o)
```

Create an InvalidFormatException object.

Parameters:

- o - the DSMCCObject that generated the event.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the DSMCCObject that generated the event

Overrides:

`getSource()` in class `AsynchronousLoadingEvent`

Returns:

the DSMCCObject that generated the event

org.dvb.dsmcc InvalidFormatException

Syntax

```
public class InvalidFormatException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--java.io.IOException
         |
         +--DSMCCException
            |
            +--org.dvb.dsmcc.InvalidFormatException
```

All Implemented Interfaces:

java.io.Serializable

Description

An InvalidFormatException is thrown when an inconsistent DSMCC message is received.

Constructors

InvalidFormatException()

```
public InvalidFormatException()
```

Construct an InvalidFormatException with no detail message

InvalidFormatException(String)

```
public InvalidFormatException(java.lang.String s)
```

Construct an InvalidFormatException with the specified detail message

Parameters:

s - the detail message

org.dvb.dsmcc InvalidPathnameEvent

Syntax

```
public class InvalidPathnameEvent extends AsynchronousLoadingEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--AsynchronousLoadingEvent
        |
        +--org.dvb.dsmcc.InvalidPathnameEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

The pathname does not exist or the ServiceDomain has been detached.

Constructors

InvalidPathnameEvent(DSMCCObject)

```
public InvalidPathnameEvent(DSMCCObject o)
```

Create an InvalidPathnameEvent.

Parameters:

- o - the DSMCCObject that generated this event.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the DSMCCObject that generated the event.

Overrides:

`getSource()` in class `AsynchronousLoadingEvent`

Returns:

the DSMCCObject that generated the event.

org.dvb.dsmcc InvalidPathNameException

Syntax

```
public class InvalidPathNameException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--java.io.IOException
            |
            +--DSMCCException
                |
                +--org.dvb.dsmcc.InvalidPathNameException
```

All Implemented Interfaces:

java.io.Serializable

Description

The InvalidPathNameException is thrown when the path name to a DSMCCObject does not exist or if the ServiceDomain has been detached.

Constructors

InvalidPathNameException()

```
public InvalidPathNameException()
```

Construct an InvalidPathNameException with no detail message

InvalidPathNameException(String)

```
public InvalidPathNameException(java.lang.String s)
```

Construct an InvalidPathNameException with the specified detail message

Parameters:

s - the detail message

org.dvb.dsmcc LoadingAbortedEvent

Syntax

```
public class LoadingAbortedEvent extends AsynchronousLoadingEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--AsynchronousLoadingEvent
        |
        +--org.dvb.dsmcc.LoadingAbortedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event will be sent to the `AsynchronousEventListener` when an asynchronous loading operation is aborted.

Since:

MHP 1.0.1

Constructors

LoadingAbortedEvent(DSMCCObject)

```
public LoadingAbortedEvent(DSMCCObject aDSMCCObject)
```

Creates a `LoadingAbortedEvent` object.

Parameters:

`aDSMCCObject` - the `DSMCCObject` that generated the event.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the `DSMCCObject` that generated the event.

Overrides:

`getSource()` in class `AsynchronousLoadingEvent`

Returns:

the `DSMCCObject` whose loading was aborted

org.dvb.dsmcc MPEGDeliveryErrorEvent

Syntax

```
public class MPEGDeliveryErrorEvent extends AsynchronousLoadingEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--AsynchronousLoadingEvent
        |
        +--org.dvb.dsmcc.MPEGDeliveryErrorEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

An MPEGDeliveryErrorEvent indicates that an error (for instance, a time out or accessing the data would require tuning) has occurred while loading data from an MPEG Stream.

Constructors

MPEGDeliveryErrorEvent(DSMCCObject)

```
public MPEGDeliveryErrorEvent(DSMCCObject o)
```

Creates an MPEGDeliveryEvent.

Parameters:

- o - the DSMCCObject that generated the event.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the DSMCCObject that generated the event.

Overrides:

getSource() in class AsynchronousLoadingEvent

Returns:

the DSMCCObject that generated the event.

org.dvb.dsmcc MPEGDeliveryException

Syntax

```
public class MPEGDeliveryException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--java.io.IOException
            |
            +--DSMCCException
                |
                +--org.dvb.dsmcc.MPEGDeliveryException
```

All Implemented Interfaces:

java.io.Serializable

Description

An MPEGDeliveryException is thrown when an error (for instance, a time out or accessing the data would require tuning) occurs while loading data from an MPEG Stream.

Constructors

MPEGDeliveryException()

```
public MPEGDeliveryException()
```

Construct an MPEGDeliveryException with no detail message

MPEGDeliveryException(String)

```
public MPEGDeliveryException(java.lang.String s)
```

Construct an MPEGDeliveryException with the specified detail message

Parameters:

s - the detail message

org.dvb.dsmcc NotEntitledEvent

Syntax

```
public class NotEntitledEvent extends AsynchronousLoadingEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--AsynchronousLoadingEvent
|
+--org.dvb.dsmcc.NotEntitledEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent when an attempt to asynchronously load an object has failed because the elementary stream carrying the object is scrambled and the user is not entitled to access the content of the object.

Constructors

NotEntitledEvent(DSMCCObject)

```
public NotEntitledEvent(DSMCCObject o)
```

Creates a NotEntitledEvent object.

Parameters:

- o - the DSMCCObject that generated the event.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the DSMCCObject that generated the event.

Overrides:

`getSource()` in class `AsynchronousLoadingEvent`

Returns:

the DSMCCObject that generated the event.

org.dvb.dsmcc NotEntitledException

Syntax

```
public class NotEntitledException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--java.io.IOException
            |
            +--DSMCCException
                |
                +--org.dvb.dsmcc.NotEntitledException
```

All Implemented Interfaces:

java.io.Serializable

Description

This Exception is thrown when the user is not entitled to access the content of the object (the Elementary Stream is scrambled and the user is not entitled).

Constructors

NotEntitledException()

```
public NotEntitledException()
```

construct a NotEntitledException with no detail message

NotEntitledException(String)

```
public NotEntitledException(java.lang.String s)
```

construct a NotEntitledException with a detail message

Parameters:

s - detail message

org.dvb.dsmcc NothingToAbortException

Syntax

```
public class NothingToAbortException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--java.io.IOException
         |
         +--DSMCCException
            |
            +--org.dvb.dsmcc.NothingToAbortException
```

All Implemented Interfaces:

java.io.Serializable

Description

A NothingToAbortException is thrown when the abort method is called and there is no loading in progress.

Constructors

NothingToAbortException()

```
public NothingToAbortException()
```

Construct a NothingToAbortException with no detail message

NothingToAbortException(String)

```
public NothingToAbortException(java.lang.String s)
```

Construct a NothingToAbortException with the specified detail message

Parameters:

s - the detail message

org.dvb.dsmcc NotLoadedException

Syntax

```
public class NotLoadedException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--java.io.IOException
            |
            +--DSMCCException
                |
                +--org.dvb.dsmcc.NotLoadedException
```

All Implemented Interfaces:

java.io.Serializable

Description

A NotLoadedException is thrown when the Stream object constructor is called with a DSMCC Object which is not loaded.

Constructors

NotLoadedException()

```
public NotLoadedException()
```

Construct a NotLoadedException with no detail message

NotLoadedException(String)

```
public NotLoadedException(java.lang.String s)
```

Construct a NotLoadedException with the specified detail message

Parameters:

s - the detail message

org.dvb.dsmcc NPTDiscontinuityEvent

Syntax

```
public class NPTDiscontinuityEvent extends NPTStatusEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--NPTStatusEvent
|
+--org.dvb.dsmcc.NPTDiscontinuityEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

Sent when an MHP terminal detects a permanent discontinuity in NPT as defined in the main body of this specification. This represents an error condition in the incoming broadcast.

This event shall be sent following a PCR discontinuity when the MHP terminal has enough information to determine that there will be an NPT discontinuity. If this is because of invalid data in a new NPTReferenceDescriptor then the event will be generated when that new NPTReferenceDescriptor is detected by the MHP terminal. If this is because no new NPTReferenceDescriptor is detected within the time allowed by the main body of this specification then it will be generated when that time interval has elapsed.

Since:

```
MHP 1.0.1
```

Constructors

NPTDiscontinuityEvent(DSMCCStream, long, long)

```
public NPTDiscontinuityEvent(DSMCCStream source, long before, long after)
```

Construct an event. The *before* and *after* values used shall be the values at the time when the receiver determined that a NPT discontinuity has happened. If this is because of invalid data in a new NPTReferenceDescriptor then this is the time when that new descriptor was known to be invalid. If this is because of the absence of a new NPTReferenceDescriptor then this will be when the MHP terminal detects that the time interval allowed by this specification for such new descriptors has elapsed

Parameters:

- source* - the stream whose NPT suffered a discontinuity
- before* - the last NPT value detected before the discontinuity
- after* - the first NPT value detected after the discontinuity

Methods

getFirstNPT()

```
public long getFirstNPT()
```

Return the first known stable value of NPT after the discontinuity

Returns:

an NPT value

getLastNPT()

```
public long getLastNPT()
```

Return the last known stable value of NPT before the discontinuity

Returns:

an NPT value

org.dvb.dsmcc NPTListener

Syntax

```
public interface NPTListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

Objects that implement the `NPTListener` interface can receive `NPTEvent` events.

Since:

MHP 1.0.1

Methods

receiveNPTStatusEvent(NPTStatusEvent)

```
public void receiveNPTStatusEvent(NPTStatusEvent e)
```

Send a `NPTStatusEvent` to a registered listener.

Parameters:

`e` - a `NPTStatusEvent` describing the status change

receiveRateChangedEvent(NPTRateChangeEvent)

```
public void receiveRateChangedEvent(NPTRateChangeEvent e)
```

Send a `NPTRateChangeEvent` to a registered listener.

Parameters:

`e` - the `NPTRateChangeEvent` event.

org.dvb.dsmcc NPTPresentEvent

Syntax

```
public class NPTPresentEvent extends NPTStatusEvent
```

```
java.lang.Object  
|  
+--java.util.EventObject  
|  
+--NPTStatusEvent  
|  
+--org.dvb.dsmcc.NPTPresentEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Sent when NPT newly appears in a stream where it was not previously present.

Since:

MHP 1.0.1

Constructors

NPTPresentEvent(DSMCCStream)

```
public NPTPresentEvent(DSMCCStream source)
```

Construct an event.

Parameters:

source - the stream where NPT appeared

org.dvb.dsmcc NPTRate

Syntax

```
public class NPTRate
```

```
java.lang.Object
```

```
|
```

```
+--org.dvb.dsmcc.NPTRate
```

Description

Represents the rate at which an NPT time-base progresses. Rates are expressed as the combination of a numerator and a denominator. Instances of this class are constructed by the platform and returned to applications.

Since:

MHP 1.0.1

Methods

getDenominator()

```
public int getDenominator()
```

Get the NPT rate's denominator.

Returns:

the denominator

getNumerator()

```
public int getNumerator()
```

Get the NPT rate's numerator. A value of zero indicates that the NPT is not progressing.

Returns:

the numerator

org.dvb.dsmcc NPTRateChangeEvent

Syntax

```
public class NPTRateChangeEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.dsmcc.NPTRateChangeEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Sent only when the rate of an NPT time-base changes value.

Since:

MHP 1.0.1

Constructors

NPTRateChangeEvent(DSMCCStream, NPTRate)

```
public NPTRateChangeEvent(DSMCCStream source, NPTRate rate)
```

Construct an event.

Parameters:

`source` - the stream whose rate changed

`rate` - the new rate of that stream immediately following the change

Methods

getRate()

```
public NPTRate getRate()
```

Return the new rate of the stream immediately after the change.

Returns:

a `NPTRate` object encapsulating the new rate

getSource()

```
public java.lang.Object getSource()
```

Return the stream whose rate changed.

Overrides:

`java.util.EventObject.getSource()` in class `java.util.EventObject`

Returns:

the `DSMCCStream` object on which the rate change has occurred.

org.dvb.dsmcc NPTRemovedEvent

Syntax

```
public class NPTRemovedEvent extends NPTStatusEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--NPTStatusEvent
        |
        +--org.dvb.dsmcc.NPTRemovedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

Sent when NPT which was present is removed from a stream.

Since:

MHP 1.0.1

Constructors

NPTRemovedEvent(DSMCCStream)

```
public NPTRemovedEvent(DSMCCStream source)
```

Construct an event.

Parameters:

`source` - the stream which NPT was removed from

org.dvb.dsmcc NPTStatusEvent

Syntax

```
public abstract class NPTStatusEvent extends java.util.EventObject

java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.dsmcc.NPTStatusEvent
```

Direct Known Subclasses:

[NPTDiscontinuityEvent](#), [NPTPresentEvent](#), [NPTRemovedEvent](#)

All Implemented Interfaces:

[java.io.Serializable](#)

Description

Sent when an MHP terminal detects a change of status in the NPT of a stream.

Since:

MHP 1.0.1

Constructors

NPTStatusEvent(DSMCCStream)

```
public NPTStatusEvent(DSMCCStream source)
```

Construct an event.

Parameters:

`source` - the stream whose NPT status changed

Methods

getSource()

```
public java.lang.Object getSource()
```

Return the stream whose NPT status changed.

Overrides:

[java.util.EventObject.getSource\(\)](#) in class [java.util.EventObject](#)

Returns:

the [DSMCCStream](#) whose status changed

org.dvb.dsmcc ObjectChangeEvent

Syntax

```
public class ObjectChangeEvent extends java.util.EventObject
```

```
java.lang.Object  
|  
+--java.util.EventObject  
|  
+--org.dvb.dsmcc.ObjectChangeEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This class describes an object change event that is used to monitor the arrival of a new version of a DSMCCObject. For files carried in a DSMCC object carousel, when a change in a module is detected, this event shall be sent to all registered listeners for all objects carried in that module.

Constructors

ObjectChangeEvent(DSMCCObject, int)

```
public ObjectChangeEvent(DSMCCObject source, int aVersionNumber)
```

Creates an ObjectChangeEvent indicating that a new version of the monitored DSMCC Object has been detected. It is up to the application to reload the new version of the object.

Parameters:

source - the DSMCCObject whose version has changed

aVersionNumber - the new version number.

Methods

getNewVersionNumber()

```
public int getNewVersionNumber()
```

This method is used to get the new version number of the monitored DSMCCObject. For files carried in a DSMCC object carousel, this method shall return the version number of the module carrying the file.

Returns:

the new version number.

getSource()

```
public java.lang.Object getSource()
```

Returns the DSMCCObject that has changed

Overrides:

java.util.EventObject.getSource() in class java.util.EventObject

Returns:

the DSMCCObject that has changed

org.dvb.dsmcc

ObjectChangeListener

Syntax

```
public interface ObjectChangeListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

The objects that implements the ObjectChangeListener interface can receive ObjectChangeEvent event.

Methods

receiveObjectChangeEvent(ObjectChangeEvent)

```
public void receiveObjectChangeEvent (ObjectChangeEvent e)
```

Send a ObjectChangeEvent to the ObjectChangeListener.

Parameters:

e - the ObjectChangeEvent event.

org.dvb.dsmcc ServerDeliveryErrorEvent

Syntax

```
public class ServerDeliveryErrorEvent extends AsynchronousLoadingEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--AsynchronousLoadingEvent
|
+--org.dvb.dsmcc.ServerDeliveryErrorEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

The local machine can not communicate with the server. This event is only used with files implemented by delivery over bi-directional IP connections. For the object carousel the `MPEGDeliveryErrorEvent` is used instead.

Constructors

ServerDeliveryErrorEvent(DSMCCObject)

```
public ServerDeliveryErrorEvent(DSMCCObject o)
```

Creates a `ServerDeliveryErrorEvent` object.

Parameters:

o - the `DSMCCObject` that generated the event.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the `DSMCCObject` that generated the event.

Overrides:

`getSource()` in class `AsynchronousLoadingEvent`

Returns:

the `DSMCCObject` that generated the event.

org.dvb.dsmcc ServerDeliveryException

Syntax

```
public class ServerDeliveryException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--java.io.IOException
            |
            +--DSMCCException
                |
                +--org.dvb.dsmcc.ServerDeliveryException
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

A `ServerDeliveryException` is thrown when the local machine can not communicate with the server. This exception is only used with files implemented by delivery over a bi-directional IP connection. For the object carousel the `MPEGDeliveryException` is used instead.

Constructors

ServerDeliveryException()

```
public ServerDeliveryException()
```

Construct a `ServerDeliveryException` with no detail message

ServerDeliveryException(String)

```
public ServerDeliveryException(java.lang.String s)
```

Construct a `ServerDeliveryException` with the specified detail message

Parameters:

`s` - the detail message

org.dvb.dsmcc ServiceDomain

Syntax

```
public class ServiceDomain
{
    java.lang.Object
    |
    +--org.dvb.dsmcc.ServiceDomain
}
```

Description

A `ServiceDomain` represents a group of DSMCC objects. The objects are sent either using the object carousel for a broadcast network or with the DSM-CC User-to-User protocol for an interactive network.

To access the objects of a `ServiceDomain`, it has to be attached to the file system name space of the MHP terminal. To access the content of an object, the application has four ways:

- It can instantiate the class that is used to read the object (`java.io.FileInputStream` or `java.io.RandomAccessFile` for a File or `DSMCCStream` for a stream) from its pathname. The loading of the object is implicit but the application has no way to abort it. NB: Obviously, for the Object Carousel, the write mode of `java.io.RandomAccessFile` is not allowed.
- It can instantiate a `DSMCCObject` and carry out a Synchronous loading. The loading can be aborted by the `abort` method of the `DSMCCObject` class. When the object is loaded, the application will instantiate the class used to read the object.
- It can instantiate a `DSMCCObject` and carry out an Asynchronous loading. So several loading can be started in parallel from the same thread.
- It is also possible to create directly a `java.io.File` for a DSMCC object.

Instances of `ServiceDomain` exist in two states, attached and detached. Newly created instances are always in the detached state. They become attached when a call to the `attach` method succeeds. They become detached following a call to the `detach` method.

When service domains in the attached state temporarily loose their network connection, (e.g. if the MHP terminal tunes away from the transport stream where they are carried), the behaviour of DSMCC objects which are part of the service domain is specified in the main body of this specification. If such a network connection becomes available again then the service domain shall resume normal behaviour.

A service domain which is temporarily lost its network connection may be forced into the detached state by the implementation if the loss of the network connection becomes irrecoverable. The precise details of when this happens are implementation dependent. This is the only situation when shall be forced into the detached state. Once a `ServiceDomain` is detached, it will never be automatically attached.

Constructors

ServiceDomain()

```
public ServiceDomain()
{
    Creates a ServiceDomain object.
}
```

Methods

attach(byte[])

```
public void attach(byte[] NSAPAddress)
```

This function is used to attach a `ServiceDomain` from either an object carousel or from an interactive network. This call will block until the attachment is done.

Parameters:

`NSAPAddress` - The NSAP Address of a `ServiceDomain` as defined in in ISO/IEC 13818-6

Throws:

`InterruptedException` - The attachment has been aborted.

`InvalidAddressException` - The NSAP Address is invalid.

`DSMCCEException` - An error has occurred during the attachment.

`MPEGDeliveryException` - attaching to this domain would require tuning.

attach(Locator)

```
public void attach(org.davic.net.Locator l)
```

This function is used to get a `ServiceDomain` from an object carousel. It loads the module which contains the service gateway object and mounts the `ServiceDomain` volume in the file system hierarchy. This call will block until the service gateway is loaded. It can be aborted by another thread with the method `detach`. In this case an `InterruptedException` is thrown.

Parameters:

`l` - The locator pointing to the elementary stream carrying the DSI of the object carousel, or to a DVB service that carries one and only one object carousel.

Throws:

`DSMCCEException` - An error has occurred during the attachment. For example, the locator does not point to a component carrying a DSI of an Object Carousel or to a service containing a single carousel)

`InterruptedException` - The attachment has been aborted.

`MPEGDeliveryException` - attaching to this domain would require tuning.

attach(Locator, int)

```
public void attach(org.davic.net.Locator aDVBSERVICE, int aCarouselId)
```

This function is used to get a `ServiceDomain` from an object carousel. It loads the module which contains the service gateway object and mounts the `ServiceDomain` volume in the file system hierarchy. This call will block until the service gateway is loaded. It can be aborted by another thread with the method `detach`. In this case an `InterruptedException` is thrown.

Parameters:

`aDVBSERVICE` - The coordinates of the DVB service which contains the object carousel. This locator has to point to a DVB service.

`aCarouselId` - The identifier of the carousel.

Throws:

`InterruptedException` - The attachment has been aborted.

`MPEGDeliveryException` - An MPEG error occurred (such as time-out).

`ServiceXFRException` - The service gateway cannot be loaded in the current service domain

detach()

```
public void detach()
```

A call to this method is a hint that the applications gives to the MHP to unmount the volume and delete the objects of the service domain. When another application is using objects of the same service domain the method has no effects. When there are no other application using objects of the service domain, a call to this method is a hint that the MHP can free all the resources allocated to this service domain.

After this, the `ServiceDomain` will be in a non-attached state and will behave as if it had just been constructed. Subsequent calls to `detach` shall throw `NotLoadedException`.

Throws:

`NotLoadedException` - is thrown if the `ServiceDomain` is not attached or if there is no call to `attach` in progress.

getLocator()

```
public org.davic.net.Locator getLocator()
```

Return the locator for this service domain. If this `ServiceDomain` instance was last attached by specifying a locator then that exact same locator shall be returned. If this `ServiceDomain` instance was last attached by specifying an NSAP address then the locator shall be generated from that address. If this `ServiceDomain` has never been attached then null shall be returned.

Returns:

a locator for this service domain

Since:

MHP 1.0.1

getMountPoint()

```
public DSMCCObject getMountPoint()
```

Returns a `DSMCCObject` object describing the top level directory of this `ServiceDomain`. If the `ServiceDomain` object is not attached then null is returned.

Returns:

an instance of `org.dvb.dsmcc.DSMCCObject` if mounted or null otherwise

Since:

MHP 1.0.1

getNSAPAddress()

```
public byte[] getNSAPAddress()
```

This method returns the NSAP address of the `ServiceDomain`.

Returns:

the NSAP address of the `ServiceDomain`.

Throws:

`NotLoadedException` - is thrown if the `ServiceDomain` is not attached.

getURL(Locator)

```
public static java.net.URL getURL(org.davic.net.Locator l)
```

Obtain a `java.net.URL` corresponding to a 'dvb:' locator. If the service domain corresponding to the locator is attached and the file referenced in the locator exists then an instance of `java.net.URL` is returned which can be used to reference this file.

Parameters:

1 - a locator object encapsulating a 'dvb:' locator which includes a 'dvb_abs_path' element.

Returns:

a `java.net.URL` which can be used to access the file referenced by the 'dvb:' locator

Throws:

`InvalidLocatorException` - if the locator is not a valid 'dvb:' locator or does not include all elements including 'dvb_abs_path' element

`NotLoadedException` - is thrown if the locator is valid and includes enough information but it references a service domain which is not attached.

`FileNotFoundException` - if the service domain is attached but the file referenced by the locator does not exist

isAttached()

```
public boolean isAttached()
```

Return whether this service domain is in the attached or detached state.

Returns:

true if this service domain is in the attached state, otherwise false

Since:

MHP 1.0.1

isNetworkConnectionAvailable()

```
public boolean isNetworkConnectionAvailable()
```

Return whether the network connection for this service domain is available. This return value is independent of whether the service domain is attached or not. If a service domain is distributed across multiple network connections (e.g. using the optional support for DSMCC over IIOp) then this will reflect the availability of the network connection carrying the object mounted to the mount point.

Returns:

true if the network connection for this service domain is available otherwise false

Since:

MHP 1.0.1

org.dvb.dsmcc ServiceXFRErrorEvent

Syntax

```
public class ServiceXFRErrorEvent extends AsynchronousLoadingEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|   |
|   +--AsynchronousLoadingEvent
|       |
|       +--org.dvb.dsmcc.ServiceXFRErrorEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

The object requested is available in an alternate ServiceDomain. When an application attempts to asynchronously load an object that has itself a LiteOptionProfileBody IOR or that has a parent directory that has a LiteOptionProfileBody IOR, this event shall be sent to the application. There is no implicit mounting by the implementation of the carousel that actually contains the object. This event is also sent even if the Service Domain that actually contains the DSMCCObject is already mounted.

Constructors

ServiceXFRErrorEvent(DSMCCObject, ServiceXFRReference)

```
public ServiceXFRErrorEvent(DSMCCObject o, ServiceXFRReference ref)
```

Creates a ServiceXFRErrorEvent object.

Parameters:

- o - the DSMCCObject that generated the event.
- ref - the address of an alternate ServiceDomain where the object can be found.

Methods

getServiceXFR()

```
public ServiceXFRReference getServiceXFR()
```

This method is used to get a reference to the service domain that contains the requested object.

Returns:

The address of an alternate ServiceDomain where the object can be found.

getSource()

```
public java.lang.Object getSource()
```

Returns the DSMCCObject that generated the event.

Overrides:

`getSource()` in class `AsynchronousLoadingEvent`

Returns:

the DSMCCObject that generated the event.

org.dvb.dsmcc ServiceXFRException

Syntax

```
public class ServiceXFRException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
|
+--java.lang.Exception
|
+--java.io.IOException
|
+--DSMCCException
|
+--org.dvb.dsmcc.ServiceXFRException
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

A ServiceXFRException is thrown when a DSMCC Object can not be loaded in the current ServiceDomain but is available in an alternate ServiceDomain (i.e. for an object Carousel, the IOR of the object or one of its parent directories contains a Lite Option Profile Body). There is no implicit mounting by the implementation of the carousel that actually contain the object. This exception is also thrown even if the Service Domain that actually contains the DSMCCObject is already mounted.

Constructors

ServiceXFRException(byte[], String)

```
public ServiceXFRException(byte[] NSAPAddress, java.lang.String pathName)
```

Creates a ServiceXFRException object.

Parameters:

NSAPAddress - The NSAP Address of a ServiceDomain as defined in ISO/IEC 13818-6

pathName - pathName of the object in the alternate ServiceDomain

ServiceXFRException(Locator, int, String)

```
public ServiceXFRException(org.davic.net.Locator aService, int carouselId,
    java.lang.String pathName)
```

Creates a ServiceXFRException object.

Parameters:

aService - Locator of the Service

carouselId - Carousel Identifier

pathName - pathName of the object in the alternate ServiceDomain

Methods

getServiceXFR()

```
public ServiceXFRReference getServiceXFR()
```

This method is used to get the alternate ServiceDomain which contains the object requested.

Returns:

the address of an alternate ServiceDomain where the object can be found.

org.dvb.dsmcc ServiceXFRReference

Syntax

```
public class ServiceXFRReference
    java.lang.Object
    |
    +--org.dvb.dsmcc.ServiceXFRReference
```

Description

A ServiceXFRReference object is used when a DSMCC Object can not be loaded in the current ServiceDomain but is available in an alternate ServiceDomain. Instances of this class are just containers. The parameters passed are merely stored and returned by the access methods. It is the responsibility of the platform when generating instances to use correct values.

Constructors

ServiceXFRReference(byte[], String)

```
public ServiceXFRReference(byte[] nsapAddress, java.lang.String pathName)
```

Creates a ServiceXFRReference object.

Parameters:

`nsapAddress` - The NSAP Address of a ServiceDomain as defined in ISO/IEC 13818-6
`pathName` - pathName of the object in the alternate ServiceDomain

ServiceXFRReference(Locator, int, String)

```
public ServiceXFRReference(org.davic.net.Locator serviceLocator, int carouselId,
    java.lang.String pathName)
```

Creates a ServiceXFRReference object.

Parameters:

`serviceLocator` - Locator of the Service
`carouselId` - Carousel Identifier
`pathName` - pathName of the object in the alternate ServiceDomain

Methods

getCarouselId()

```
public int getCarouselId()
```

This method returns the carousel identifier. If the object was constructed using the constructor which includes a carousel ID or if it was constructed using the constructor which includes an NSAP

address and that NSAP address contains a carouselID then this method shall return that carousel ID otherwise this method shall return -1.

Returns:

the carousel identifier or -1.

getLocator()

```
public org.davic.net.Locator getLocator()
```

This method returns the Locator of the Service for an Object Carousel.

Returns:

the Locator of the Service for an Object Carousel. This method returns null, if the ServiceDomain is not associated with an Object Carousel. In this case the NSAP address must be used instead.

getNSAPAddress()

```
public byte[] getNSAPAddress()
```

This method returns the NSAP Address of a ServiceDomain as defined in ISO/IEC 13818-6. If the object was constructed using an NSAP address then this method shall return the NSAP address passed into the constructor. If the object was constructed with a locator and a carouselID then this method shall return an NSAP address derived from this information when locator is an instance of org.davic.net.dvb.DVBLocator. Otherwise this method shall return null

Returns:

the NSAP Address of a ServiceDomain as defined in ISO/IEC 13818-6 or null

getPathName()

```
public java.lang.String getPathName()
```

This method returns the pathname of the object in the alternate ServiceDomain.

Returns:

the pathname of the object in the alternate ServiceDomain.

org.dvb.dsmcc StreamEvent

Syntax

```
public class StreamEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.dsmcc.StreamEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This class describes a Stream event which is used to synchronize an application with an MPEG Stream.

Constructors

StreamEvent(DSMCCStreamEvent, long, String, int, byte[])

```
public StreamEvent(DSMCCStreamEvent source, long npt, java.lang.String name, int eventId,
                  byte[] eventData)
```

Creates a StreamEvent object.

Parameters:

`source` - The DSMCCStreamEvent that has generated the event.

`npt` - The value of the NPT (Normal Play Time) when the event is triggered. This value is equal to the field eventNPT in the DSMCC StreamEventDescriptor except where the event is a "do it now" event in which case the value -1 is returned (as the value of NPT may not be meaningful).

`name` - The name of this event. The list of event names is located in the DSMCC StreamEvent object. This list is returned by the method DSMCCStreamEvent.getEventList.

`eventId` - The eventId of this event. The list of event IDs is located in the DSMCC StreamEvent object.

`eventData` - The application specific data found in the DSMCC StreamEventDescriptor.

Methods

getEventData()

```
public byte[] getEventData()
```

This method is used to retrieve the private data associated with the event.

Returns:

The private data associated with the event.

getEventId()

```
public int getEventId()
```

This method is used to get the identifier of the StreamEvent.

Returns:

The identifier of the StreamEvent.

getEventName()

```
public java.lang.String getEventName()
```

This method is used to get the name of the StreamEvent

Returns:

the name of the StreamEvent

getEventNPT()

```
public long getEventNPT()
```

This method is used to get the NPT of the Event in milliseconds.

Returns:

The NPT of the Event in milliseconds.

getSource()

```
public java.lang.Object getSource()
```

This method returns the DSMCCStreamEvent that generated the event.

Overrides:

java.util.EventObject.getSource() in class java.util.EventObject

Returns:

the DSMCCStreamEvent that generated the event.

org.dvb.dsmcc

StreamEventListener

Syntax

```
public interface StreamEventListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

Objects that implement the StreamEventListener interface can receive StreamEvent event.

Methods

receiveStreamEvent(StreamEvent)

```
public void receiveStreamEvent(StreamEvent e)
```

Send a StreamEvent to the StreamEventListener.

Parameters:

e - the StreamEvent event.

org.dvb.dsmcc SuccessEvent

Syntax

```
public class SuccessEvent extends AsynchronousLoadingEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--AsynchronousLoadingEvent
        |
        +--org.dvb.dsmcc.SuccessEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event indicates that the asynchronous loading was successful.

Constructors

SuccessEvent(DSMCCObject)

```
public SuccessEvent(DSMCCObject o)
```

Creates a SuccessEvent object.

Parameters:

o - the DSMCCObject which was successfully loaded.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the DSMCCObject which was successfully loaded.

Overrides:

getSource() in class AsynchronousLoadingEvent

Returns:

the loaded DSMCCObject

org.dvb.dsmcc UnknownEventException

Syntax

```
public class UnknownEventException extends DSMCCException
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--java.io.IOException
         |
         +--DSMCCException
            |
            +--org.dvb.dsmcc.UnknownEventException
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

The `UnknownEventException` is thrown when a method tries to access to an unknown event. This exception may get thrown because the event in question is not being signalled yet. It does not indicate that the event is permanently unavailable. Applications may choose to attempt to subscribe to the event again at a later point in time in the expectation that the event has become available since the previous attempt.

Constructors

UnknownEventException()

```
public UnknownEventException()
```

Construct an `UnknownEventException` with no detail message

UnknownEventException(String)

```
public UnknownEventException(java.lang.String s)
```

Construct an `UnknownEventException` with the specified detail message

Parameters:

`s` - the detail message

Annex Q (normative): Datagram Socket Buffer Control

Package org.dvb.net

Description

Provides general networking features not found elsewhere.

Class Summary

Classes

<code>DatagramSocketBuffer-</code> <code>Control</code>	This class provides additional control over buffering for <code>DatagramSockets</code> .
--	--

org.dvb.net

DatagramSocketBufferControl

Syntax

```
public class DatagramSocketBufferControl
|
|  java.lang.Object
|  |
|  |--org.dvb.net.DatagramSocketBufferControl
```

Description

This class provides additional control over buffering for `DatagramSockets`.

Methods

getReceiveBufferSize(DatagramSocket)

```
public static int getReceiveBufferSize(java.net.DatagramSocket d)
```

Get value of the `SO_RCVBUF` option for this socket, that is the buffer size used by the platform for input on the this Socket.

Parameters:

`d` - The `DatagramSocket` for which to query the receive buffer size.

Returns:

The size of the receive buffer, in bytes.

Throws:

`SocketException` - - If there is an error when querying the `SO_RCVBUF` option.

setReceiveBufferSize(DatagramSocket, int)

```
public static void setReceiveBufferSize(java.net.DatagramSocket d, int size)
```

Sets the `SO_RCVBUF` option to the specified value for this `DatagramSocket`. The `SO_RCVBUF` option is used by the platform's networking code as a hint for the size to use when allocating the underlying network I/O buffers.

Increasing buffer size can increase the performance of network I/O for high-volume connection, while decreasing it can help reduce the backlog of incoming data. For UDP, this sets the buffer size for received packets.

Because `SO_RCVBUF` is a hint, applications that want to verify what size the buffers were set to should call `getReceiveBufferSize`. This method shall throw `IllegalArgumentException` - if size is 0 or is negative.

Parameters:

`d` - The `DatagramSocket` for which to change the receive buffer size.

`size` - The requested size of the receive buffer, in bytes.

Throws:

`SocketException` - - If there is an error when setting the `SO_RCVBUF` option.

Annex R (normative): DVB-J Return Channel Connection Management API

Package org.dvb.net.rc

Description

Provides session management for bi-directional IP connections which are session based from the point of view of an application. The best example of this is a conventional modem.

Class Summary	
Interfaces	
<code>ConnectionListener</code>	This interface should be implemented by objects wishing to be notified about the connection status of a <code>ConnectionRCInterface</code> .
Classes	
<code>ConnectionEstablishedEvent</code>	<code>ConnectionEstablishedEvent</code> - An event generated after a connection is established for a <code>ConnectionRCInterface</code> .
<code>ConnectionFailedEvent</code>	<code>ConnectionFailedEvent</code> - An event generated after an attempt to setup a connection for a <code>ConnectionRCInterface</code> fails.
<code>ConnectionParameters</code>	This class encapsulates the parameters needed to specify the target of a connection.
<code>ConnectionRCEvent</code>	<code>ConnectionRCEvent</code> - the base class for events related to connection oriented return channels.
<code>ConnectionRCInterface</code>	This class models a connection based return channel network interface for use in receiving and transmitting IP packets over a return channel.
<code>ConnectionTerminatedEvent</code>	<code>ConnectionTerminatedEvent</code> - An event generated after a connected <code>ConnectionRCInterface</code> is disconnected.
<code>RCInterface</code>	This class models a return channel network interface for use in receiving and transmitting IP packets over a logical return channel.
<code>RCInterfaceManager</code>	This class is the factory and manager for all return channel interfaces in the system.
<code>RCInterfaceReleasedEvent</code>	This event informs an application that a <code>RCInterface</code> has been released by an application or other entity in the system.
<code>RCInterfaceReservedEvent</code>	This event informs an application that a <code>RCInterface</code> has been reserved by an application or other entity in the system.
<code>RCPermission</code>	This class is for return channel set-up permissions.
Exceptions	
<code>IncompleteTargetException</code>	Thrown when the target for a connection is incompletely specified.
<code>PermissionDeniedException</code>	Thrown when an application calls a method which it does not have permission to call at that time.

org.dvb.net.rc

ConnectionEstablishedEvent

Syntax

```
public class ConnectionEstablishedEvent extends ConnectionRCEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--ConnectionRCEvent
        |
        +--org.dvb.net.rc.ConnectionEstablishedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

ConnectionEstablishedEvent - An event generated after a connection is established for a ConnectionRCInterface.

Constructors

ConnectionEstablishedEvent(Object)

```
public ConnectionEstablishedEvent(java.lang.Object source)
```

Construct an event.

Parameters:

source - the ConnectionRCInterface whose connection was established

org.dvb.net.rc ConnectionFailedEvent

Syntax

```
public class ConnectionFailedEvent extends ConnectionRCEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--ConnectionRCEvent
|
+--org.dvb.net.rc.ConnectionFailedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

ConnectionFailedEvent - An event generated after an attempt to setup a connection for a ConnectionRCInterface fails.

Constructors

ConnectionFailedEvent(Object)

```
public ConnectionFailedEvent(java.lang.Object source)
```

Construct an event.

Parameters:

source - the ConnectionRCInterface whose connection attempt failed

org.dvb.net.rc

ConnectionListener

Syntax

```
public interface ConnectionListener
```

Description

This interface should be implemented by objects wishing to be notified about the connection status of a `ConnectionRCInterface`.

Methods

connectionChanged(ConnectionRCEvent)

```
public void connectionChanged(ConnectionRCEvent e)
```

This method is called to report events related to the setup and termination of return channel interface connections.

Parameters:

e - the event which happened

org.dvb.net.rc

ConnectionParameters

Syntax

```
public class ConnectionParameters
    java.lang.Object
    |
    +--org.dvb.net.rc.ConnectionParameters
```

Description

This class encapsulates the parameters needed to specify the target of a connection.

Constructors

ConnectionParameters(String, String, String)

```
public ConnectionParameters(java.lang.String number, java.lang.String username,
    java.lang.String password)
```

Construct a set of connection parameters. Details of the DNS server to use are supplied by the server.

Parameters:

- number - the target of the connection, e.g. a phone number
- username - the username to use in connection setup
- password - the password to use in connection setup

ConnectionParameters(String, String, String, InetAddress[])

```
public ConnectionParameters(java.lang.String number, java.lang.String username,
    java.lang.String password, java.net.InetAddress[] dns)
```

Construct a set of connection parameters.

Parameters:

- number - the target of the connection, e.g. a phone number
- username - the username to use in connection setup
- password - the password to use in connection setup
- dns - the list of DNS servers to try before reporting failure. The order in which they are interrogated is not specified. Once one result has been obtained, there is no requirement to try others.

Methods

getDNSServer()

```
public java.net.InetAddress[] getDNSServer()
```


Return the addresses of the DNS servers to use for the connection

Returns:

return the addresses of the DNS servers to use for the connection or null where the DNS address is server supplied.

getPassword()

```
public java.lang.String getPassword()
```

Return the password used in establishing this connection

Returns:

the password used in establishing this connection

getTarget()

```
public java.lang.String getTarget()
```

Return the target of this connection for example a phone number

Returns:

the target of the connection

getUsername()

```
public java.lang.String getUsername()
```

Return the username used in establishing this connection

Returns:

the username used in establishing the connection

org.dvb.net.rc ConnectionRCEvent

Syntax

```
public class ConnectionRCEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.net.rc.ConnectionRCEvent
```

Direct Known Subclasses:

```
ConnectionEstablishedEvent, ConnectionFailedEvent,
ConnectionTerminatedEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

ConnectionRCEvent - the base class for events related to connection oriented return channels.

Constructors

ConnectionRCEvent(Object)

```
public ConnectionRCEvent(java.lang.Object source)
```

Construct an event

Parameters:

source - the ConnectionRCInterface for which the event was generated.

org.dvb.net.rc ConnectionRCInterface

Syntax

```
public class ConnectionRCInterface extends RCInterface implements
    org.davic.resources.ResourceProxy
```

```
java.lang.Object
|
+--RCInterface
|
+--org.dvb.net.rc.ConnectionRCInterface
```

All Implemented Interfaces:

org.davic.resources.ResourceProxy

Description

This class models a connection based return channel network interface for use in receiving and transmitting IP packets over a return channel. Targets for connections are specified as strings including the number to dial. These strings can only include numbers and are passed direct to the underlying device.

Methods

addConnectionListener(ConnectionListener)

```
public void addConnectionListener(ConnectionListener l)
```

Add a listener for events related to connections of this interface.

Parameters:

`l` - the listener for the connection related events

connect()

```
public void connect()
```

Connect this return channel to the current target. If this ResourceProxy does not have the underlying resource reserved then a `PermissionDeniedException` will be thrown. Where the underlying resource is reserved but at the time the method is called, it is known that connection is impossible then an `IOException` will be thrown. Apart from this, this method is asynchronous and completion or failure is reported through the event listener on this class. If a connection is already established when this method is called then the method call shall have no effect.

Throws:

`PermissionDeniedException` - if this application does not own the resource

`IOException` - if connection is known to be impossible at the time when the method is called

disconnect()

```
public void disconnect()
```

Disconnect this return channel from the current target. This method is asynchronous and completion is reported through the event listener on this class. This method does not release the underlying resource from the ResourceProxy. If no connection is established then this method shall have no effect.

Throws:

`PermissionDeniedException` - if this application does not own the resource

getClient()

```
public org.davic.resources.ResourceClient getClient()
```

Return the object which asked to be notified about withdrawal of the underlying resource. This is the object provided as the first parameter to the last call to the reserve method on this object. If this object does not have the underlying resource reserved then null is returned.

Specified By:

`org.davic.resources.ResourceProxy.getClient()` in interface `org.davic.resources.ResourceProxy`

Returns:

the object which asked to be notified about withdrawal of the underlying physical resource from this resource proxy or null

getConnectedTime()

```
public int getConnectedTime()
```

Return the time an interface has been connected

Returns:

the time in seconds for which this interface has been connected or -1 if the device is not connected

getCurrentTarget()

```
public ConnectionParameters getCurrentTarget()
```

Get the current target for connections.

Returns:

the current set of connection target parameters

Throws:

`IncompleteTargetException` - if the current target is not completely configured

`SecurityException` - if the application is not allowed to read the current target as defined by the security policy of the platform

getSetupTimeEstimate()

```
public float getSetupTimeEstimate()
```

Obtain an estimate of the setup time for a successful connection for this interface in seconds.

Returns:

an estimate of the setup time for a successful connection for this interface in seconds.

isConnected()

```
public boolean isConnected()
```

Check if this interface is connected. Connected means able to receive and transmit packets.

Returns:

true if the interface is connected, otherwise false

release()

```
public void release()
```

Release the right to control this return channel interface. If this object does not have the right to control this return channel interface then this method shall have no effect.

removeConnectionListener(ConnectionListener)

```
public void removeConnectionListener(ConnectionListener l)
```

Remove a listener for events related to connections of this interface. If the listener specified is not currently receiving these events then this method has no effect.

Parameters:

l - the listener for the connection related events

reserve(ResourceClient, Object)

```
public void reserve(org.davic.resources.ResourceClient c, java.lang.Object requestData)
```

Request the right to control this return channel interface. If the right to control the return channel interface has already been reserved then this method shall have no effect.

Parameters:

c - the object to be notified when resources are removed

requestData - Used by the Resource Notification API in the requestRelease method of the ResourceClient interface. The usage of this parameter is optional and a null reference may be supplied.

Throws:

`PermissionDeniedException` - if this interface cannot be reserved

`SecurityException` - if the application is denied access to the resource by security policy.

setTarget(ConnectionParameters)

```
public void setTarget(ConnectionParameters target)
```

Set a non-default target for connections.

Parameters:

target - the new set of connection target parameters

Throws:

`IncompleteTargetException` - if the application owns the resource but the target is not completely specified

`PermissionDeniedException` - if this application does not own the resource

`SecurityException` - if the application is not allowed to modify the target as defined by the security policy of the platform

setTargetToDefault()

```
public void setTargetToDefault()
```

Set the target for connections to the default.

Throws:

`IncompleteTargetException` - if the application owns the resource but the target is not completely specified

`PermissionDeniedException` - if this application does not own the resource

`SecurityException` - if the application is not allowed to connect to the default target

org.dvb.net.rc

ConnectionTerminatedEvent

Syntax

```
public class ConnectionTerminatedEvent extends ConnectionRCEvent
```

```
java.lang.Object
|
+--java.util.EventObject
    |
    +--ConnectionRCEvent
        |
        +--org.dvb.net.rc.ConnectionTerminatedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

ConnectionTerminatedEvent - An event generated after a connected ConnectionRCInterface is disconnected.

Constructors

ConnectionTerminatedEvent(Object)

```
public ConnectionTerminatedEvent(java.lang.Object source)
```

Construct an event.

Parameters:

source - the ConnectionRCInterface whose status changed

org.dvb.net.rc

IncompleteTargetException

Syntax

```
public class IncompleteTargetException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--org.dvb.net.rc.IncompleteTargetException
```

All Implemented Interfaces:

java.io.Serializable

Description

Thrown when the target for a connection is incompletely specified. This is thrown either when the default connection target is incompletely defined in the device or when an application provides an incompletely defined connection target to the device or when the connection target is badly formed, e.g. includes illegal characters in a number parameter.

Constructors

IncompleteTargetException()

```
public IncompleteTargetException()
```

Default constructor for the exception

IncompleteTargetException(String)

```
public IncompleteTargetException(java.lang.String reason)
```

Constructor for the exception with a specified reason

Parameters:

`reason` - the reason why the exception was raised

org.dvb.net.rc PermissionDeniedException

Syntax

```
public class PermissionDeniedException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--org.dvb.net.rc.PermissionDeniedException
```

All Implemented Interfaces:

java.io.Serializable

Description

Thrown when an application calls a method which it does not have permission to call at that time.

Constructors

PermissionDeniedException()

```
public PermissionDeniedException()
```

Default constructor for the exception

PermissionDeniedException(String)

```
public PermissionDeniedException(java.lang.String reason)
```

Constructor for the exception with a specified reason

Parameters:

`reason` - the reason why the exception was raised

org.dvb.net.rc RCInterface

Syntax

```
public class RCInterface
{
    java.lang.Object
    |
    +--org.dvb.net.rc.RCInterface
}
```

Direct Known Subclasses:

[ConnectionRCInterface](#)

Description

This class models a return channel network interface for use in receiving and transmitting IP packets over a logical return channel. This can include real analog modems, cable return channel and all the other options allowed by the relevant DVB specification. This class does not model any concept of connection. Hence interfaces represented by this class and not by a sub-class of it are permanently connected.

Fields

TYPE_CATV

```
public static final int TYPE_CATV
Constant to indicate a CATV return channel.
```

TYPE_DECT

```
public static final int TYPE_DECT
Constant to indicate a DECT return channel.
```

TYPE_ISDN

```
public static final int TYPE_ISDN
Constant to indicate an ISDN return channel.
```

TYPE_LMDS

```
public static final int TYPE_LMDS
Constant to indicate a LMDS return channel.
```

TYPE_MATV

```
public static final int TYPE_MATV
Constant to indicate a MATV return channel.
```

TYPE_PSTN

```
public static final int TYPE_PSTN
```

Constant to indicate a PSTN return channel.

Methods

getDataRate()

```
public int getDataRate()
```

Return the maximum data rate of the connection over the immediate access network to which this network interface is connected. For asymmetric connections, the data rate coming into the MHP terminal shall be returned. For connection oriented interfaces which are not currently connected, the value returned shall be that of the last connection established where that information is available. Where that information is not available, (e.g. where no connection has been established since an MHP terminal was power cycled), -1 shall be returned.

Returns:

a data rate in KBaud or -1 where this is not available

Since:

MHP 1.0.1

getType()

```
public int getType()
```

Return the type of return channel represented by this object.

Returns:

the type of return channel represented by this object encoded as one of the constants defined in this class

org.dvb.net.rc RCInterfaceManager

Syntax

```
public class RCInterfaceManager implements org.davic.resources.ResourceServer
```

```
java.lang.Object
|
+--org.dvb.net.rc.RCInterfaceManager
```

All Implemented Interfaces:

org.davic.resources.ResourceServer

Description

This class is the factory and manager for all return channel interfaces in the system. The methods on this class which return instances of the `RCInterface` will only return new instances of that class under the following conditions:-

- on the first occasion an instance needs to be returned to a particular application for a particular interface.
- when new return channel interfaces are added to the system

Methods

addResourceStatusEventListener(ResourceStatusListener)

```
public void addResourceStatusEventListener(org.davic.resources.ResourceStatusListener
    listener)
```

This method informs a resource server that a particular object should be informed of changes in the state of the resources managed by that server.

Specified By:

org.davic.resources.ResourceServer.addResourceStatusEventListener(org.davic.resources.ResourceStatusListener) in interface org.davic.resources.ResourceServer

Parameters:

`listener` - the object to be informed of state changes

getInstance()

```
public static RCInterfaceManager getInstance()
```

Factory method to obtain a manager. From the point of view of any individual application, this is a singleton.

Returns:

an instance of an `RCInterfaceManager`

getInterface(InetAddress)

```
public RCInterface getInterface(java.net.InetAddress addr)
```

Return the interface which will be used when connecting to a particular host. Null is returned if this is not known when the method is called.

Parameters:

`addr` - the IP address of the host to connect to

Returns:

the interface which will be used or null if this is not known

getInterface(Socket)

```
public RCInterface getInterface(java.net.Socket s)
```

Return the interface which is used for a particular socket.

Parameters:

`s` - the socket to use

Returns:

the interface which is used or null if the socket isn't connected

getInterface(URLConnection)

```
public RCInterface getInterface(java.net.URLConnection u)
```

Return the interface which is used for a particular URLConnection

Parameters:

`u` - the URLConnection to use

Returns:

the interface which is used or null if the URLConnection isn't connected

getInterfaces()

```
public RCInterface[] getInterfaces()
```

Factory method to return a list of all return channel interfaces visible to this application. The number of entries in the array will exactly match the number of return channel interfaces visible to the application. Null is returned if no interfaces are visible to this application.

Returns:

an array of available return channel interfaces

removeResourceStatusEventListener(ResourceStatusListener)

```
public void removeResourceStatusEventListener(org.davic.resources.ResourceStatusListener listener)
```

This method informs a resource server that a particular object is no longer interested in being informed about changes in state of resources managed by that server. If the object had not registered its interest initially then this method has no effect.

Specified By:

`org.davic.resources.ResourceServer.removeResourceStatusEventListener(org.davic.resources.ResourceStatusListener)` in interface `org.davic.resources.ResourceServer`

Parameters:

`listener` - the object which is no longer interested

org.dvb.net.rc RCInterfaceReleasedEvent

Syntax

```
public class RCInterfaceReleasedEvent extends org.davic.resources.ResourceStatusEvent
```

```
java.lang.Object
|
|--org.davic.resources.ResourceStatusEvent
|
|--org.dvb.net.rc.RCInterfaceReleasedEvent
```

Description

This event informs an application that a `RCInterface` has been released by an application or other entity in the system. It is generated when an application which had successfully reserved a `RCInterface` calls the `ConnectionRCInterface.release` method. It will also be generated if any other entities in the system own such an interface and then release that interface in such a way that it could then become available to applications using this API.

Constructors

RCInterfaceReleasedEvent(Object)

```
public RCInterfaceReleasedEvent(java.lang.Object bg)
```

Constructor for the event

Parameters:

`bg` - the `RCInterface` which has been released

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the device that has been released

Overrides:

`org.davic.resources.ResourceStatusEvent.getSource()` in class `org.davic.resources.ResourceStatusEvent`

Returns:

the `RCInterface` object representing the interface that has been released

org.dvb.net.rc RCInterfaceReservedEvent

Syntax

```
public class RCInterfaceReservedEvent extends org.davic.resources.ResourceStatusEvent
```

```
java.lang.Object
|
+--org.davic.resources.ResourceStatusEvent
|
+--org.dvb.net.rc.RCInterfaceReservedEvent
```

Description

This event informs an application that a `RCInterface` has been reserved by an application or other entity in the system. It is generated when an application successfully reserves a `RCInterface`. It will also be generated if any other entities in the system reserve such an interface with the effect of something which was visible to applications using this API becoming unavailable.

Constructors

RCInterfaceReservedEvent(Object)

```
public RCInterfaceReservedEvent(java.lang.Object bg)
```

Constructor for the event

Parameters:

bg - the `RCInterface` representing the device which has been reserved

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the device that has been reserved

Overrides:

`org.davic.resources.ResourceStatusEvent.getSource()` in class
`org.davic.resources.ResourceStatusEvent`

Returns:

an `RCInterface` representing the device that has been reserved

org.dvb.net.rc RCPermission

Syntax

```
public class RCPermission extends java.security.BasicPermission
```

```
java.lang.Object
|
+--java.security.Permission
|
+--java.security.BasicPermission
|
+--org.dvb.net.rc.RCPermission
```

All Implemented Interfaces:

java.security.Guard, java.io.Serializable

Description

This class is for return channel set-up permissions. An RCPermission contains a name, but no actions list.

The permission name can be "target:default", which indicates the permission to use the default connection parameters.

The permission name can also be "target:<phone number>", which indicates the permission to use the specified phone number in the connection set-up (ConnectionRCInterface.setTarget(ConnectionParameters) method).

A wildcard may be used at the end of the permission name. In that case, all phone numbers starting with the number before the wildcard are included in the permission.

Examples:

- target:0206234342 (Permission to dial the specified phone number)
- target:020* (Permission to dial phone numbers starting with 020)
- target:* (Permission to dial all phone numbers, including the default)

Note: ConnectionRCInterface.reserve(ResourceClient, Object) will throw a SecurityException if the application is not allowed to set-up a connection over the return channel at all (i.e., there is no valid target allowed).

Constructors

RCPermission(String)

```
public RCPermission(java.lang.String name)
```

Creates a new RCPermission with the specified name. The name is the symbolic name of the RCPermission.

Parameters:

name - the name of the RCPermission

RCPPermission(String, String)

```
public RCPPermission(java.lang.String name, java.lang.String actions)
```

Creates a new RCPPermission object with the specified name. The name is the symbolic name of the RCPPermission, and the actions String is unused and should be null. This constructor exists for use by the Policy object to instantiate new Permission objects.

Parameters:

`name` - the name of the RCPPermission

`actions` - should be null.

Annex S (normative): Application Listing and Launching

Package org.dvb.application

Description

Provides access to lists of applications which are available in this context and the ability to launch those applications.

Class Summary	
Interfaces	
<code>AppAttributes</code>	The <code>AppAttributes</code> class is a mapping of various information about a registered application.
<code>AppProxy</code>	An <code>AppProxy</code> Object is a proxy to an application.
<code>AppsDatabaseEventListener</code>	The <code>AppsDatabaseListener</code> class allows an application to monitor the application database so that it can keep an up to date interface without polling the state.
<code>AppStateChangeListener</code>	The <code>AppStateChangeListener</code> class allows a launcher application to keep track of applications it launches or other applications running as part of the same service.
<code>DVBHTMLProxy</code>	A <code>DVBHTMLProxy</code> Object is a proxy to a DVBHTML application.
<code>DVBJSProxy</code>	A <code>DVBJSProxy</code> Object is a proxy to a DVBJS application.
Classes	
<code>AppIcon</code>	The <code>AppIcon</code> encapsulates the information concerning the icon attached to the application
<code>AppID</code>	The <code>AppID</code> is a representation of the unique identifier for applications.
<code>AppsControlPermission</code>	This class represents a Permission to control the lifecycle of another application.
<code>AppsDatabase</code>	The <code>AppsDatabase</code> is an abstract view of the currently available applications.
<code>AppsDatabaseEvent</code>	The <code>AppsDatabaseEvent</code> class indicates either the an entry in the application database has changed, or so many changes have occurred.
<code>AppsDatabaseFilter</code>	Abstract class for the filters.
<code>AppStateChangeEvent</code>	The <code>AppStateChangeEvent</code> class indicates a state transition of the application.
<code>CurrentServiceFilter</code>	Instances of <code>CurrentServiceFilter</code> are used to set a filter on the list of applications that are retrieved from the <code>AppsDatabase</code> (See methods <code>getAppAttributes</code> and <code>getAppIDs</code>)
Exceptions	
<code>IllegalProfileParameterException</code>	The <code>IllegalProfileParameter</code> exception is thrown if the application attempts to ask for a version number for a profile not specified for the application.
<code>LanguageNotAvailableException</code>	The <code>LanguageNotAvailableException</code> exception is thrown if the application asks for the name of an application in a language not signalled in the AIT.

org.dvb.application

AppAttributes

Syntax

```
public interface AppAttributes
```

Description

The `AppAttributes` class is a mapping of various information about a registered application. For applications which are signalled in an AIT, the mapping between the values returned by methods in this class and the fields and descriptors of the AIT shall be as specified in the main body of this specification.

Instances of objects implementing this interface are immutable and populated before the instance is first returned to an application.

Since:

MHP1.0

Fields

DVB_HTML_application

```
public static final int DVB_HTML_application
```

The DVB registered value for all DVB-HTML applications.

DVB_J_application

```
public static final int DVB_J_application
```

The DVB registered value for all DVB-J applications.

Methods

getAppIcon()

```
public AppIcon getAppIcon()
```

This method returns an object encapsulating the information about the icon(s) for the application.

Returns:

the information related to the icons that are attached to the application or null if no icon information is available

Since:

MHP1.0

getIdentifier()

```
public AppID getIdentifier()
```

This method returns the application identifier. depending on the

Returns:

the application identifier

Since:

MHP1.0

getIsServiceBound()

```
public boolean getIsServiceBound()
```

This method determines whether the application is bound to a single service.

Returns:

true if the application is bound to a single service, false otherwise.

Since:

MHP1.0

getName()

```
public java.lang.String getName()
```

This method returns the name of the application. If the default language (as specified in user preferences) is in the set of available language / name pairs then the name in that language shall be returned. Otherwise this method will return a name which appears in that set on a "best-effort basis".

Returns:

the name of the application

Since:

MHP1.0

getName(String)

```
public java.lang.String getName(java.lang.String iso639code)
```

This method returns the name of the application in the language which is specified by the parameter passed as an argument. If the language specified is not in the set of available language /name pairs then an exception shall be thrown.

Parameters:

`iso639code` - the specified language, encoded as per ISO 639.

Returns:

returns the name of the application in the specified language

Throws:

[LanguageNotAvailableException](#) - if the name is not available in the language specified

Since:

MHP1.0

getNames()

```
public java.lang.String[][] getNames()
```

This method returns all the available names for the application together with their ISO 639 language code.

Returns:

the possible names of the application, along with their ISO 639 language code. The first string in each sub-array is the ISO 639 language code. The second string in each sub-array is the corresponding application name.

Since:

MHP1.0

getPriority()

```
public int getPriority()
```

This method returns the priority of the application.

Returns:

the priority of the application.

Since:

MHP1.0

getProfiles()

```
public java.lang.String[] getProfiles()
```

This method returns those minimum profiles required for the application may execute. Profile names shall be encoded using the same encoding specified elsewhere in this specification as input for use with the `java.lang.System.getProperty` method to query if a profile is supported by this platform.

For example, for implementations conforming to the first version of the specification, the translation from AIT signaling values to strings shall be as follows:

- '1' in the signaling will be translated into 'mhp.profile.enhanced_broadcast'
- '2' in the signaling will be translated into 'mhp.profile.interactive_broadcast'

Only profiles known to this particular MHP terminal shall be returned. Hence the method can return an array of size zero where all the profiles on which an application can execute an application are unknown.

Returns:

an array of Strings, each String describing a profile.

Since:

MHP1.0

getProperty(String)

```
public java.lang.Object getProperty(java.lang.String index)
```

The following method is included for properties that do not have explicit property accessors. The naming of properties and their return values are described in the main body of this specification.

Parameters:

`index` - a property name

Returns:

either the return value corresponding to the property name or null if the property name is unknown

Since:

MHP1.0

getServiceLocator()

```
public org.davic.net.Locator getServiceLocator()
```

This method returns the locator of the Service describing the application. For an application transmitted on a remote connection, the returned locator shall be the service for that remote connection. For applications not transmitted on a remote connection, the service returned shall be the currently selected service of the service context within which the application calling the method is running.

Returns:

the locator of the Service describing the application.

Since:

MHP1.0

getType()

```
public int getType()
```

This method returns the type of the application (as registered by DVB).

Returns:

the type of the application (as registered by DVB).

Since:

MHP1.0

getVersions(String)

```
public int[] getVersions(java.lang.String profile)
```

This method returns an array of integers containing the version number of the specification required to run this application at the specified profile.

Parameters:

`profile` - a profile encoded as described in the main body of this specification for use with `java.lang.System.getProperty`.

Returns:

an array of integers, containing the major, minor and micro values (in that order) required for the specified profile.

Throws:

`IllegalProfileParameterException` - thrown if the profile specified is not one of the minimum profiles required for the application to execute.

Since:

MHP1.0

isStartable()

```
public boolean isStartable()
```

This method determines whether the application is startable or not. An Application is not startable if any of the following apply.

- The application is transmitted on a remote connection.
- The caller of the method does not have the Permissions to start it.
- At the moment when the method is called, the implementation has detected that this application is not available any more.

The value returned by this method does not depend on whether the application is actually running or not.

Returns:

true if an application is startable, false otherwise.

Since:

MHP1.0

org.dvb.application AppIcon

Syntax

```
public class AppIcon
    java.lang.Object
    |
    +--org.dvb.application.AppIcon
```

Description

The `AppIcon` encapsulates the information concerning the icon attached to the application

Constructors

AppIcon()

```
protected AppIcon()
```

The constructor for the class. This constructor is intended for implementation convenience and evolution of the specification and not for use by MHP applications. Applications should obtain instances of this class from `AppAttributes.getAppIcon`.

See Also:

[getAppIcon\(\)](#)

Methods

getIconFlags()

```
public java.util.BitSet getIconFlags()
```

This method returns the flags identifying which icons are provided for the application.

Returns:

the icon flags encoded as a `BitSet`

Since:

MHP1.0

getLocator()

```
public org.davic.net.Locator getLocator()
```

This method returns the location of the directory containing the application icons.

Returns:

the location of the directory containing the application icons.

Since:

MHP1.0

org.dvb.application AppID

Syntax

```
public class AppID
    java.lang.Object
    |
    +--org.dvb.application.AppID
```

Description

The `AppID` is a representation of the unique identifier for applications. Its string form is the Hex representation of the 48 bit number.

Constructors

`AppID(int, int)`

```
public AppID(int oid, int aid)
```

Create a new `AppID` based on the given integers. There is no range checking on these numbers.

Parameters:

`oid` - the globally unique organization number.

`aid` - the unique count within the organization.

Since:

MHP1.0

Methods

`getAID()`

```
public int getAID()
```

This method returns the integer value of the application count supplied in the constructor

Returns:

the integer value of the application count supplied in the constructor

Since:

MHP1.0

`getOID()`

```
public int getOID()
```

This method returns the integer value of the organization number supplied in the constructor.

Returns:

the integer value of the organization number supplied in the constructor.

Since:
MHP1.0

toString()

```
public java.lang.String toString()
```

This method returns a string containing the Hex representation of the 48 bit number.

Overrides:
java.lang.Object.toString() in class java.lang.Object

Returns:
a string containing the Hex representation of the 48 bit number.

Since:
MHP1.0

org.dvb.application

AppProxy

Syntax

```
public interface AppProxy
```

All Known Subinterfaces:

[DVBHTMLProxy](#), [DVBJProxy](#)

Description

An `AppProxy` Object is a proxy to an application. A call to the `start`, `stop` or `pause` will cause the resident Application Manager to respectively start, stop or pause the application bound to this `AppProxy` object. Each of these three method calls can throw a Security Exception if the calling application is not entitled to do so.

Each of these method call is asynchronous and will result in exactly one `AppStateChangeEvent` to be generated whether the method call was successful or not. If the method call was not successful, any call to the `hasFailed` method of the corresponding `AppStateChangeEvent` will return true.

Some of the methods here allow the `AppProxy` to transition through several states before the final state is reached. If this compound state transition is unsuccessful at any point, the resulting `AppStateChangeEvent` shall have a `fromstate` and a `tostate` which are both the last state in this transition which the `AppProxy` successfully entered. For instance, if an application were to call `start` on an `AppProxy` for a DVB-J application in the `NOT_LOADED` state and that DVB-J application was to throw a `XletStateChangeException` from its `startXlet` method, both the `getFromState` and `getToState` will return `PAUSED`.

Calling the `start` method for an application which is already running shall fail and generate an `AppStateChangeEvent` with `hasFailed` returning true and both `fromstate` and `tostate` being `STARTED`.

See the definition of `AppStateChangeEvent` for more information.

See Also:

[AppStateChangeEvent](#)

Fields

DESTROYED

```
public static final int DESTROYED
```

The application is in the destroyed state.

NOT_LOADED

```
public static final int NOT_LOADED
```

The application has not yet been loaded from the network at all.

PAUSED

```
public static final int PAUSED
```

The application is in the paused state.

STARTED

```
public static final int STARTED
```

The application is in the active state.

Methods

addAppStateChangeListener(AppStateChangeListener)

```
public void addAppStateChangeListener(AppStateChangeListener listener)
```

Add a listener to the application proxy so that an application can be informed if the application changes state.

Parameters:

`listener` - the listener to be added.

Since:

MHP1.0

getState()

```
public int getState()
```

Return the current state of the application.

Returns:

the state of the application.

pause()

```
public void pause()
```

Request that the application manager pause the application bound to this information structure.

The application will be paused. Calls to this method shall fail if the application is not in the active state. If the application represented by this AppProxy is a DVB-J application, calling this method will, if successful, result in the `pauseXlet` method being called on the Xlet making up the DVB-J application.

Throws:

`SecurityException` - if the application is not entitled to pause this application. Note that if an application is entitled to stop an application, it is also entitled to pause it: having the right to stop an application is logically equivalent to having the right to pause it.

Since:

MHP1.0

removeAppStateChangeListener(AppStateChangeListener)

```
public void removeAppStateChangeListener(AppStateChangeListener listener)
```

Remove a listener on the database.

Parameters:

`listener` - the listener to be removed.

Since:

MHP1.0

resume()

```
public void resume()
```

Request that the application manager resume the execution of the application. The `application` will be started. This method will throw a security exception if the application does not have the authority to resume the application. Calls to this method shall fail if the application is not in the paused state.

This method is asynchronous and its completion will be notified by an `AppStateChangeEvent`. In case of failure, the `hasFailed` method of the `AppStateChangeEvent` will return true. If the application represented by this `AppProxy` is a DVB-J application, calling this method will, if successful, result in the `startXlet` method being called on the Xlet making up the DVB-J application.

Throws:

`SecurityException` - if the application is not entitled to resume this application.

Since:

MHP1.0

start()

```
public void start()
```

Request that the application manager start the application bound to this information structure.

The `application` will be started. This method will throw a security exception if the application does not have the authority to start applications. Calls to this method shall only succeed if the application is in the not loaded or paused states. If the application was not loaded at the moment of this call, then the application will be started. In the case of a DVB-J application, it will be initialized and then started by the Application Manager, hence causing the Xlet to go from NotLoaded to Paused and then from Paused to Active. If the application was in the Paused state at the moment of the call and had never been in the Active state, then the application will be started. If the application represented by this `AppProxy` is a DVB-J application, calling this method will, if successful, result in the `startXlet` method being called on the Xlet making up the DVB-J application.

This method is asynchronous and its completion will be notified by an `AppStateChangeEvent`. In case of failure, the `hasFailed` method of the `AppStateChangeEvent` will return true.

Throws:

`SecurityException` - if the application is not entitled to start this application.

Since:

MHP1.0

start(String[])

```
public void start(java.lang.String[] args)
```

Request that the application manager start the application bound to this information structure passing to that application the specified parameters.

The `application` will be started. This method will throw a security exception if the application does not have the authority to start applications. Calls to this method shall only succeed if the application is in the not loaded or paused states. If the application was not loaded at the moment of this call, then the application will be started. In the case of a DVB-J application, it will be initialized and then started by the Application Manager, hence causing the Xlet to go from NotLoaded to Paused and then from Paused to Active. If the application was in the Paused state at the moment of the call and had never been in the Active state, then the application will be started. If the application represented by this `AppProxy` is a DVB-J application, calling this method will, if successful, result in the `startXlet` method being called on the Xlet making up the DVB-J application.

This method is asynchronous and its completion will be notified by an `AppStateChangeEvent`. In case of failure, the `hasFailed` method of the `AppStateChangeEvent` will return true.

Parameters:

`args` - the parameters to be passed into the application being started

Throws:

`SecurityException` - if the application is not entitled to start this application.

Since:

MHP1.0.1

stop(boolean)

```
public void stop(boolean forced)
```

Request that the application manager stop the application bound to this information structure.

The `application` will be stopped. A call to this method shall fail if the application was already in the destroyed state. This method call will stop the application if it was in any other state before the call. If the application is in the NOT_LOADED state then it shall move directly to the DESTROYED state with no other action being taken. If the application represented by this `AppProxy` is a DVB-J application and is not in the DESTROYED state then calling this method will, if successful, result in the `destroyXlet` method being called on the Xlet making up the DVB-J application with the same value for the parameter as passed to this method.

This method is asynchronous and its completion will be notified by an `AppStateChangeEvent`. In case of failure, the `hasFailed` method of the `AppStateChangeEvent` will return true.

Parameters:

`forced` - if true then do not ask the application but forcibly terminate it, if false give the application an opportunity to refuse.

Throws:

`SecurityException` - if the application is not entitled to stop this application.

Since:

MHP1.0

org.dvb.application AppsControlPermission

Syntax

```
public final class AppsControlPermission extends java.security.BasicPermission
```

```
java.lang.Object
|
+--java.security.Permission
|
+--java.security.BasicPermission
|
+--org.dvb.application.AppsControlPermission
```

All Implemented Interfaces:

java.security.Guard, java.io.Serializable

Description

This class represents a Permission to control the lifecycle of another application.

Constructors

AppsControlPermission()

```
public AppsControlPermission()
```

Creates a new AppsControlPermission. There is a simple mapping between the Application control Permission requests and the way the AppsControlPermission are granted. This mapping is defined in the main body of this specification.

AppsControlPermission(String, String)

```
public AppsControlPermission(java.lang.String name, java.lang.String actions)
```

Creates a new AppsControlPermission. There is a simple mapping between the Application control Permission requests and the way the AppsControlPermission are granted. This mapping is defined in the main body of this specification. The actions string is currently unused and should be null. The name string is currently unused and should be empty. This constructor exists for use by the java.security.Policy object to instantiate new permission objects.

Parameters:

name - the name of the permission

actions - the actions string

Methods

equals(Object)

```
public boolean equals(java.lang.Object obj)
```


Checks for equality against this AppsControlPermission object.

Overrides:

`java.security.BasicPermission.equals(java.lang.Object)` in class `java.security.BasicPermission`

Parameters:

`obj` - the object to test for equality with this AppsControlPermission object.

Returns:

true if `obj` is an AppsControlPermission

getActions()

```
public java.lang.String getActions()
```

Returns the list of actions that had been passed to the constructor - it shall return null.

Overrides:

`java.security.BasicPermission.getActions()` in class `java.security.BasicPermission`

Returns:

a null String.

hashCode()

```
public int hashCode()
```

Returns the hash code value for this object.

Overrides:

`java.security.BasicPermission.hashCode()` in class `java.security.BasicPermission`

Returns:

the hash code value for this object.

implies(Permission)

```
public boolean implies(java.security.Permission permission)
```

Checks if this AppsControlPermission object "implies" the specified permission.

Overrides:

`java.security.BasicPermission.implies(java.security.Permission)` in class `java.security.BasicPermission`

Parameters:

`permission` - the specified permission to check.

Returns:

true if and only if the specified permission is an instance of AppsControlPermission, false otherwise.

org.dvb.application AppsDatabase

Syntax

```
public class AppsDatabase

java.lang.Object
|
+--org.dvb.application.AppsDatabase
```

Description

The `AppsDatabase` is an abstract view of the currently available applications. The entries will be provided by the application manager, and gleaned from the AIT signaling. When the service context in which an application is running undergoes service selection, instances of `AppsDatabase` used by that application shall be updated from the new service before an `AppsDatabaseEvent` is sent to the `newDatabase` method of any registered `AppsDatabaseEventListeners`.

Externally authorized applications shall not appear unless an instance of that application is actually running.

A generic launcher may be written which uses the database to display information in `AppAttributes` and uses an `AppProxy` to launch it

Methods on classes in this package do not block, they return the information the system currently has. Therefore applications should be aware that data may be stale, to within one refresh period of the AIT.

eg:

```
AppsDatabase theDatabase = AppsDatabase.getDatabase();
if (theDatabase != null) {
    Enumeration attributes = theDatabase.getAppAttributes();
    if(attributes != null) {
        while(attributes.hasMoreElements()) {
            AppAttributes info ;
            AppProxy proxy ;

            info = (AppAttributes)attributes.nextElement();
            proxy = (AppProxy)theDatabase.getAppProxy(info.getIdentifier());
            URL icon = info.getIcon();
            // blah blah..
            // lets start it.
            proxy.start(false, null);
        }
    }
}
```

Where methods on this class as specified as working on "available" applications or "currently available" applications the following definition shall apply. An application is "currently available" if and only if one of the following applies in the service context within which the application calling the method is executing.

- it is signalled as being present or autostart in the currently selected service of that service context and could be started.
- it is currently running in that service context.

In addition to the methods listed below, all calls made using an `AppsDatabaseFilter` shall only use that filter to test "currently available" applications as defined here.

Applications whose information (e.g. signaling) is invalid (e.g. one or more mandatory descriptors are missing or incorrect) may not be listed in the `AppsDatabase`. Where applications are signalled in a broadcast AIT and the MHP terminal tunes away from the service on which the AIT is carried, but without selecting a new service, the `AppsDatabase` shall retain the entries as signalled in that AIT until a new service is selected.

Methods

addListener(AppsDatabaseEventListener)

```
public void addListener(AppsDatabaseEventListener listener)
```

Add a listener to the database so that an application can be informed if the database changes.

Parameters:

`listener` - the listener to be added.

Since:

MHP1.0

getAppAttributes(AppID)

```
public AppAttributes getAppAttributes(AppID key)
```

Returns the properties associated with the given ID. Returns null if no such application is available, or if the application is externally authorized.

Only one AppAttributes object shall be returned in the case where there are several applications having the same (organisationId, applicationId) pair. In such a case, the same algorithm as would be used to autostart such applications shall be used to decide between the available choices by the implementation.

This method shall return instances which reflect the contents of the database at the time the method is called. After an AppsDatabaseEvent has been generated, new instances may be returned. After a service selection has taken place, applications which survived the service selection may call this method in order to discover the attributes of the applications signalled on the new service.

Parameters:

`key` - an application ID.

Returns:

the value to which the key is mapped in this dictionary or `null` if the key is not an application ID, or not mapped to any application currently available.

Since:

MHP1.0

getAppAttributes(AppsDatabaseFilter)

```
public java.util.Enumeration getAppAttributes(AppsDatabaseFilter filter)
```

Returns an enumeration of AppAttributes of the applications available. The Enumeration will contain the set of AppAttributes that satisfy the filtering criteria. For implementations conforming to this version of the specification, only `CurrentServiceFilter` filters may return a non empty Enumeration. If the filter object is not an instance of `CurrentServiceFilter` or a subclasses then, the method shall return an empty Enumeration.

This method shall return instances which reflect the contents of the database at the time the method is called. After an AppsDatabaseEvent has been generated, new instances may be returned. After a service selection has taken place, applications which survived the service selection may call this method in order to discover the attributes of the applications signalled on the new service.

No AppAttribute shall be returned for externally authorized applications, even ones which are executing. This method will return an empty Enumeration if there are no attributes.

Parameters:

`filter` - the filter to apply

Returns:

an enumeration of the applications attributes.

Since:

MHP1.0

getAppIDs(AppsDatabaseFilter)

```
public java.util.Enumeration getAppIDs(AppsDatabaseFilter filter)
```

Returns an enumeration of the application ID's available. The Enumeration will contain the set of AppID that match the filtering criteria. For implementations conforming to this version of the specification, only `CurrentServiceFilter` filters may return a non empty Enumeration. If the filter object is not an instance of `CurrentServiceFilter` or one of its subclasses then, the method shall return an empty Enumeration. No IDs shall be returned for externally authorized applications, even ones which are executing. This method will return an empty Enumeration if there are no matching applications.

Parameters:

`filter` - the filter to apply

Returns:

the applications available matching the filtering criteria

Since:

MHP1.0

getAppProxy(AppID)

```
public AppProxy getAppProxy(AppID key)
```

Returns the ApplicationProxy associated with the given ID. Returns null if no such application available.

Only one AppProxy object shall be returned in the case where there are several applications having the same (organisationId, applicationId) pair. In such a case, the same algorithm as would be used to autostart such applications shall be used to decide between the available choices by the implementation.

Parameters:

`key` - an application ID. `null` if the key is not an application ID, or not mapped to any application available.

Returns:

the value to which the key is mapped in this dictionary;

Throws:

`SecurityException` - if the calling application does not have the right to control the application associated with the given ID as defined by the security policy of the platform

Since:

MHP1.0

getAppsDatabase()

```
public static AppsDatabase getAppsDatabase()
```

Returns the singleton system-wide AppsDatabase object.

Returns:

the singleton AppsDatabase object.

Since:

MHP1.0

removeListener(AppsDatabaseEventListener)

```
public void removeListener(AppsDatabaseEventListener listener)
```

remove a listener on the database.

Parameters:

`listener` - the listener to be removed.

Since:

MHP1.0

size()

```
public int size()
```

Returns the number of applications currently available.

Returns:

the number of applications currently available.

Since:

MHP1.0

org.dvb.application AppsDatabaseEvent

Syntax

```
public class AppsDatabaseEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.application.AppsDatabaseEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

The `AppsDatabaseEvent` class indicates either the an entry in the application database has changed, or so many changes have occurred. that the database should be considered totally new This event shall always be sent after switching to a new service. It is platform dependant if and when a new database event is thrown while tuned to the same service.

Since:

```
MHP1.0
```

Fields

APP_ADDED

```
public static final int APP_ADDED
```

The addition event id. The APP_ADDED event is generated whenever an entry is added to the AppsDatabase. It is NOT generated when the entry already in the AppsDatabase changes.

APP_CHANGED

```
public static final int APP_CHANGED
```

The changed event id. The APP_CHANGED event is generated whenever any of the information about an application changes. It is NOT generated when the entry is added to or removed from the AppsDatabase. In such cases, the APP_ADDED or APP_DELETED events will be generated instead.

APP_DELETED

```
public static final int APP_DELETED
```

The deletion event id. The APP_DELETED event is generated whenever an entry is removed from the AppsDatabase.

NEW_DATABASE

```
public static final int NEW_DATABASE
```

The new database event id.

Constructors

AppsDatabaseEvent(int, AppID, Object)

```
public AppsDatabaseEvent(int id, AppID appid, java.lang.Object source)
```

Create a new AppsDatabaseEvent object for the entry in the database that changed, or for a new database.

Parameters:

id - the cause of the event

appid - the AppID of the entry that changed

source - the AppsDatabase object.

Since:

MHP1.0

Methods

getAppID()

```
public AppID getAppID()
```

gets the application ID object for the entry in the database that changed.

When the event type is NEW_DATABASE, AppID will be null.

Returns:

application ID representing the application

Since:

MHP1.0

getEventId()

```
public int getEventId()
```

gets the type of the event.

Returns:

an integer that matches one of the static fields describing events.

Since:

MHP1.0

org.dvb.application

AppsDatabaseEventListener

Syntax

```
public interface AppsDatabaseEventListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

The `AppsDatabaseEventListener` class allows an application to monitor the application database so that it can keep an up to date interface without polling the state. The application shall receive these events in a timely fashion after the AIT changes, however it is system dependant how often the AIT table is checked.

Since:

MHP1.0

Methods

entryAdded(AppsDatabaseEvent)

```
public void entryAdded(AppsDatabaseEvent evt)
```

The AppsDataBase has had an application entry added.

Parameters:

`evt` - the AppsDatabaseEvent.

Since:

MHP1.0

entryChanged(AppsDatabaseEvent)

```
public void entryChanged(AppsDatabaseEvent evt)
```

The AppsDataBase has had an application entry changed.

Parameters:

`evt` - the AppsDatabaseEvent.

Since:

MHP1.0

entryRemoved(AppsDatabaseEvent)

```
public void entryRemoved(AppsDatabaseEvent evt)
```

The AppsDataBase has had an application entry removed.

Parameters:

`evt` - the AppsDatabaseEvent.

Since:

MHP1.0

newDatabase(AppsDatabaseEvent)

```
public void newDatabase(AppsDatabaseEvent evt)
```

The AppsDataBase has radically changed.

Parameters:

`evt` - the AppsDatabaseEvent.

Since:

MHP1.0

org.dvb.application AppsDatabaseFilter

Syntax

```
public abstract class AppsDatabaseFilter
    java.lang.Object
    |
    +--org.dvb.application.AppsDatabaseFilter
```

Direct Known Subclasses:

[CurrentServiceFilter](#)

Description

Abstract class for the filters. Instances of concrete classes that extend `AppsDatabaseFilter` are passed to the `AppsDatabase.getAppAttributes` and `AppsDatabase.getAppIDs` methods to allow an applications to set a filter on the list of applications (respectively `AppAttributes` and `AppIDs`) that it wants to retrieve from the `AppDatabase`.

For this version of the specification, only one subclass is defined: `CurrentServiceFilter`

Since:

MHP 1.0

Constructors

AppsDatabaseFilter()

```
public AppsDatabaseFilter()
```

Construct an `AppsDatabaseFilter` object.

Methods

accept(AppID)

```
public abstract boolean accept(AppID appid)
```

Test if a specified `appid` should be included in the Enumeration.

Parameters:

`appid` - the specified `appid` to test.

Returns:

true if the application with identifier `appid` should be listed, false otherwise.

Since:

MHP1.0

org.dvb.application AppStateChangeEvent

Syntax

```
public class AppStateChangeEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.dvb.application.AppStateChangeEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

The `AppStateChangeEvent` class indicates a state transition of the application. If the state transition was requested by an application through this API, the method `hasFailed` indicates whether the state change failed or not. Where a state change succeeds, `fromState` and `toState` shall indicate the original and destination state of the transition. If it failed, `fromState` shall return the state the application was in before the state transition was requested and the `toState` method shall return the state the application would have been in if the state transition had succeeded.

Attempting to start an application which is already running shall fail and generate an `AppStateChangeEvent` with `hasFailed` returning true and both `fromstate` and `tostate` being `STARTED`.

Since:

```
MHP1.0
```

Constructors

AppStateChangeEvent(AppID, int, int, Object, boolean)

```
public AppStateChangeEvent(AppID appid, int fromstate, int tostate,
    java.lang.Object source, boolean hasFailed)
```

Create an `AppStateChangeEvent` object.

Parameters:

`appid` - a registry entry representing the tracked application

`fromstate` - the state the application was in before the state transition was requested, where the value of `fromState` is one of the state values defined in the `AppProxy` interface or in the interfaces inheriting from it

`tostate` - state the application would be in if the state transition succeeds, where the value of `toState` is one of the state values defined in the `AppProxy` interface or in the interfaces inheriting from it

`hasFailed` - an indication of whether the transition failed (true) or succeeded (false)

`source` - the `AppProxy` where the state transition happened

Methods

getAppID()

```
public AppID getAppID()
```

The application the listener was tracking has made a state transition from `fromState` to `toState`.

Returns:

a registry entry representing the tracked application

Since:

MHP1.0

getFromState()

```
public int getFromState()
```

The application the listener is tracking was in `fromState`, where the value of `fromState` is one of the state values defined in the `AppProxy` interface or in the interfaces inheriting from it.

Returns:

the old state

Since:

MHP1.0

getToState()

```
public int getToState()
```

The application the listener is tracking is now in `toState`, where the value of `toState` is one of the state values defined in the `AppProxy` interface or in the interfaces inheriting from it.

Returns:

the intended new state

Since:

MHP1.0

hasFailed()

```
public boolean hasFailed()
```

This method determines whether an attempt to change the state of an application has failed.

Returns:

true if the attempt to change the state of the application failed, false otherwise

Since:

MHP1.0

org.dvb.application

AppStateChangeListener

Syntax

```
public interface AppStateChangeListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

Description

The `AppStateChangeListener` class allows a launcher application to keep track of applications it launches or other applications running as part of the same service.

Since:

MHP1.0

Methods

stateChange(AppStateChangeEvent)

```
public void stateChange(AppStateChangeEvent evt)
```

The application the listener was tracking has made a state transition from `fromState` to `toState` and this method will be given the state event.

Parameters:

`evt` - the `AppStateChangeEvent`.

Since:

MHP1.0

org.dvb.application CurrentServiceFilter

Syntax

```
public class CurrentServiceFilter extends AppsDatabaseFilter
```

```
java.lang.Object
|
+--AppsDatabaseFilter
|
+--org.dvb.application.CurrentServiceFilter
```

Description

Instances of `CurrentServiceFilter` are used to set a filter on the list of applications that are retrieved from the `AppsDatabase` (See methods `getAppsAttributes` and `getAppIDs`)

For this version of the specification, only the `CurrentServiceFilter` class is defined. A `CurrentServiceFilter` is used to indicate that only broadcast applications that are signalled in one of the AITs of the current service shall be returned by the `getAppsAttributes` and `getAppIDs` methods of `AppsDatabase`. Subclasses of `CurrentServiceFilter` can override the `accept` method so as to implement their own filter criteria on the `AppID`'s values.

Since:

MHP 1.0

Constructors

CurrentServiceFilter()

```
public CurrentServiceFilter()
```

public Constructor of the `CurrentServiceFilter`

Methods

accept(AppID)

```
public boolean accept(AppID appid)
```

Test if a specified `appid` should be included in the Enumeration.

Overrides:

`accept(AppID)` in class `AppsDatabaseFilter`

Parameters:

`appid` - the specified `appid` to test.

Returns:

true if the application with identifier `appid` should be listed, false otherwise.

Since:

MHP1.0

org.dvb.application DVBHTMLProxy

Syntax

```
public interface DVBHTMLProxy extends AppProxy
```

All Superinterfaces:

[AppProxy](#)

Description

A `DVBHTMLProxy` Object is a proxy to a DVBHTML application.

Methods

prefetch()

```
public void prefetch()
```

Loads the initial entry page of the application and waits for a signal. This method mimics the PREFETCH control code and is intended to be called instead of and not as well as start. Calling prefetch on a started application will have no effect.

Throws:

`SecurityException` - if the calling application does not have permission to start applications

Since:

MHP1.0

startTrigger(Date)

```
public void startTrigger(java.util.Date starttime)
```

Sends the application a start trigger at the specified time.

Parameters:

`starttime` - the specified time to send a start trigger to the application. If the time has already passed the application manager shall send the trigger immediately. Dates pre-epoch shall always cause the application manager to send the trigger immediately.

Throws:

`SecurityException` - if the calling application does not have permission to start applications

Since:

MHP1.0

trigger(Date, Object)

```
public void trigger(java.util.Date time, java.lang.Object triggerPayload)
```

Sends the application a trigger with the given payload at the specified time.

Parameters:

`time` - the specified time to send a start trigger to the application. If the time has already passed the application manager should send the trigger immediately. Dates pre-epoch shall always cause the application manager to send a 'now' trigger.

`triggerPayload` - the specified payload to deliver with the trigger. The payload is specified as object, but this will be refined once DVB-HTML Triggers are properly defined.

Throws:

`SecurityException` - if the calling application does not have permission to start applications

Since:

MHP1.0

org.dvb.application DVBJProxy

Syntax

```
public interface DVBJProxy extends AppProxy
```

All Superinterfaces:

[AppProxy](#)

Description

A DVBJProxy Object is a proxy to a DVBJ application.

Fields

LOADED

```
public static final int LOADED
```

The application is in the loaded state.

Methods

init()

```
public void init()
```

Requests the application manager calls the `initXlet` method on the application.

This method is asynchronous and its completion will be notified by an `AppStateChangeEvent`. In case of failure, the `hasFailed` method of the `AppStateChangeEvent` will return true. Calls to this method shall only succeed if the application is in the `NOT_LOADED` or `LOADED` states. If the application is in the `NOT_LOADED` state, the application will move through the `LOADED` state into the `PAUSED` state before calls to this method complete.

In all cases, an `AppStateChangeEvent` will be sent, whether the call was successful or not.

Throws:

`SecurityException` - if the application is not entitled to load this application. being able to load an application requires to be entitled to start it.

Since:

MHP1.0

load()

```
public void load()
```

Provides a hint to preload at least the initial class of the application into local storage, resources permitting. This does not require loading of classes into the virtual machine or creation of a new logical virtual machine which are implications of the `init` method.

This method is asynchronous and its completion will be notified by an `AppStateChangeEvent`. In case of failure, the `hasFailed` method of the `AppStateChangeEvent` will return `true`. Calls to this method shall only succeed if the application is in the `NOT_LOADED` state. In all cases, an `AppStateChangeEvent` will be sent, whether the call was successful or not.

Throws:

`SecurityException` - if the application is not entitled to load this application. being able to load an application requires to be entitled to start it.

Since:

MHP1.0

org.dvb.application IllegalProfileParameterException

Syntax

```
public class IllegalProfileParameterException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--org.dvb.application.IllegalProfileParameterException
```

All Implemented Interfaces:

java.io.Serializable

Description

The `IllegalProfileParameter` exception is thrown if the application attempts to ask for a version number for a profile not specified for the application.

Since:

MHP1.0

Constructors

IllegalProfileParameterException()

```
public IllegalProfileParameterException()
```

Construct a `IllegalProfileParameterException` with no detail message

IllegalProfileParameterException(String)

```
public IllegalProfileParameterException(java.lang.String s)
```

Construct a `IllegalProfileParameterException` with a detail message

Parameters:

`s` - detail message

org.dvb.application

LanguageNotAvailableException

Syntax

```
public class LanguageNotAvailableException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
|
+--java.lang.Exception
|
+--org.dvb.application.LanguageNotAvailableException
```

All Implemented Interfaces:

java.io.Serializable

Description

The `LanguageNotAvailableException` exception is thrown if the application asks for the name of an application in a language not signalled in the AIT.

Since:

MHP1.0

Constructors

LanguageNotAvailableException()

```
public LanguageNotAvailableException()
```

Construct a `LanguageNotAvailableException` with no detail message

LanguageNotAvailableException(String)

```
public LanguageNotAvailableException(java.lang.String s)
```

Construct a `LanguageNotAvailableException` with a detail message

Parameters:

`s` - detail message

Annex T (normative): Permissions

Package org.dvb.net.ca

Description

Provides extensions to the conditional access API from DAVIC.

Class Summary

Classes

[CAPermission](#)

This class is for CA permissions.

org.dvb.net.ca CAPermission

Syntax

```
public class CAPermission extends java.security.BasicPermission
```

```
java.lang.Object
|
+--java.security.Permission
|
+--java.security.BasicPermission
|
+--org.dvb.net.ca.CAPermission
```

All Implemented Interfaces:

java.security.Guard, java.io.Serializable

Description

This class is for CA permissions. A CAPermission contains a name, but no actions list.

A CAPermission contains a range of CA system ids and a specific permission for that range of CA system ids. Instead of a range of CA system ids, the CAPermission can also refer to a single CA system id.

The name has the following syntax:

CASystemIdRange ":" Permission

where CASystemIdRange = CASystemId ["-" CASystemId] | ""

and Permission = "MMI" | "buy" | "entitlementInfo" | "messagePassing" | ""

Examples:

- 0x1200-0x120A:buy (The permission to buy entitlement for all the CA systems with ids between 0x1200 and 0x120A inclusive.)
- 0x1201:entitlementInfo (The permission to get entitlement information for the CA system with id 0x1201)
- 0x120d:* (This wildcard expresses all the permissions for the CA system with id 0x120d).

Note: The CASystemId is expressed as a hexadecimal value.

The permission "MMI" corresponds with the SecurityException on CAModuleManager.addMMIListener(). The permission "buy" corresponds with the SecurityException on CAModule.buyEntitlement(). The permission "entitlementInfo" corresponds with the SecurityException on CAModule.queryEntitlement() and CAModule.listEntitlements(). The permission "messagePassing" corresponds with CAModule.openMessageSession(MessageListener)

Constructors

CAPermission(String)

```
public CAPermission(java.lang.String name)
```

Creates a new CAPermission with the specified name. The name is the symbolic name of the CAPermission.

Parameters:

name - the name of the CAPermission

CAPermission(String, String)

```
public CAPermission(java.lang.String name, java.lang.String actions)
```

Creates a new CAPermission object with the specified name. The name is the symbolic name of the CAPermission, and the actions String is unused and should be null. This constructor exists for use by the Policy object to instantiate new Permission objects.

Parameters:

`name` - the name of the CAPermission

`actions` - should be null.

Package org.dvb.net.tuning

Description

Provides extensions to the tuning API from DAVIC.

Class Summary

Classes

<code>DvbNetworkInterface-</code> <code>SIUtil</code>	Each SI database is associated with a network interface and vice versa.
<code>TunerPermission</code>	This class is for tuner permissions.

org.dvb.net.tuning DvbNetworkInterfaceSIUtil

Syntax

```
public class DvbNetworkInterfaceSIUtil  
  
java.lang.Object  
|  
+--org.dvb.net.tuning.DvbNetworkInterfaceSIUtil
```

Description

Each SI database is associated with a network interface and vice versa. This class allows the application to query this association.

Since:

MHP 1.0.1

Methods

getNetworkInterface(SIDatabase)

```
public static org.davic.net.tuning.NetworkInterface getNetworkInterface(SIDatabase sd)
```

Gets the network interface for a particular SI database.

Parameters:

`sd` - the SI database for which the associated network interface will be returned.

Returns:

the associated network interface

getSIDatabase(NetworkInterface)

```
public static SIDatabase getSIDatabase(org.davic.net.tuning.NetworkInterface ni)
```

Gets the SI database for a particular network interface.

Parameters:

`ni` - the network interface for which the associated SI database will be returned.

Returns:

the associated SI database

org.dvb.net.tuning TunerPermission

Syntax

```
public class TunerPermission extends java.security.BasicPermission
```

```
java.lang.Object
|
+--java.security.Permission
   |
   +--java.security.BasicPermission
      |
      +--org.dvb.net.tuning.TunerPermission
```

All Implemented Interfaces:

java.security.Guard, java.io.Serializable

Description

This class is for tuner permissions. A TunerPermission contains no name and no actions list. If an application has the tuner permission, then it shall not receive a `SecurityException` from those methods in that API defined to throw one. Without such a permission, it shall receive such an exception.

Constructors

TunerPermission(String)

```
public TunerPermission(java.lang.String name)
```

Creates a new TunerPermission. The name string is currently unused and should be empty.

Parameters:

`name` - the name of the TunerPermission.

TunerPermission(String, String)

```
public TunerPermission(java.lang.String name, java.lang.String actions)
```

Creates a new TunerPermission. The name string is currently unused and should be empty. The actions string is currently unused and should be null. This constructor exists for use by the Policy object to instantiate new Permission objects.

Parameters:

`name` - the name of the TunerPermission.

`actions` - the actions list

Annex U (normative): Extended graphics APIs

Package org.dvb.ui

Description

Provides extended graphics functionality.

Class Summary	
Interfaces	
<code>TestOpacity</code>	Interface implemented by Components or Containers in order to allow the platform to query whether their paint method is fully opaque.
<code>TextOverflowListener</code>	The <code>TextOverflowListener</code> is an interface that an application may implement and register in the <code>DVBTextLayoutManager</code> .
Classes	
<code>DVBAlphaComposite</code>	This <code>DVBAlphaComposite</code> class implements the basic alpha compositing rules for combining source and destination pixels to achieve blending and transparency effects with graphics, images and video.
<code>DVBBufferedImage</code>	The <code>DVBBufferedImage</code> subclass describes an <code>java.awt.Image</code> with an accessible buffer of image data.
<code>DVBColor</code>	A <code>Color</code> class which adds the notion of alpha.
<code>DVBGraphics</code>	The <code>DVBGraphics</code> class is a adapter class to support alpha compositing in an MHP device.
<code>DVBTextLayoutManager</code>	The <code>DVBTextLayoutManager</code> provides a text rendering layout mechanism for the <code>org.havi.ui.HStaticText</code> , <code>org.havi.ui.HText</code> and <code>org.havi.ui.HTextButton</code> classes.
<code>FontFactory</code>	Provides a mechanism for applications to instantiate fonts that are not built into the system.
Exceptions	
<code>DVBRasterFormatException</code>	This exception is thrown for some invalid operations on instances of <code>DVBBufferedImage</code> .
<code>FontFormatException</code>	Thrown when attempt is made to read a file describing a font when the contents of that file are not valid.
<code>FontNotAvailableException</code>	Thrown when attempt is made to instantiate a font that cannot be located.
<code>UnsupportedDrawingOperationException</code>	The <code>UnsupportedDrawingOperationException</code> class represents an exception that is thrown if a drawing operation is not supported on this platform.

org.dvb.ui DVBAAlphaComposite

Syntax

```
public final class DVBAAlphaComposite
```

```
java.lang.Object
|
+--org.dvb.ui.DVBAAlphaComposite
```

Description

This `DVBAAlphaComposite` class implements the basic alpha compositing rules for combining source and destination pixels to achieve blending and transparency effects with graphics, images and video. The rules implemented by this class are a subset of the Porter-Duff rules described in T. Porter and T. Duff, "Compositing Digital Images", SIGGRAPH 84, 253-259.

If any input does not have an alpha channel, an alpha value of 1.0, which is completely opaque, is assumed for all pixels. A constant alpha value can also be specified to be multiplied with the alpha value of the source pixels.

The following abbreviations are used in the description of the rules:

- C_s = one of the color components of the source pixel without alpha.
- cs = color component of a source pixel premultiplied with alpha ($cs = A_s * A_r * C_s$)
- C_d = one of the color components of the destination pixel without alpha.
- cd = color component of a destination pixel premultiplied with alpha
- C_n = the new constructed color without alpha.
- cn = the new constructed color premultiplied with alpha
- A_s = alpha component of the source pixel.
- A_d = alpha component of the destination pixel.
- A_n = the new alpha after compositing
- A_r = alpha, specified by `getInstance(int Rule, float Ar)`. Unless otherwise specified $A_r = 1.0$
- F_s = fraction of the source pixel that contributes to the output.
- F_d = fraction of the input destination pixel that contributes to the output.

The color and alpha components produced by the compositing operation are calculated as follows:

$$cn = (As * Ar) * Cs * Fs + Ad * Cd * Fd$$

$$An = (As * Ar) * Fs + Ad * Fd$$

$$Cn = cn / An$$

where F_s and F_d are specified by each rule.

The alpha resulting from the compositing operation is stored in the destination if the destination has an alpha channel. Otherwise, the resulting color is divided by the resulting alpha before being stored in the destination and the alpha is discarded. If the alpha value is 0.0, the color values are set to 0.0.

See Also:

```
java.awt.AlphaComposite
```

Fields

Clear

```
public static final DVBAAlphaComposite Clear
```

DVBAlphaComposite object that implements the opaque CLEAR rule with an alpha (Ar) of 1.0f.

See Also:

[CLEAR](#)

CLEAR

```
public static final int CLEAR
```

Porter-Duff Clear rule. Both the color and the alpha of the destination are cleared. Neither the source nor the destination is used as input.

$F_s = 0$ and $F_d = 0$, thus:

```
cn = 0
An = 0
Cn = 0
```

Note that this operation is a fast drawing operation This operation is the same as using a source with $\alpha = 0$ and the SRC rule

DST_IN

```
public static final int DST_IN
```

Porter-Duff Destination In Source rule. The part of the destination lying inside of the source replaces the destination.

$F_s = 0$ and $F_d = (A_s * A_r)$, thus:

```
cn = Ad * Cd * (As * Ar)
An = Ad * (As * Ar)
Cn = Cd
```

Note that this operation is faster than e.g. SRC_OVER but slower as SRC

DST_OUT

```
public static final int DST_OUT
```

Porter-Duff Destination Held Out By Source rule. The part of the destination lying outside of the source replaces the destination.

$F_s = 0$ and $F_d = (1 - (A_s * A_r))$, thus:

```
cn = Ad * Cd * (1 - (As * Ar))
An = Ad * (1 - (As * Ar))
Cn = Cd
```

Note that this operation is faster than e.g. SRC_OVER but slower as SRC

DST_OVER

```
public static final int DST_OVER
```

Porter-Duff Destination Over Source rule. The destination is composited over the source and the result replaces the destination.

$F_s = (1 - A_d)$ and $F_d = 1$, thus:

```
cn = (As * Ar) * Cs * (1 - Ad) + Ad * Cd
An = (As * Ar) * (1 - Ad) + Ad
```

Note that this can be a very slow drawing operation

DstIn

```
public static final DVBAAlphaComposite DstIn
```

DVBAlphaComposite object that implements the opaque DST_IN rule with an alpha (Ar) of 1.0f.

See Also:

DST_IN

DstOut

```
public static final DVBAlphaComposite DstOut
```

DVBAlphaComposite object that implements the opaque DST_OUT rule with an alpha (Ar) of 1.0f.

See Also:

DST_OUT

DstOver

```
public static final DVBAlphaComposite DstOver
```

DVBAlphaComposite object that implements the opaque DST_OVER rule with an alpha (Ar) of 1.0f.

See Also:

DST_OVER

Src

```
public static final DVBAlphaComposite Src
```

DVBAlphaComposite object that implements the opaque SRC rule with an alpha (Ar) of 1.0f.

See Also:

SRC

SRC

```
public static final int SRC
```

Porter-Duff Source rule. The source is copied to the destination. The destination is not used as input.

Fs = 1 and Fd = 0, thus:

```
cn = (As*Ar)*Cs
An = As*Ar
Cn = Cs
```

Note that this is a fast drawing routine

SRC_IN

```
public static final int SRC_IN
```

Porter-Duff Source In Destination rule. The part of the source lying inside of the destination replaces the destination.

Fs = Ad and Fd = 0, thus:

```
cn = (As*Ar)*Cs*Ad
An = (As*Ar)*Ad
Cn = Cs
```

Note that this operation is faster than e.g. SRC_OVER but slower as SRC

SRC_OUT

```
public static final int SRC_OUT
```


Porter-Duff Source Held Out By Destination rule. The part of the source lying outside of the destination replaces the destination.

$F_s = (1 - A_d)$ and $F_d = 0$, thus:

```
cn = (As*Ar)*Cs*(1-Ad)
An = (As*Ar)*(1-Ad)
Cn = Cs
```

Note that this operation is faster than e.g. SRC_OVER but slower as SRC

SRC_OVER

```
public static final int SRC_OVER
```

Porter-Duff Source Over Destination rule. The source is composited over the destination.

$F_s = 1$ and $F_d = (1 - (A_s * A_r))$, thus:

```
cn = (As*Ar)*Cs + Ad*Cd*(1-(As*Ar))
An = (As*Ar) + Ad*(1-(As*Ar))
```

Note that this can be a very slow drawing operation

SrcIn

```
public static final DVBAAlphaComposite SrcIn
```

DVBAAlphaComposite object that implements the opaque SRC_IN rule with an alpha (A_r) of 1.0f.

See Also:

[SRC_IN](#)

SrcOut

```
public static final DVBAAlphaComposite SrcOut
```

DVBAAlphaComposite object that implements the opaque SRC_OUT rule with an alpha (A_r) of 1.0f.

See Also:

[SRC_OUT](#)

SrcOver

```
public static final DVBAAlphaComposite SrcOver
```

DVBAAlphaComposite object that implements the opaque SRC_OVER rule with an alpha (A_r) of 1.0f.

See Also:

[SRC_OVER](#)

Methods

equals(Object)

```
public boolean equals(java.lang.Object obj)
```

Tests if the specified `java.lang.Object` is equal to this DVBAAlphaComposite object.

Overrides:

`java.lang.Object.equals(java.lang.Object)` in class `java.lang.Object`

Parameters:

obj - the Object to test for equality

Returns:

true if obj is a DVBAAlphaComposite and has the same values for rule and alpha as this object. Otherwise false shall be returned.

getAlpha()

```
public float getAlpha()
```

Returns the alpha value of this DVBAAlphaComposite. If this DVBAAlphaComposite does not have an alpha value, 1.0 is returned.

Returns:

the alpha value of this DVBAAlphaComposite.

getInstance(int)

```
public static DVBAAlphaComposite getInstance(int rule)
```

Creates an DVBAAlphaComposite object with the specified rule. The value for alpha shall be 1.0f.

Parameters:

rule - the compositing rule

Returns:

an DVBAAlphaComposite object with the specified rule.

getInstance(int, float)

```
public static DVBAAlphaComposite getInstance(int rule, float alpha)
```

Creates an DVBAAlphaComposite object with the specified rule and the constant alpha (Ar) to multiply with the alpha of the source (As). The source is multiplied with the specified alpha before being composited with the destination.

Parameters:

rule - the compositing rule

alpha - the constant alpha (Ar) to be multiplied with the alpha of the source (As). alpha must be a floating point number in the inclusive range [0.0, 1.0].

Returns:

an DVBAAlphaComposite object with the specified rule and the constant alpha to multiply with the alpha of the source.

getRule()

```
public int getRule()
```

Returns the compositing rule of this DVBAAlphaComposite.

Returns:

the compositing rule of this DVBAAlphaComposite.

org.dvb.ui DVBBufferedImage

Syntax

```
public class DVBBufferedImage extends java.awt.Image
```

```
java.lang.Object
|
+--java.awt.Image
|
+--org.dvb.ui.DVBBufferedImage
```

Description

The `DVBBufferedImage` subclass describes an `java.awt.Image` with an accessible buffer of image data. The `DVBBufferedImage` is an adapter class for `java.awt.image.BufferedImage`. It supports two different platform dependent sample models `TYPE_BASE` and `TYPE_ADVANCED`. Buffered images with the `TYPE_BASE` have the same sample model as the on screen graphics buffer, thus `TYPE_BASE` could be CLUT based. `TYPE_ADVANCED` has a direct color model but it is not specified how many bits are used to store the different color components. By default, a new `DVBBufferedImage` is transparent. All alpha values are set to 0;

Since:

MHP 1.0

Fields

TYPE_ADVANCED

```
public static final int TYPE_ADVANCED
```

Represents an image stored in a best possible `SampleModel` (platform dependent) The image has a `DirectColorModel` with alpha. The color data in this image is considered not to be premultiplied with alpha. The data returned by `getRGB()` will be in the `TYPE_INT_ARGB` color model that is alpha component in bits 24-31, the red component in bits 16-23, the green component in bits 8-15, and the blue component in bits 0-7. The data for `setRGB()` shall be in the `TYPE_INT_ARGB` color model as well.

Since:

MHP 1.0

TYPE_BASE

```
public static final int TYPE_BASE
```

Represents an image stored in a platform dependent `Sample Model`. This color model is not visible to applications. The data returned by `getRGB()` will be in the `TYPE_INT_ARGB` color model that is alpha component in bits 24-31, the red component in bits 16-23, the green component in bits 8-15, and the blue component in bits 0-7. The data for `setRGB()` shall be in the `TYPE_INT_ARGB` color model as well.

Since:

MHP 1.0

Constructors

DVBBufferedImage(int, int)

```
public DVBBufferedImage(int width, int height)
```

Constructs a DVBBufferedImage with the specified width and height. The Sample Model used the image is the native Sample Model (TYPE_BASE) of the implementation. Note that a request can lead to an `java.lang.OutOfMemoryError`. Applications should be aware of this.

Parameters:

`width` - the width of the created image

`height` - the height of the created image

Since:

MHP 1.0

DVBBufferedImage(int, int, int)

```
public DVBBufferedImage(int width, int height, int type)
```

Constructs a new DVBBufferedImage with the specified width and height in the Sample Model specified by type. Note that a request can lead to an `java.lang.OutOfMemoryError`. Applications should be aware of this.

Parameters:

`width` - the width of the DVBBufferedImage

`height` - the height of the DVBBufferedImage

`type` - the ColorSpace of the DVBBufferedImage

Since:

MHP 1.0

Methods

createGraphics()

```
public DVBGraphics createGraphics()
```

Creates a DVBGraphics, which can be used to draw into this DVBBufferedImage.

Returns:

a DVBGraphics, used for drawing into this image.

Since:

MHP 1.0

dispose()

```
public void dispose()
```

Disposes of this buffered image. This method releases the resources (e.g. pixel memory) underlying this buffered image. After calling this method ;

- the image concerned may not be used again
- the image shall be considered to have a width and height of -1, -1 as specified for instances of `java.awt.Image` where the width and height are not yet known.

- the `getGraphics` method may return null

Since:

MHP 1.0.1

flush()

```
public void flush()
```

Flushes all resources being used to cache optimization information. The underlying pixel data is unaffected.

Overrides:

`java.awt.Image.flush()` in class `java.awt.Image`

getGraphics()

```
public java.awt.Graphics getGraphics()
```

This method returns a `java.awt.Graphics`, it is here for backwards compatibility. `createGraphics()` is more convenient, since it is declared to return a `DVBGraphics`.

Overrides:

`java.awt.Image.getGraphics()` in class `java.awt.Image`

Returns:

a `Graphics`, which can be used to draw into this image.

getHeight()

```
public int getHeight()
```

Returns the height of the `DVBBufferedImage`.

Returns:

the height of this `DVBBufferedImage`.

Since:

MHP 1.0

getHeight(ImageObserver)

```
public int getHeight(java.awt.image.ImageObserver observer)
```

Returns the actual height of the image. If the height is not known yet then the `ImageObserver` is notified later and `-1` is returned.

Overrides:

`java.awt.Image.getHeight(java.awt.image.ImageObserver)` in class `java.awt.Image`

Parameters:

`observer` - the `ImageObserver` that receives information about the image

Returns:

the height of the image or `-1` if the height is not yet known.

See Also:

`java.awt.Image.getWidth(ImageObserver)`, `java.awt.image.ImageObserver`

getImage()

```
public java.awt.Image getImage()
```

Returns a `java.awt.Image` representing this buffered image. In implementations using the JDK1.2 API this returns a `java.awt.image.BufferedImage` cast to a `java.awt.Image`. Otherwise it is implementation dependent whether it returns this image or whether it returns an instance of an underlying platform specific sub-class of `java.awt.Image`.

Returns:

a `java.awt.image` representing this buffered image

Since:

MHP 1.0

getProperty(String, ImageObserver)

```
public java.lang.Object getProperty(java.lang.String name,  
    java.awt.image.ImageObserver observer)
```

Returns a property of the image by name. Individual property names are defined by the various image formats. If a property is not defined for a particular image, this method returns the `UndefinedProperty` field. If the properties for this image are not yet known, then this method returns `null` and the `ImageObserver` object is notified later. The property name "comment" should be used to store an optional comment that can be presented to the user as a description of the image, its source, or its author.

Overrides:

`java.awt.Image.getProperty(java.lang.String, java.awt.image.ImageObserver)` in class `java.awt.Image`

Parameters:

`name` - the property name

`observer` - the `ImageObserver` that receives notification regarding image information

Returns:

an `java.lang.Object` that is the property referred to by the specified `name` or `null` if the properties of this image are not yet known.

See Also:

`java.awt.image.ImageObserver`, `java.awt.Image.UndefinedProperty`

getRGB(int, int)

```
public int getRGB(int x, int y)
```

Returns the specified integer pixel in the default RGB color model (`TYPE_INT_ARGB`) and default sRGB colorspace. Color conversion takes place if the used Sample Model is not 8-bit for each color component. There are only 8-bits of precision for each color component in the returned data when using this method. Note that when a lower precision is used in this buffered image `getRGB` may return different values than those used in `setRGB()`

Parameters:

`x` - the x-coordinate of the pixel

`y` - the y-coordinate of the pixel

Returns:

an integer pixel in the default RGB color model (`TYPE_INT_ARGB`) and default sRGB colorspace.

Throws:

`ArrayIndexOutOfBoundsException` - if `x` or `y` is out of bounds

Since:

MHP 1.0

getRGB(int, int, int, int, int[], int, int)

```
public int[] getRGB(int startX, int startY, int w, int h, int[] rgbArray, int offset,
                  int scansize)
```

Returns an array of integer pixels in the default RGB color model (TYPE_INT_ARGB) and default sRGB color space, from a rectangular region of the image data. There are only 8-bits of precision for each color component in the returned data when using this method. With a specified coordinate (x, y) in the image, the ARGB pixel can be accessed in this way:

```
pixel = rgbArray[offset + (y-startY)*scansize + (x-startX)];
```

Parameters:

`startX` - the x-coordinate of the upper-left corner of the specified rectangular region

`startY` - the y-coordinate of the upper-left corner of the specified rectangular region

`w` - the width of the specified rectangular region

`h` - the height of the specified rectangular region

`rgbArray` - if not null, the rgb pixels are written here

`offset` - offset into the `rgbArray`

`scansize` - scanline stride for the `rgbArray`

Returns:

array of ARGB pixels.

Throws:

`ArrayIndexOutOfBoundsException` - if the specified portion of the image data is out of bounds.

`IllegalArgumentException`

Since:

MHP 1.0

getSource()

```
public java.awt.image.ImageProducer getSource()
```

Returns the object that produces the pixels for the image.

Overrides:

`java.awt.Image.getSource()` in class `java.awt.Image`

Returns:

the `java.awt.image.ImageProducer` that is used to produce the pixels for this image.

See Also:

`java.awt.image.ImageProducer`

getSubimage(int, int, int, int)

```
public DVBufferedImage getSubimage(int x, int y, int w, int h)
```

Returns a subimage defined by a specified rectangular region. The returned `DVBufferedImage` shares the same data array as the original image.

Parameters:

`x` - the x-coordinate of the upper-left corner of the specified rectangular region

`y` - the y-coordinate of the upper-left corner of the specified rectangular region

`w` - the width of the specified rectangular region

h - the height of the specified rectangular region

Returns:

a `DVBBufferedImage` that is the subimage of this `DVBBufferedImage`.

Throws:

`DVBRasterFormatException` - if the specified area is not contained within this `DVBBufferedImage`.

Since:

MHP 1.0

getWidth()

```
public int getWidth()
```

Returns the width of the `DVBBufferedImage`.

Returns:

the width of this `DVBBufferedImage`.

Since:

MHP 1.0

getWidth(ImageObserver)

```
public int getWidth(java.awt.image.ImageObserver observer)
```

Returns the actual width of the image. If the width is not known yet then the `java.awt.image.ImageObserver` is notified later and `-1` is returned.

Overrides:

`java.awt.Image.getWidth(java.awt.image.ImageObserver)` in class `java.awt.Image`

Parameters:

`observer` - the `ImageObserver` that receives information about the image

Returns:

the width of the image or `-1` if the width is not yet known.

See Also:

`java.awt.Image.getHeight(ImageObserver)`, `java.awt.image.ImageObserver`

setRGB(int, int, int)

```
public synchronized void setRGB(int x, int y, int rgb)
```

Sets a pixel in this `DVBBufferedImage` to the specified ARGB value. The pixel is assumed to be in the default RGB color model, `TYPE_INT_ARGB`, and default sRGB color space.

Parameters:

x - the x-coordinate of the pixel to set

y - the y-coordinate of the pixel to set

rgb - the ARGB value

Since:

MHP 1.0

setRGB(int, int, int, int, int[], int, int)

```
public void setRGB(int startX, int startY, int w, int h, int[] rgbArray, int offset,
int scansize)
```


Sets an array of integer pixels in the default RGB color model (TYPE_INT_ARGB) and default sRGB color space, into a rectangular portion of the image data. There are only 8-bits of precision for each color component in the returned data when using this method. With a specified coordinate (x, y) in the this image, the ARGB pixel can be accessed in this way:

```
pixel = rgbArray[offset + (y-startY)*scansize + (x-startX)];
```

WARNING: No dithering takes place.

Parameters:

`startX` - the x-coordinate of the upper-left corner of the specified rectangular region

`startY` - the y-coordinate of the upper-left corner of the specified rectangular region

`w` - the width of the specified rectangular region

`h` - the height of the specified rectangular region

`rgbArray` - the ARGB pixels

`offset` - offset into the `rgbArray`

`scansize` - scanline stride for the `rgbArray`

Since:

MHP 1.0

toString()

```
public java.lang.String toString()
```

Returns a `String` representation of this `DVBBufferedImage` object and its values.

Overrides:

`java.lang.Object.toString()` in class `java.lang.Object`

Returns:

a `String` representing this `DVBBufferedImage`.

org.dvb.ui

DVBColor

Syntax

```
public class DVBColor extends javax.tv.graphics.AlphaColor
```

```
java.lang.Object
|
+--java.awt.Color
|
+--javax.tv.graphics.AlphaColor
|
+--org.dvb.ui.DVBColor
```

All Implemented Interfaces:

java.io.Serializable

Description

A Color class which adds the notion of alpha. It is compatible with the JDK1.2 java.awt.Color class. DVBColor extends org.davic.awt.Color which extends java.awt.Color. In implementations using the JDK1.1 this class adds support for alpha. In implementations using the JDK1.2 the additional methods would just call super. Because DVBColor extends Color the signatures in the existing classes do not change. Classes like Component should work with DVBColor internally. Instances of this class are a container for the values which are passed in to the constructor. Any approximations made by the platform are made when the colors are used.

Since:

MHP 1.0

Constructors

DVBColor(Color)

```
public DVBColor(java.awt.Color c)
```

Constructs a new DVBColor using the specified color. If c supports alpha, e.g. if it is an instance of javax.tv.graphics.AlphaColor or JDK 1.2's java.awt.Color, then the alpha value of c shall be used.

Parameters:

c - the java.awt.Color used to create a new DVBColor

DVBColor(float, float, float, float)

```
public DVBColor(float r, float g, float b, float a)
```

Creates an sRGB color with the specified red, green, blue, and alpha values in the range (0.0 - 1.0). The actual color used in rendering will depend on finding the best match given the color space available for a given output device.

Parameters:

r - the red component

g - the green component

b - the blue component

a - the alpha component

See Also:

```
java.awt.Color.getRed(), java.awt.Color.getGreen(),  
java.awt.Color.getBlue(), getAlpha\(\), getRGB\(\)
```

DVBColor(int, boolean)

```
public DVBColor(int rgba, boolean hasalpha)
```

Creates an sRGB color with the specified combined RGBA value consisting of the alpha component in bits 24-31, the red component in bits 16-23, the green component in bits 8-15, and the blue component in bits 0-7. If the hasalpha argument is False, alpha is defaulted to 255.

Parameters:

rgba - the combined RGBA components

hasalpha - true if the alpha bits are valid, false otherwise

See Also:

```
java.awt.Color.getRed(), java.awt.Color.getGreen(),  
java.awt.Color.getBlue(), getAlpha\(\), getRGB\(\)
```

DVBColor(int, int, int, int)

```
public DVBColor(int r, int g, int b, int a)
```

Creates an sRGB color with the specified red, green, blue, and alpha values in the range (0 - 255).

Parameters:

r - the red component

g - the green component

b - the blue component

a - the alpha component

See Also:

```
java.awt.Color.getRed(), java.awt.Color.getGreen(),  
java.awt.Color.getBlue(), getAlpha\(\), getRGB\(\)
```

Methods

brighter()

```
public java.awt.Color brighter()
```

Creates a brighter version of this color. This method applies an arbitrary scale factor to each of the three RGB components of the color to create a brighter version of the same color. Although brighter and darker are inverse operations, the results of a series of invocations of these two methods may be inconsistent because of rounding errors.

Overrides:

`javax.tv.graphics.AlphaColor.brighter()` in class `javax.tv.graphics.AlphaColor`

Returns:

a new DVBColor object (cast to a java.awt.Color object) representing a brighter version of this color. Applications can recast it to a org.dvb.ui.DVBColor object

See Also:

`java.awt.Color.brighter()`

darker()

```
public java.awt.Color darker()
```

Creates a darker version of this color. This method applies an arbitrary scale factor to each of the three RGB components of the color to create a darker version of the same color. Although `brighter` and `darker` are inverse operations, the results of a series of invocations of these two methods may be inconsistent because of rounding errors.

Overrides:

`javax.tv.graphics.AlphaColor.darker()` in class `javax.tv.graphics.AlphaColor`

Returns:

a new `DVBColor` object (cast to a `java.awt.Color` object), representing a darker version of this color. Applications can recast it to a `org.dvb.ui.DVBColor` object

See Also:

`java.awt.Color.darker()`

equals(Object)

```
public boolean equals(java.lang.Object obj)
```

Determines whether another object is equal to this color. The result is true if and only if the argument is not null and is a `DVBColor` object that has the same red, green, blue and alpha values as this object.

Overrides:

`javax.tv.graphics.AlphaColor.equals(java.lang.Object)` in class `javax.tv.graphics.AlphaColor`

Parameters:

`obj` -- the object to compare with.

Returns:

true if the objects are the same; false otherwise.

Since:

JDK1.0

getAlpha()

```
public int getAlpha()
```

Returns the alpha component. In the range 0-255.

Overrides:

`javax.tv.graphics.AlphaColor.getAlpha()` in class `javax.tv.graphics.AlphaColor`

Returns:

the alpha component

See Also:

`getRGB()`

getRGB()

```
public int getRGB()
```

Returns the RGB value representing the color in the default sRGB ColorModel. (Bits 24-31 are alpha, 16-23 are red, 8-15 are green, 0-7 are blue).

Overrides:

`javax.tv.graphics.AlphaColor.getRGB()` in class `javax.tv.graphics.AlphaColor`

Returns:

the RGB value representing the color in the default sRGB ColorModel.

Since:

JDK1.0

See Also:

`java.awt.Color.getRed()`, `java.awt.Color.getGreen()`,
`java.awt.Color.getBlue()`, [getAlpha\(\)](#)

toString()

```
public java.lang.String toString()
```

Creates a string that represents this color and indicates the values of its ARGB components.

Overrides:

`javax.tv.graphics.AlphaColor.toString()` in class `javax.tv.graphics.AlphaColor`

Returns:

a representation of this color as a String object.

Since:

JDK1.0

org.dvb.ui DVBGraphics

Syntax

```
public abstract class DVBGraphics extends java.awt.Graphics
```

```
java.lang.Object
|
+--java.awt.Graphics
|
+--org.dvb.ui.DVBGraphics
```

Description

The `DVBGraphics` class is a adapter class to support alpha compositing in an MHP device. Most methods directly delegate to `java.awt.Graphics` other methods could delegate to the appropriate methods in `java.awt.Graphics2D` where available or could be implemented in native code This class inherits from `java.awt.Graphics` in implementations using the JDK1.1. In implementations using the JDK1.2 `DVBGraphics` inherits from `java.awt.Graphics2D`. **In MHP devices all Graphics Objects are DVBGraphics objects.** Thus one can get a `DVBGraphics` by casting a given `Graphics` object. The normal compositing rule used is **DVBAlphaComposite.SRC**. This is the fastest rule because there is no computation. Note this is not the default behaviour of other graphics libraries. When drawing pictures with an alpha channel the transparent part will be transparent to the video in the background. Programmers should set the rule to `DVBAlphaComposite.SRC_OVER` when drawing images or other shapes which shall be transparent to the graphics in the background The intersection between `setDVBCompsite` in this class and the `setPaintMode` and `setXORMode` methods inherited from `java.awt.Graphics` shall be as follows.

- Calling `setPaintMode` on an instance of this class shall be equivalent to calling `setDVBComposite(DVBAlphaComposite.Src)`.
- Calling `setXORMode` on an instance of this class shall be equivalent to calling `setDVBComposite` with a special and implementation dependent `DVBAlphaComposite` object with implements the semantics specified for this method in the parent class.
- Calling `getDVBComposite` when `setXORMode` is the last `DVBComposite` set shall return this implementation dependent object. Conformant MHP applications shall not do anything with or to this object including calling any methods on it.
- This specification does not tighten, refine or detail the definition of the `setXORMode` beyond what is specified for the parent class.

Note: Implementations of XOR mode may change colours with alpha to without and vice versa (reversibly).

Since:

MHP1.0

See Also:

`java.awt.Graphics`

Constructors

DVBGraphics()

```
protected DVBGraphics()
```

Constructs a new `DVBGraphics` object. This constructor is the default constructor for a graphics context.

Since `DVBGraphics` is an abstract class, applications cannot call this constructor directly. `DVBGraphics` contexts are obtained from other `DVBGraphics` contexts or are created by casting `java.awt.Graphics` to `DVBGraphics`.

Since:

MHP 1.0

See Also:

`java.awt.Graphics.create()`, `java.awt.Component.getGraphics()`

Methods

`getAvailableCompositeRules()`

```
public abstract int[] getAvailableCompositeRules()
```

Returns all available Porter-Duff Rules for this specific Graphics context. E.g. a device could support the `SRC_OVER` rule when using a destination which does not have Alpha or where the alpha is null, while this rule is not available when drawing on a graphic context where the destination has alpha. Which rules are supported for the different graphics objects is defined in the Minimum Platform Capabilities of the MHP spec.

Returns:

all available Porter-Duff Rules for this specific Graphics context.

Since:

MHP 1.0

`getBestColorMatch(Color)`

```
public DVBColor getBestColorMatch(java.awt.Color c)
```

Returns the best match for the specified `Color` as a `DVBColor`, in a device-dependent manner, as constrained by the MHP graphics reference model.

Parameters:

`c` - the specified `Color`.

Returns:

the best `DVBColor` match for the specified `Color`.

Since:

MHP 1.0

`getColor()`

```
public abstract java.awt.Color getColor()
```

Gets this graphics context's current color. This will return a `DVBColor` cast to `java.awt.Color`.

Overrides:

`java.awt.Graphics.getColor()` in class `java.awt.Graphics`

Returns:

this graphics context's current color.

Since:

MHP 1.0

See Also:

[DVBColor](#), [java.awt.Color](#), [setColor\(Color\)](#)

getDVBComposite()

```
public abstract DVBAlphaComposite getDVBComposite()
```

Returns the current `DVBAlphaComposite` in the `DVBGraphics` context. This method could delegate to a `java.awt.Graphics2D` object where available

Returns:

the current `DVBGraphics` `DVBAlphaComposite`, which defines a compositing style.

Since:

MHP 1.0

See Also:

[setDVBComposite\(DVBAlphaComposite\)](#)

getType()

```
public int getType()
```

Returns the `Sample Model` (`DVBBufferedImage.TYPE_BASE`, `DVBBufferedImage.TYPE_ADVANCED`) which is used in the on/off screen buffer this graphics object draws into.

Returns:

the type of the `Sample Model`

Since:

MHP 1.0

See Also:

[DVBBufferedImage](#)

setColor(Color)

```
public abstract void setColor(java.awt.Color c)
```

Sets this graphics context's current color to the specified color. All subsequent graphics operations using this graphics context use this specified color. Note that color `c` can be a `DVBColor`

Overrides:

`java.awt.Graphics.setColor(java.awt.Color)` in class `java.awt.Graphics`

Parameters:

`c` - the new rendering color.

Since:

MHP 1.0

See Also:

[java.awt.Color](#), [DVBColor](#), [getColor\(\)](#)

setDVBComposite(DVBAlphaComposite)

```
public abstract void setDVBComposite(DVBAlphaComposite comp)
```

Sets the `DVBAlphaComposite` for the `DVBGraphics` context. The `DVBAlphaComposite` is used in all drawing methods such as `drawImage`, `drawString`, `draw`, and `fill`. It specifies how new

pixels are to be combined with the existing pixels on the graphics device during the rendering process.

This method could delegate to a `Graphics2D` object or to an native implementation

Parameters:

`comp` - the `DVBAlphaComposite` object to be used for rendering

Throws:

`UnsupportedDrawingOperationException` - when the requested Porter-Duff rule is not supported by this graphics context

Since:

MHP 1.0

See Also:

`java.awt.Graphics.setXORMode(Color)`, `java.awt.Graphics.setPaintMode()`, `DVBAlphaComposite`

toString()

```
public java.lang.String toString()
```

Returns a `String` object representing this `DVBGraphics` object's value.

Overrides:

`java.awt.Graphics.toString()` in class `java.awt.Graphics`

Returns:

a string representation of this graphics context.

Since:

MHP 1.0

org.dvb.ui DVBRasterFormatException

Syntax

```
public class DVBRasterFormatException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--org.dvb.ui.DVBRasterFormatException
```

All Implemented Interfaces:

java.io.Serializable

Description

This exception is thrown for some invalid operations on instances of `DVBBufferedImage`. The precise conditions are defined in the places where this exception is throw.

Since:

MHP 1.0.1

See Also:

[DVBBufferedImage](#)

Constructors

DVBRasterFormatException(String)

```
public DVBRasterFormatException(java.lang.String s)
```

Constructs an instance of `DVBRasterFormatException` with the specified detail message.

Parameters:

`s` - the detail message

Since:

MHP1.0

org.dvb.ui DVBTextLayoutManager

Syntax

```
public class DVBTextLayoutManager implements HTextLayoutManager
```

```
java.lang.Object  
|  
+--org.dvb.ui.DVBTextLayoutManager
```

All Implemented Interfaces:

```
HTextLayoutManager
```

Description

The DVBTextLayoutManager provides a text rendering layout mechanism for the org.havi.ui.HStaticText org.havi.ui.HText and org.havi.ui.HTextButton classes.

The semantics of the rendering behaviour and the settings are specified in the "Text presentation" annex of this specification. The DVBTextLayoutManager renders the text according to the semantics described in that annex.

Fields

HORIZONTAL_CENTER

```
public static final int HORIZONTAL_CENTER
```

The text should be centered horizontally.

HORIZONTAL_END_ALIGN

```
public static final int HORIZONTAL_END_ALIGN
```

The text should be horizontally to the horizontal end side (e.g. when start corner is upper left and line orientation horizontal, meaning text that is read left to right from top to bottom, this implies alignment to right).

HORIZONTAL_START_ALIGN

```
public static final int HORIZONTAL_START_ALIGN
```

The text should be aligned horizontally to the horizontal start side (e.g. when start corner is upper left and line orientation horizontal, meaning text that is read left to right from top to bottom, this implies alignment to left).

LINE_ORIENTATION_HORIZONTAL

```
public static final int LINE_ORIENTATION_HORIZONTAL
```

Horizontal line orientation.

LINE_ORIENTATION_VERTICAL

```
public static final int LINE_ORIENTATION_VERTICAL
```

Vertical line orientation.

START_CORNER_LOWER_LEFT

```
public static final int START_CORNER_LOWER_LEFT
```

Lower left text start corner.

START_CORNER_LOWER_RIGHT

```
public static final int START_CORNER_LOWER_RIGHT
```

Lower right text start corner.

START_CORNER_UPPER_LEFT

```
public static final int START_CORNER_UPPER_LEFT
```

Upper left text start corner.

START_CORNER_UPPER_RIGHT

```
public static final int START_CORNER_UPPER_RIGHT
```

Upper right text start corner.

VERTICAL_CENTER

```
public static final int VERTICAL_CENTER
```

The text should be centered vertically.

VERTICAL_END_ALIGN

```
public static final int VERTICAL_END_ALIGN
```

The text should be aligned vertically to the vertical end side (e.g. when start corner is upper left and line orientation horizontal, meaning text that is read left to right from top to bottom, this implies alignment to bottom).

This is defined by the section "Vertical limits" in the "Text presentation" annex of this specification.

VERTICAL_START_ALIGN

```
public static final int VERTICAL_START_ALIGN
```

The text should be aligned vertically to the vertical start side (e.g. when start corner is upper left and line orientation horizontal, meaning text that is read left to right from top to bottom, this implies alignment to top).

This is defined by the section "Vertical limits" in the "Text presentation" annex of this specification.

Constructors

DVBTextLayoutManager()

```
public DVBTextLayoutManager()
```

Constructs a DVBTextLayoutManager object with default parameters (HORIZONTAL_START_ALIGN, VERTICAL_START_ALIGN, LINE_ORIENTATION_HORIZONTAL, START_CORNER_UPPER_LEFT, wrap = true, linespace = (point size of the default font for HVisible) + 7, letterspace = 0, horizontalTabSpace = 56)

DVBTextLayoutManager(int, int, int, int, boolean, int, int, int)

```
public DVBTextLayoutManager(int horizontalAlign, int verticalAlign, int lineOrientation,
    int startCorner, boolean wrap, int linespace, int letterspace,
    int horizontalTabSpace)
```

Constructs a DVBTextLayoutManager object.

Parameters:

horizontalAlign - Horizontal alignment setting

verticalAlign - Vertical alignment setting

lineOrientation - Line orientation setting

startCorner - Starting corner setting

wrap - Text wrapping setting

linespace - Line spacing setting expressed in points

letterspace - Letterspacing adjustment relative to the default letterspacing. Expressed in units of 1/256th point as the required increase in the spacing between consecutive characters. May be either positive or negative.

horizontalTabSpace - Horizontal tabulation setting in points

Methods

addTextOverflowListener(TextOverflowListener)

```
public void addTextOverflowListener(TextOverflowListener l)
```

Register a TextOverflowListener that will be notified if the text string does not fit in the component when rendering.

Parameters:

l - a listener object

getHorizontalAlign()

```
public int getHorizontalAlign()
```

Get the horizontal alignment.

Returns:

Horizontal alignment setting

getHorizontalTabSpacing()

```
public int getHorizontalTabSpacing()
```

Get the horizontal tabulation spacing.

Returns:

the horizontal tabulation spacing

getInsets()

```
public java.awt.Insets getInsets()
```

Returns the insets that this text layout manager uses. When rendering text, it leaves empty margins of the size defined by the insets. The actual area used for the text is the area of the component decreased by the amount of insets at each edge. The default insets, if not set explicitly using `setInsets`, are 0 at each edge, i.e. no margins.

Returns:

Insets used by this text layout manager.

getLetterSpace()

```
public int getLetterSpace()
```

Get the letter space setting.

Returns:

letter space setting

getLineOrientation()

```
public int getLineOrientation()
```

Get the line orientation.

Returns:

Line orientation setting

getLineSpace()

```
public int getLineSpace()
```

Get the line space setting.

Returns:

line space setting or -1, if the default line spacing is determined from the size of the default font is used.

getStartCorner()

```
public int getStartCorner()
```

Get the starting corner.

Returns:

Starting corner setting

getTextWrapping()

```
public boolean getTextWrapping()
```

Get the text wrapping setting.

Returns:

text wrapping setting

getVerticalAlign()

```
public int getVerticalAlign()
```

Get the vertical alignment.

Returns:

Vertical alignment setting

removeTextOverflowListener(TextOverflowListener)

```
public void removeTextOverflowListener(TextOverflowListener l)
```

Removes a TextOverflowListener that has been registered previously.

Parameters:

l - a listener object

render(String, Graphics, HVisible, Insets)

```
public void render(java.lang.String markedUpString, java.awt.Graphics g, HVisible v,  
                  java.awt.Insets insets)
```

Render the string. The `HTextLayoutManager` should use the passed `HVisible` object to determine any additional information required to render the string, e.g. `Font`, `Color` etc.

The text should be laid out in the layout area, which is defined by the bounds of the specified `HVisible`, after subtracting the insets. If the insets are `null` the full bounding rectangle is used as the area to render text into.

The `HTextLayoutManager` should not modify the clipping rectangle of the `Graphics` object.

Specified By:

`render(String, Graphics, HVisible, Insets)` in interface `HTextLayoutManager`

Parameters:

`markedUpString` - the string to render.

`g` - the graphics context, including a clipping rectangle which encapsulates the area within which rendering is permitted. If a valid insets value is passed to this method then text must only be rendered into the bounds of the widget after the insets are subtracted. If the insets value is `null` then text is rendered into the entire bounding area of the `HVisible`. It is implementation specific whether or not the renderer takes into account the intersection of the clipping rectangle in each case for optimization purposes.

`v` - the `HVisible` into which to render.

`insets` - the insets to determine the area in which to layout the text, or `null`.

setHorizontalAlign(int)

```
public void setHorizontalAlign(int horizontalAlign)
```

Set the horizontal alignment.

Parameters:

`horizontalAlign` - Horizontal alignment setting

setHorizontalTabSpacing(int)

```
public void setHorizontalTabSpacing(int horizontalTabSpace)
```

Set the horizontal tabulation spacing.

Parameters:

`horizontalTabSpace` - tab spacing in points

setInsets(Insets)

```
public void setInsets(java.awt.Insets insets)
```

Sets the insets that should be used by this text layout manager. The text is rendered to the area defined by the area of the component decreased by the amount of insets at each edge. If this method is not called, the default insets are 0 at each edge.

Parameters:

`insets` - Insets that should be used

setLetterSpace(int)

```
public void setLetterSpace(int letterSpace)
```

Set the letter space setting.

Parameters:

`letterSpace` - letter space setting

setLineOrientation(int)

```
public void setLineOrientation(int lineOrientation)
```

Set the line orientation.

Parameters:

`lineOrientation` - Line orientation setting

setLineSpace(int)

```
public void setLineSpace(int lineSpace)
```

Set the line space setting. Using -1 as the line space setting shall cause the line spacing to be determined from the size of the default font.

Parameters:

`lineSpace` - line space setting

setStartCorner(int)

```
public void setStartCorner(int startCorner)
```

Set the starting corner.

Parameters:

`startCorner` - Starting corner setting

setTextWrapping(boolean)

```
public void setTextWrapping(boolean wrap)
```


Set the text wrapping setting

Parameters:

`wrap` - Text wrapping setting

setVerticalAlign(int)

```
public void setVerticalAlign(int verticalAlign)
```

Set the vertical alignment.

Parameters:

`verticalAlign` - Vertical alignment setting

org.dvb.ui FontFactory

Syntax

```
public class FontFactory
    java.lang.Object
    |
    +--org.dvb.ui.FontFactory
```

Description

Provides a mechanism for applications to instantiate fonts that are not built into the system.

Constructors

FontFactory()

```
public FontFactory()
```

Constructs a `FontFactory` for the font index file bound to this application in the application signaling. The call to the constructor is synchronous and shall block until the font index file has been retrieved or an an exception is thrown.

Throws:

`FontFormatException` - if there is an error in the font index file bound with the application.

`java.io.IOException` - if there is no font index file bound with the application, or if there is an error attempting to access the data in that file.

FontFactory(URL)

```
public FontFactory(java.net.URL u)
```

Constructs a `FontFactory` for the specification of fonts found at the given location. The call to the constructor is synchronous and shall block until the font file has been retrieved or an exception is thrown.

Parameters:

`u` - The source of the font description

Throws:

`java.io.IOException` - if there is an error attempting to access the data referenced by the URL

`IllegalArgumentException` - if the URL is not both valid and supported

`SecurityException` - if access to the specified URL is denied by security policy

`FontFormatException` - if the file at that URL is not a valid font file as specified in the main body of this specification

Methods

createFont(String, int, int)

```
public java.awt.Font createFont(java.lang.String name, int style, int size)
```

Creates a font object from the font source associated with this `FontFactory`. This font will remain valid even if the `FontFactory` is no longer reachable from application code. The name returned by `Font.getName()` might not be the same as the name supplied, for example, it might have a string prepended to it that identifies the source `FontFactory` in a platform-dependant manner. For `FontFactory` instances bound to the font index file of an application, the call to the method is synchronous and shall block until either an exception is thrown or any required network access has completed.

The value of the style argument must be as defined in `java.awt.Font`. Valid values are the following:

- `java.awt.Font.PLAIN`
- `java.awt.Font.BOLD`
- `java.awt.Font.ITALIC`
- `java.awt.Font.BOLD + java.awt.Font.ITALIC`

Parameters:

`name` - the font name

`style` - the constant style used, such as `java.awt.Font.PLAIN`.

`size` - the point size of the font

Throws:

`FontNotAvailableException` - if a font with given parameters cannot be located or created.

`java.io.IOException` - if there is an error retrieving a font from the network. Thrown only for font factory instances bound to the font index file of an application.

`IllegalArgumentException` - if the style parameter is not in the set of valid values, or if the size parameter is zero or negative.

`FontFormatException` - if the font file is not a valid font file as specified in the main body of this specification. Thrown only for font factory instances bound to the font index file of an application.

org.dvb.ui FontFormatException

Syntax

```
public class FontFormatException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--org.dvb.ui.FontFormatException
```

All Implemented Interfaces:

java.io.Serializable

Description

Thrown when attempt is made to read a file describing a font when the contents of that file are not valid.

Constructors

FontFormatException()

```
public FontFormatException()
```

Constructs a `FontNotAvailableException` with `null` as its error detail message.

FontFormatException(String)

```
public FontFormatException(java.lang.String s)
```

Constructs a `FontFormatException` with the specified detail message. The error message string `s` can later be retrieved by the `java.lang.Throwable.getMessage()` method of class `java.lang.Throwable`.

Parameters:

`s` - the detail message.

org.dvb.ui FontNotAvailableException

Syntax

```
public class FontNotAvailableException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
   |
   +--java.lang.Exception
      |
      +--org.dvb.ui.FontNotAvailableException
```

All Implemented Interfaces:

java.io.Serializable

Description

Thrown when attempt is made to instantiate a font that cannot be located.

Constructors

FontNotAvailableException()

```
public FontNotAvailableException()
```

Constructs a `FontNotAvailableException` with `null` as its error detail message.

FontNotAvailableException(String)

```
public FontNotAvailableException(java.lang.String s)
```

Constructs a `FontNotAvailableException` with the specified detail message. The error message string `s` can later be retrieved by the `java.lang.Throwable.getMessage()` method of class `java.lang.Throwable`.

Parameters:

`s` - the detail message.

org.dvb.ui TestOpacity

Syntax

```
public interface TestOpacity
```

All Known Implementing Classes:

```
HContainer, HComponent
```

Description

Interface implemented by Components or Containers in order to allow the platform to query whether their paint method is fully opaque.

Methods

isOpaque()

```
public boolean isOpaque()
```

Returns true if the entire area of the component as given by the `getBounds` method, is fully opaque. Hence its paint method (or surrogate methods) guarantees that all pixels are painted in an opaque Color.

Classes implementing this interface shall return true from their implementation of this method if and only if their implementation can guarantee full opacity. The consequences of an invalid overridden value are implementation specific.

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method are fully opaque, otherwise false.

org.dvb.ui

TextOverflowListener

Syntax

```
public interface TextOverflowListener
```

Description

The `TextOverflowListener` is an interface that an application may implement and register in the `DVBTextLayoutManager`. This listener will be notified if the text string does not fit within the component when rendering it.

Methods

`notifyTextOverflow(String, HVisible, boolean, boolean)`

```
public void notifyTextOverflow(java.lang.String markedUpString, HVisible v,  
    boolean overflowedHorizontally, boolean overflowedVertically)
```

This method is called by the `DVBTextLayoutManager` if the text does not fit within the component

Parameters:

`markedUpString` - the string that was rendered

`v` - the `HVisible` object that was being rendered

`overflowedHorizontally` - true if the text overflow the bounds of the component in the horizontal direction; otherwise false

`overflowedVertically` - true if the text overflow the bounds of the component in the vertical direction; otherwise false

org.dvb.ui

UnsupportedDrawingOperationException

Syntax

```
public class UnsupportedDrawingOperationException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--org.dvb.ui.UnsupportedDrawingOperationException
```

All Implemented Interfaces:

java.io.Serializable

Description

The `UnsupportedDrawingOperationException` class represents an exception that is thrown if an drawing operation is not supported on this platform. E.g. `DVBGraphics.setComposite` could throw an Exception when setting the `SRC_OVER` rule on some devices while the `SRC` rule will always work.

Since:

MHP 1.0

Constructors

UnsupportedDrawingOperationException(String)

```
public UnsupportedDrawingOperationException(java.lang.String s)
```

Constructs an instance of `UnsupportedDrawingOperationException` with the specified detail message.

Parameters:

`s` - the detail message

Since:

MHP1.0

Annex V (normative): HAVi Level 2 User Interface

V.1 Register of Constants

```

public final static int org.havi.ui.HAdjustableLook.ADJUST_NONE = 0;
public final static int org.havi.ui.HAdjustableLook.ADJUST_BUTTON_LESS = 1;
public final static int org.havi.ui.HAdjustableLook.ADJUST_BUTTON_MORE = 2;
public final static int org.havi.ui.HAdjustableLook.ADJUST_PAGE_LESS = 2;
public final static int org.havi.ui.HAdjustableLook.ADJUST_PAGE_MORE = 3;
public final static int org.havi.ui.HAdjustableLook.ADJUST_THUMB = 4;

public final static int org.havi.ui.HAnimateEffect.PLAY_REPEATING = 1;
public final static int org.havi.ui.HAnimateEffect.PLAY_ALTERNATING = 2;
public final static int org.havi.ui.HAnimateEffect.REPEAT_INFINITE = -1;

public final static int org.havi.ui.HbackgroundConfigTemplate.CHANGEABLE_SINGLE_COLOR = 0x0A;
public final static int org.havi.ui.HbackgroundConfigTemplate.STILL_IMAGE = 0x0B;

public final static int org.havi.ui.HFontCapabilities.BASIC_LATIN = 1;
public final static int org.havi.ui.HFontCapabilities.LATIN_1_SUPPLEMENT = 2;
public final static int org.havi.ui.HFontCapabilities.LATIN_EXTENDED_A = 3;
public final static int org.havi.ui.HFontCapabilities.LATIN_EXTENDED_B = 4;
public final static int org.havi.ui.HFontCapabilities.IPA_EXTENSIONS = 5;
public final static int org.havi.ui.HFontCapabilities.SPACING_MODIFIER_LETTERS = 6;
public final static int org.havi.ui.HFontCapabilities.COMBINING_DIACRITICAL_MARKS = 7;
public final static int org.havi.ui.HFontCapabilities.BASIC_GREEK = 8;
public final static int org.havi.ui.HFontCapabilities.GREEK_SYMBOLS_AND_COPTIC = 9;
public final static int org.havi.ui.HFontCapabilities.CYRILLIC = 10;
public final static int org.havi.ui.HFontCapabilities.ARMEIANIAN = 11;
public final static int org.havi.ui.HFontCapabilities.BASIC_HEBREW = 12;
public final static int org.havi.ui.HFontCapabilities.HEBREW_EXTENDED = 13;
public final static int org.havi.ui.HFontCapabilities.BASIC_ARABIC = 14;
public final static int org.havi.ui.HFontCapabilities.ARABIC_EXTENDED = 15;
public final static int org.havi.ui.HFontCapabilities.DEVANAGARI = 16;
public final static int org.havi.ui.HFontCapabilities.BENGALI = 17;
public final static int org.havi.ui.HFontCapabilities.GURMUKHI = 18;
public final static int org.havi.ui.HFontCapabilities.GUJARATI = 19;
public final static int org.havi.ui.HFontCapabilities.ORIYA = 20;
public final static int org.havi.ui.HFontCapabilities.TAMIL = 21;
public final static int org.havi.ui.HFontCapabilities.TELUGU = 22;
public final static int org.havi.ui.HFontCapabilities.KANNADA = 23;
public final static int org.havi.ui.HFontCapabilities.MALAYALAM = 24;
public final static int org.havi.ui.HFontCapabilities.THAI = 25;
public final static int org.havi.ui.HFontCapabilities.LAO = 26;
public final static int org.havi.ui.HFontCapabilities.BASIC_GEORGIAN = 27;
public final static int org.havi.ui.HFontCapabilities.GEORGIAN_EXTENDED = 28;
public final static int org.havi.ui.HFontCapabilities.HANGUL_JAMO = 29;
public final static int org.havi.ui.HFontCapabilities.LATIN_EXTENDED_ADDITIONAL = 30;
public final static int org.havi.ui.HFontCapabilities.GREEK_EXTENDED = 31;
public final static int org.havi.ui.HFontCapabilities.GENERAL_PUNCTUATION = 32;
public final static int org.havi.ui.HFontCapabilities.SUPERSCRIPTS_AND_SUBSCRIPTS = 33;
public final static int org.havi.ui.HFontCapabilities.CURRENCY_SYMBOLS = 34;
public final static int org.havi.ui.HFontCapabilities.COMBINING_DIACRITICAL_MARKS_FOR_SYMBOLS = 35;
public final static int org.havi.ui.HFontCapabilities.LETTERLIKE_SYMBOLS = 36;
public final static int org.havi.ui.HFontCapabilities.NUMBER_FORMS = 37;
public final static int org.havi.ui.HFontCapabilities.ARROWS = 38;
public final static int org.havi.ui.HFontCapabilities.MATHEMATICAL_OPERATORS = 39;
public final static int org.havi.ui.HFontCapabilities.MISCELLANEOUS_TECHNICAL = 40;
public final static int org.havi.ui.HFontCapabilities.CONTROL_PICTURES = 41;
public final static int org.havi.ui.HFontCapabilities.OPTICAL_CHARACTER_RECOGNITION = 42;
public final static int org.havi.ui.HFontCapabilities.ENCLOSED_ALPHANUMERICS = 43;
public final static int org.havi.ui.HFontCapabilities.BOX_DRAWING = 44;
public final static int org.havi.ui.HFontCapabilities.BLOCK_ELEMENTS = 45;
public final static int org.havi.ui.HFontCapabilities.GEOMETRICAL_SHAPES = 46;
public final static int org.havi.ui.HFontCapabilities.MISCELLANEOUS_SYMBOLS = 47;
public final static int org.havi.ui.HFontCapabilities.DINGBATS = 48;
public final static int org.havi.ui.HFontCapabilities.CJK_SYMBOLS_AND_PUNCTUATION = 49;
public final static int org.havi.ui.HFontCapabilities.HIRAGANA = 50;
public final static int org.havi.ui.HFontCapabilities.KATAKANA = 51;

```

```

public final static int org.havi.ui.HFontCapabilities.BOPOMOFO = 52;
public final static int org.havi.ui.HFontCapabilities.HANGUL_COMPATIBILITY_JAMO = 53;
public final static int org.havi.ui.HFontCapabilities.CJK_MISCELLANEOUS = 54;
public final static int org.havi.ui.HFontCapabilities.ENCLOSED_CJK_LETTERS_AND_MONTHS = 55;
public final static int org.havi.ui.HFontCapabilities.CJK_COMPATIBILITY = 56;
public final static int org.havi.ui.HFontCapabilities.HANGUL = 57;
public final static int org.havi.ui.HFontCapabilities.HANGUL_SUPPLEMENTARY_A = 58;
public final static int org.havi.ui.HFontCapabilities.HANGUL_SUPPLEMENTARY_B = 59;
public final static int org.havi.ui.HFontCapabilities.CJK_UNIFIED_IDEOGRAPHS = 60;
public final static int org.havi.ui.HFontCapabilities.PRIVATE_USE_AREA = 61;
public final static int org.havi.ui.HFontCapabilities.CJK_COMPATIBILITY_IDEOGRAPHS = 62;
public final static int org.havi.ui.HFontCapabilities.ALPHABETIC_PRESENTATION_FORMS_A = 63;
public final static int org.havi.ui.HFontCapabilities.ARABIC_PRESENTATION_FORMS_A = 64;
public final static int org.havi.ui.HFontCapabilities.COMBINING_HALF_MARKS = 65;
public final static int org.havi.ui.HFontCapabilities.CJK_COMPATIBILITY_FORMS = 66;
public final static int org.havi.ui.HFontCapabilities.SMALL_FORM_VARIANTS = 67;
public final static int org.havi.ui.HFontCapabilities.ARABIC_PRESENTATION_FORMS_B = 68;
public final static int org.havi.ui.HFontCapabilities.HALFWIDTH_AND_FULLWIDTH_FORMS = 69;
public final static int org.havi.ui.HFontCapabilities.SPECIALS = 70;

public final static int org.havi.ui.HGraphicsConfigTemplate.VIDEO_MIXING = 0x0C;
public final static int org.havi.ui.HGraphicsConfigTemplate.MATTE_SUPPORT = 0x0D;
public final static int org.havi.ui.HGraphicsConfigTemplate.IMAGE_SCALING_SUPPORT = 0x0E;

public final static int org.havi.ui.HImageHints.NATURAL_IMAGE = 0x01;
public final static int org.havi.ui.HImageHints.CARTOON = 0x02;
public final static int org.havi.ui.HImageHints.BUSINESS_GRAPHICS = 0x03;
public final static int org.havi.ui.HImageHints.LINE_ART = 0x04;

public final static int org.havi.ui.HKeyboardInputPreferred.INPUT_ALPHANUMERIC = 0;
public final static int org.havi.ui.HKeyboardInputPreferred.INPUT_NUMERIC = 1;
public final static int org.havi.ui.HKeyboardInputPreferred.INPUT_ALPHA = 2;
public final static int org.havi.ui.HKeyboardInputPreferred.INPUT_CUSTOMIZED = 3;
public final static int org.havi.ui.HKeyboardInputPreferred.INPUT_ANY = 4;

public final static int org.havi.ui.HListGroup.ITEM_NOT_FOUND = -1;
public final static int org.havi.ui.HListGroup.ADD_INDEX_END = -1;
public final static int org.havi.ui.HListGroup.DEFAULT_LABEL_WIDTH = -1;
public final static int org.havi.ui.HListGroup.DEFAULT_LABEL_HEIGHT = -2;
public final static int org.havi.ui.HListGroup.DEFAULT_ICON_WIDTH = -3;
public final static int org.havi.ui.HListGroup.DEFAULT_ICON_HEIGHT = -4;

public final static int org.havi.ui.HOrientable.ORIENT_LEFT_TO_RIGHT = 0;
public final static int org.havi.ui.HOrientable.ORIENT_RIGHT_TO_LEFT = 1;
public final static int org.havi.ui.HOrientable.ORIENT_TOP_TO_BOTTOM = 2;
public final static int org.havi.ui.HOrientable.ORIENT_BOTTOM_TO_TOP = 3;

public final static int org.havi.ui.HScene.IMAGE_NONE = 0;
public final static int org.havi.ui.HScene.IMAGE_STRETCH = 1;
public final static int org.havi.ui.HScene.IMAGE_CENTER = 2;
public final static int org.havi.ui.HScene.IMAGE_TILE = 3;
public final static int org.havi.ui.HScene.NO_BACKGROUND_FILL = 0;
public final static int org.havi.ui.HScene.BACKGROUND_FILL = 1;

public final static int org.havi.ui.HSceneTemplate.REQUIRED = 0x01;
public final static int org.havi.ui.HSceneTemplate.PREFERRED = 0x02;
public final static int org.havi.ui.HSceneTemplate.UNNECESSARY = 0x03;
public final static int org.havi.ui.HSceneTemplate.GRAPHICS_CONFIGURATION = 0x00;
public final static int org.havi.ui.HSceneTemplate.SCENE_PIXEL_DIMENSION = 0x01;
public final static int org.havi.ui.HSceneTemplate.SCENE_PIXEL_LOCATION = 0x02;
public final static int org.havi.ui.HSceneTemplate.SCENE_SCREEN_DIMENSION = 0x04;
public final static int org.havi.ui.HSceneTemplate.SCENE_SCREEN_LOCATION = 0x08;

public final static int org.havi.ui.HScreenConfigTemplate.REQUIRED = 0x01;
public final static int org.havi.ui.HScreenConfigTemplate.PREFERRED = 0x02;
public final static int org.havi.ui.HScreenConfigTemplate.DONT_CARE = 0x03;
public final static int org.havi.ui.HScreenConfigTemplate.PREFERRED_NOT = 0x04;
public final static int org.havi.ui.HScreenConfigTemplate.REQUIRED_NOT = 0x05;
public final static int org.havi.ui.HScreenConfigTemplate.ZERO_BACKGROUND_IMPACT = 0x01;
public final static int org.havi.ui.HScreenConfigTemplate.ZERO_GRAPHICS_IMPACT = 0x02;
public final static int org.havi.ui.HScreenConfigTemplate.ZERO_VIDEO_IMPACT = 0x03;

```

```

public final static int org.havi.ui.HScreenConfigTemplate.INTERLACED_DISPLAY = 0x04;
public final static int org.havi.ui.HScreenConfigTemplate.FLICKER_FILTERING = 0x05;
public final static int org.havi.ui.HScreenConfigTemplate.VIDEO_GRAPHICS_PIXEL_ALIGNED = 0x06;
public final static int org.havi.ui.HScreenConfigTemplate.PIXEL_ASPECT_RATIO = 0x07;
public final static int org.havi.ui.HScreenConfigTemplate.PIXEL_RESOLUTION = 0x08;
public final static int org.havi.ui.HScreenConfigTemplate.SCREEN_RECTANGLE = 0x09;

public final static int org.havi.ui.HState.FOCUSED_STATE_BIT = 0x01;
public final static int org.havi.ui.HState.ACTIONED_STATE_BIT = 0x02;
public final static int org.havi.ui.HState.DISABLED_STATE_BIT = 0x04;
public final static int org.havi.ui.HState.FIRST_STATE = 0x80;
public final static int org.havi.ui.HState.NORMAL_STATE = 0x80;
public final static int org.havi.ui.HState.FOCUSED_STATE = 0x81;
public final static int org.havi.ui.HState.ACTIONED_STATE = 0x82;
public final static int org.havi.ui.HState.ACTIONED_FOCUSED_STATE = 0x83;
public final static int org.havi.ui.HState.DISABLED_STATE = 0x84;
public final static int org.havi.ui.HState.DISABLED_FOCUSED_STATE = 0x85;
public final static int org.havi.ui.HState.DISABLED_ACTIONED_STATE = 0x86;
public final static int org.havi.ui.HState.DISABLED_ACTIONED_FOCUSED_STATE = 0x87;
public final static int org.havi.ui.HState.ALL_STATES = 0x07;
public final static int org.havi.ui.HState.LAST_STATE = 0x07;

public final static int org.havi.ui.HStaticRange.SLIDER_BEHAVIOR = 0;
public final static int org.havi.ui.HStaticRange.SCROLLBAR_BEHAVIOR = 1;

public final static int org.havi.ui.HVideoConfigTemplate.GRAPHICS_MIXING = 0x0F;

public final static int org.havi.ui.HVisible.HALIGN_LEFT = 0;
public final static int org.havi.ui.HVisible.HALIGN_CENTER = 1;
public final static int org.havi.ui.HVisible.HALIGN_RIGHT = 2;
public final static int org.havi.ui.HVisible.HALIGN_JUSTIFY = 3;
public final static int org.havi.ui.HVisible.VALIGN_TOP = 0;
public final static int org.havi.ui.HVisible.VALIGN_CENTER = 4;
public final static int org.havi.ui.HVisible.VALIGN_BOTTOM = 8;
public final static int org.havi.ui.HVisible.VALIGN_JUSTIFY = 12;
public final static int org.havi.ui.HVisible.RESIZE_NONE = 0;
public final static int org.havi.ui.HVisible.RESIZE_PRESERVE_ASPECT = 1;
public final static int org.havi.ui.HVisible.RESIZE_ARBITRARY = 2;
public final static int org.havi.ui.HVisible.NO_BACKGROUND_FILL = 0;
public final static int org.havi.ui.HVisible.BACKGROUND_FILL = 1;
public final static int org.havi.ui.HVisible.FIRST_CHANGE = 0;
public final static int org.havi.ui.HVisible.TEXT_CONTENT_CHANGE = 0;
public final static int org.havi.ui.HVisible.GRAPHIC_CONTENT_CHANGE = 1;
public final static int org.havi.ui.HVisible.ANIMATE_CONTENT_CHANGE = 2;
public final static int org.havi.ui.HVisible.CONTENT_CHANGE = 3;
public final static int org.havi.ui.HVisible.STATE_CHANGE = 4;
public final static int org.havi.ui.HVisible.CARET_POSITION_CHANGE = 5;
public final static int org.havi.ui.HVisible.ECHO_CHAR_CHANGE = 6;
public final static int org.havi.ui.HVisible.EDIT_MODE_CHANGE = 7;
public final static int org.havi.ui.HVisible.MIN_MAX_CHANGE = 8;
public final static int org.havi.ui.HVisible.THUMB_OFFSETS_CHANGE = 9;
public final static int org.havi.ui.HVisible.ADJUSTMENT_VALUE_CHANGE = 13;
public final static int org.havi.ui.HVisible.ORIENTATION_CHANGE = 10;
public final static int org.havi.ui.HVisible.TEXT_VALUE_CHANGE = 11;
public final static int org.havi.ui.HVisible.ITEM_VALUE_CHANGE = 12;
public final static int org.havi.ui.HVisible.LIST_CONTENT_CHANGE = 14;
public final static int org.havi.ui.HVisible.LIST_ICONSIZE_CHANGE = 15;
public final static int org.havi.ui.HVisible.LIST_LABELSIZE_CHANGE = 16;
public final static int org.havi.ui.HVisible.LIST_MULTISELECTION_CHANGE = 17;
public final static int org.havi.ui.HVisible.LIST_SCROLLPOSITION_CHANGE = 18;
public final static int org.havi.ui.HVisible.UNKNOWN_CHANGE = 19;
public final static int org.havi.ui.HVisible.LAST_CHANGE = 19;
public final static int org.havi.ui.HVisible.NO_DEFAULT_WIDTH = -1;
public final static int org.havi.ui.HVisible.NO_DEFAULT_HEIGHT = -1;

public final static int org.havi.ui.event.HAdjustmentEvent.ADJUST_FIRST = 2000;
public final static int org.havi.ui.event.HAdjustmentEvent.ADJUST_LAST = 2005;
public final static int org.havi.ui.event.HAdjustmentEvent.ADJUST_START_CHANGE = 2000;
public final static int org.havi.ui.event.HAdjustmentEvent.ADJUST_LESS = 2001;
public final static int org.havi.ui.event.HAdjustmentEvent.ADJUST_MORE = 2002;
public final static int org.havi.ui.event.HAdjustmentEvent.ADJUST_PAGE_LESS = 2003;

```

```

public final static int org.havi.ui.event.HAdjustmentEvent.ADJUST_PAGE_MORE = 2004;
public final static int org.havi.ui.event.HAdjustmentEvent.ADJUST_END_CHANGE = 2005;

public final static int org.havi.ui.event.HBackgroundImageEvent.BACKGROUNDIMAGE_FIRST = 1;
public final static int org.havi.ui.event.HBackgroundImageEvent.BACKGROUNDIMAGE_LOADED = 1;
public final static int org.havi.ui.event.HBackgroundImageEvent.BACKGROUNDIMAGE_FILE_NOT_FOUND = 2;
public final static int org.havi.ui.event.HBackgroundImageEvent.BACKGROUNDIMAGE_IOERROR = 3;
public final static int org.havi.ui.event.HBackgroundImageEvent.BACKGROUNDIMAGE_INVALID = 4;
public final static int org.havi.ui.event.HBackgroundImageEvent.BACKGROUNDIMAGE_LAST = 4;

public final static int org.havi.ui.event.HEventRepresentation.ER_TYPE_NOT_SUPPORTED = 0;
public final static int org.havi.ui.event.HEventRepresentation.ER_TYPE_STRING = 1;
public final static int org.havi.ui.event.HEventRepresentation.ER_TYPE_COLOR = 2;
public final static int org.havi.ui.event.HEventRepresentation.ER_TYPE_SYMBOL = 4;

public final static int org.havi.ui.event.HFocusEvent.HFOCUS_FIRST = 2025;
public final static int org.havi.ui.event.HFocusEvent.FOCUS_TRANSFER = 2025;
public final static int org.havi.ui.event.HFocusEvent.HFOCUS_LAST = 2025;
public final static int org.havi.ui.event.HFocusEvent.NO_TRANSFER_ID = -1;

public final static int org.havi.ui.event.HItemEvent.ITEM_FIRST = 2006;
public final static int org.havi.ui.event.HItemEvent.ITEM_START_CHANGE = 2006;
public final static int org.havi.ui.event.HItemEvent.ITEM_TOGGLE_SELECTED = 2007;
public final static int org.havi.ui.event.HItemEvent.ITEM_SELECTED = 2008;
public final static int org.havi.ui.event.HItemEvent.ITEM_CLEARED = 2009;
public final static int org.havi.ui.event.HItemEvent.ITEM_SELECTION_CLEARED = 2010;
public final static int org.havi.ui.event.HItemEvent.ITEM_SET_CURRENT = 2011;
public final static int org.havi.ui.event.HItemEvent.ITEM_SET_PREVIOUS = 2012;
public final static int org.havi.ui.event.HItemEvent.ITEM_SET_NEXT = 2013;
public final static int org.havi.ui.event.HItemEvent.ITEM_END_CHANGE = 2014;
public final static int org.havi.ui.event.HItemEvent.ITEM_LAST = 2014;

public final static int org.havi.ui.event.HRcEvent.RC_FIRST = 400;
public final static int org.havi.ui.event.HRcEvent.VK_COLORED_KEY_0 = 403;
public final static int org.havi.ui.event.HRcEvent.VK_COLORED_KEY_1 = 404;
public final static int org.havi.ui.event.HRcEvent.VK_COLORED_KEY_2 = 405;
public final static int org.havi.ui.event.HRcEvent.VK_COLORED_KEY_3 = 406;
public final static int org.havi.ui.event.HRcEvent.VK_COLORED_KEY_4 = 407;
public final static int org.havi.ui.event.HRcEvent.VK_COLORED_KEY_5 = 408;
public final static int org.havi.ui.event.HRcEvent.VK_POWER = 409;
public final static int org.havi.ui.event.HRcEvent.VK_DIMMER = 410;
public final static int org.havi.ui.event.HRcEvent.VK_WINK = 411;
public final static int org.havi.ui.event.HRcEvent.VK_REWIND = 412;
public final static int org.havi.ui.event.HRcEvent.VK_STOP = 413;
public final static int org.havi.ui.event.HRcEvent.VK_EJECT_TOGGLE = 414;
public final static int org.havi.ui.event.HRcEvent.VK_PLAY = 415;
public final static int org.havi.ui.event.HRcEvent.VK_RECORD = 416;
public final static int org.havi.ui.event.HRcEvent.VK_FAST_FWD = 417;
public final static int org.havi.ui.event.HRcEvent.VK_PLAY_SPEED_UP = 418;
public final static int org.havi.ui.event.HRcEvent.VK_PLAY_SPEED_DOWN = 419;
public final static int org.havi.ui.event.HRcEvent.VK_PLAY_SPEED_RESET = 420;
public final static int org.havi.ui.event.HRcEvent.VK_RECORD_SPEED_NEXT = 421;
public final static int org.havi.ui.event.HRcEvent.VK_GO_TO_START = 422;
public final static int org.havi.ui.event.HRcEvent.VK_GO_TO_END = 423;
public final static int org.havi.ui.event.HRcEvent.VK_TRACK_PREV = 424;
public final static int org.havi.ui.event.HRcEvent.VK_TRACK_NEXT = 425;
public final static int org.havi.ui.event.HRcEvent.VK_RANDOM_TOGGLE = 426;
public final static int org.havi.ui.event.HRcEvent.VK_CHANNEL_UP = 427;
public final static int org.havi.ui.event.HRcEvent.VK_CHANNEL_DOWN = 428;
public final static int org.havi.ui.event.HRcEvent.VK_STORE_FAVORITE_0 = 429;
public final static int org.havi.ui.event.HRcEvent.VK_STORE_FAVORITE_1 = 430;
public final static int org.havi.ui.event.HRcEvent.VK_STORE_FAVORITE_2 = 431;
public final static int org.havi.ui.event.HRcEvent.VK_STORE_FAVORITE_3 = 432;
public final static int org.havi.ui.event.HRcEvent.VK_RECALL_FAVORITE_0 = 433;
public final static int org.havi.ui.event.HRcEvent.VK_RECALL_FAVORITE_1 = 434;
public final static int org.havi.ui.event.HRcEvent.VK_RECALL_FAVORITE_2 = 435;
public final static int org.havi.ui.event.HRcEvent.VK_RECALL_FAVORITE_3 = 436;
public final static int org.havi.ui.event.HRcEvent.VK_CLEAR_FAVORITE_0 = 437;
public final static int org.havi.ui.event.HRcEvent.VK_CLEAR_FAVORITE_1 = 438;
public final static int org.havi.ui.event.HRcEvent.VK_CLEAR_FAVORITE_2 = 439;
public final static int org.havi.ui.event.HRcEvent.VK_CLEAR_FAVORITE_3 = 440;

```

```
public final static int org.havi.ui.event.HRcEvent.VK_SCAN_CHANNELS_TOGGLE = 441;
public final static int org.havi.ui.event.HRcEvent.VK_PINP_TOGGLE = 442;
public final static int org.havi.ui.event.HRcEvent.VK_SPLIT_SCREEN_TOGGLE = 443;
public final static int org.havi.ui.event.HRcEvent.VK_DISPLAY_SWAP = 444;
public final static int org.havi.ui.event.HRcEvent.VK_SCREEN_MODE_NEXT = 445;
public final static int org.havi.ui.event.HRcEvent.VK_VIDEO_MODE_NEXT = 446;
public final static int org.havi.ui.event.HRcEvent.VK_VOLUME_UP = 447;
public final static int org.havi.ui.event.HRcEvent.VK_VOLUME_DOWN = 448;
public final static int org.havi.ui.event.HRcEvent.VK_MUTE = 449;
public final static int org.havi.ui.event.HRcEvent.VK_SURROUND_MODE_NEXT = 450;
public final static int org.havi.ui.event.HRcEvent.VK_BALANCE_RIGHT = 451;
public final static int org.havi.ui.event.HRcEvent.VK_BALANCE_LEFT = 452;
public final static int org.havi.ui.event.HRcEvent.VK_FADER_FRONT = 453;
public final static int org.havi.ui.event.HRcEvent.VK_FADER_REAR = 454;
public final static int org.havi.ui.event.HRcEvent.VK_BASS_BOOST_UP = 455;
public final static int org.havi.ui.event.HRcEvent.VK_BASS_BOOST_DOWN = 456;
public final static int org.havi.ui.event.HRcEvent.VK_INFO = 457;
public final static int org.havi.ui.event.HRcEvent.VK_GUIDE = 458;
public final static int org.havi.ui.event.HRcEvent.VK_TELETEXT = 459;
public final static int org.havi.ui.event.HRcEvent.VK_SUBTITLE = 460;
public final static int org.havi.ui.event.HRcEvent.RC_LAST = 460;
public final static int org.havi.ui.event.HTextEvent.TEXT_FIRST = 2015;
public final static int org.havi.ui.event.HTextEvent.TEXT_LAST = 2024;
public final static int org.havi.ui.event.HTextEvent.TEXT_START_CHANGE = 2015;
public final static int org.havi.ui.event.HTextEvent.TEXT_CHANGE = 2016;
public final static int org.havi.ui.event.HTextEvent.TEXT_CARET_CHANGE = 2017;
public final static int org.havi.ui.event.HTextEvent.TEXT_END_CHANGE = 2018;
public final static int org.havi.ui.event.HTextEvent.CARET_NEXT_CHAR = 2019;
public final static int org.havi.ui.event.HTextEvent.CARET_NEXT_LINE = 2020;
public final static int org.havi.ui.event.HTextEvent.CARET_PREV_CHAR = 2021;
public final static int org.havi.ui.event.HTextEvent.CARET_PREV_LINE = 2022;
public final static int org.havi.ui.event.HTextEvent.CARET_NEXT_PAGE = 2023;
public final static int org.havi.ui.event.HTextEvent.CARET_PREV_PAGE = 2024;
```

Package org.havi.ui

Class Summary	
Interfaces	
<code>HActionable</code>	This interface is implemented by all HAVi UI components that can be actioned by the user.
<code>HActionInputPreferred</code>	A component which implements <code>HActionInputPreferred</code> indicates that this component expects to receive <code>HActionEvent</code> input events.
<code>HAdjustableLook</code>	The <code>HAdjustableLook</code> interface is implemented by all platform looks which support adjustable components (i.e.
<code>HAdjustmentInputPreferred</code>	A component which implements <code>HAdjustmentInputPreferred</code> indicates that this component expects to receive <code>HAdjustmentEvent</code> input events.
<code>HAdjustmentValue</code>	This interface is implemented by all HAVi UI components which have some form of adjustable numerical value (e.g.
<code>HAnimateEffect</code>	The <code>HAnimateEffect</code> interface defines effect constants and controls for time-varying animations.
<code>HComponentOrdering</code>	This interface is implemented for all HAVi component containers that support the manipulation of the z-ordering of their children.
<code>HItemValue</code>	This interface is implemented by all HAVi UI components which have some form of selectable content (e.g.
<code>HKeyboardInputPreferred</code>	A component which implements <code>HKeyboardInputPreferred</code> indicates that this component expects to receive both <code>HKeyEvent</code> and <code>HTextEvent</code> input events.
<code>HLook</code>	The <code>HLook</code> interface defines the "look" of a component and may be regarded as a mechanism to allow a "pluggable" paint method to be attached to the component.
<code>HMatte</code>	<code>HMatte</code> is the base interface for all matte classes.
<code>HMatteLayer</code>	This <code>HMatteLayer</code> interface enables the presentation of components, together with an associated <code>HMatte</code> , for matte compositing.
<code>HNavigable</code>	This interface is implemented by all HAVi UI components that can be navigated to by the user (i.e.
<code>HNavigationInputPreferred</code>	A component which implements <code>HNavigationInputPreferred</code> indicates that this component expects to receive <code>HFocusEvent</code> events.
<code>HNoInputPreferred</code>	A component which implements <code>HNoInputPreferred</code> indicates that the user cannot navigate to this component.
<code>HOrientable</code>	The <code>HOrientable</code> interface provides support for components which have an orientation.
<code>HSelectionInputPreferred</code>	A component which implements <code>HSelectionInputPreferred</code> indicates that this component expects to receive <code>HItemEvent</code> input events.
<code>HState</code>	The <code>HState</code> interface encapsulates constants for component states which are used in the various <code>HVisible</code> <code>setContent</code> and <code>getContent</code> methods, to indicate which state the specified content is to be set.
<code>HSwitchable</code>	This interface is implemented for all user interface components that can be actioned such that they "toggle" on and off and maintain the chosen state.

Class Summary	
<code>HTextLayoutManager</code>	The <code>HTextLayoutManager</code> class manages the layout and rendering on-screen of a "marked-up" string.
<code>HTextValue</code>	This interface is implemented by all HAVi UI components which have have editable text content (e.g.
<code>HVersion</code>	The <code>HVersion</code> interface defines some versioning constants that are accessible by using the <code>java.lang.System</code> method <code>getProperty</code> , with the appropriate property name.
Classes	
<code>HAnimateLook</code>	The <code>HAnimateLook</code> class is used by any <code>HVisible</code> component to display animated graphical content.
<code>HAnimation</code>	The <code>HAnimation</code> class is a user interface component used to display animated graphical content (as <code>HStaticAnimation</code>) which additionally enables a user to navigate to it, i.e.
<code>HBackgroundConfigTemplate</code>	The <code>HBackgroundConfigTemplate</code> class is used to obtain a valid <code>HBackgroundConfiguration</code> .
<code>HBackgroundConfiguration</code>	The <code>HBackgroundConfiguration</code> class describes the characteristics (settings) of an <code>HBackgroundDevice</code> .
<code>HBackgroundDevice</code>	This class represents the ultimate background of a screen.
<code>HBackgroundImage</code>	This class represents a background image.
<code>HChangeData</code>	A class used as argument for <code>widgetChanged(HVisible, HChangeData[])</code> .
<code>HComponent</code>	The <code>HComponent</code> class extends the <code>java.awt.Component</code> class by implementing the <code>HMatteLayer</code> interface.
<code>HContainer</code>	The <code>HContainer</code> class extends the <code>java.awt.Container</code> class by implementing the <code>HMatteLayer</code> interface and providing additional Z-ordering capabilities, which are required since components in the HAVi user-interface are explicitly allowed to overlap each other.
<code>HDefaultTextLayoutManager</code>	The <code>HDefaultTextLayoutManager</code> provides the default text rendering mechanism for the <code>HStaticText</code> <code>HText</code> and <code>HTextButton</code> classes.
<code>HEmulatedGraphicsConfiguration</code>	An <code>HEmulatedGraphicsConfiguration</code> is a configuration for a "virtual" graphics device that may perform one or more emulations, e.g.
<code>HEmulatedGraphicsDevice</code>	An <code>HEmulatedGraphicsDevice</code> is a "virtual" graphics device that has the capability to be configured to perform one (of many) possible emulations.
<code>HEventMulticaster</code>	The <code>HEventMulticaster</code> class is intended to handle event dispatching for the following HAVi events: <code>HBackgroundImageEvent</code> <code>HScreenConfigurationEvent</code> <code>HScreenLocationModifiedEvent</code> <code>HActionEvent</code> <code>HFocusEvent</code> <code>HItemEvent</code> <code>HTextEvent</code> <code>HKeyEvent</code> <code>HAdjustmentEvent</code> <code>java.awt.event.WindowEvent</code> <code>org.davic.resources.ResourceStatusEvent</code>
<code>HFlatEffectMatte</code>	The <code>HFlatEffectMatte</code> class represents a matte that is constant over space but varies over time.

Class Summary	
<code>HFlatMatte</code>	The <code>HFlatMatte</code> class represents a matte that is constant over space and time.
<code>HFontCapabilities</code>	The <code>HFontCapabilities</code> class allows applications to query the rendering support for various character ranges and individual characters within specified fonts.
<code>HGraphicButton</code>	The <code>HGraphicButton</code> is a user interface component representing a push-button with static read-only graphical content.
<code>HGraphicLook</code>	The <code>HGraphicLook</code> class is used by any <code>HVisible</code> component to display static graphical content.
<code>HGraphicsConfigTemplate</code>	The <code>HGraphicsConfigTemplate</code> class is used to obtain a valid <code>HGraphicsConfiguration</code> .
<code>HGraphicsConfiguration</code>	The <code>HGraphicsConfiguration</code> class describes the characteristics (settings) of an <code>HGraphicsDevice</code> .
<code>HGraphicsDevice</code>	The <code>HGraphicsDevice</code> class describes the raster graphics devices that are available for a particular <code>HScreen</code> .
<code>HIcon</code>	The <code>HIcon</code> is a user interface component used to display static graphical content (as <code>HStaticIcon</code>) which also enables a user to navigate to it, i.e.
<code>HImageEffectMatte</code>	The <code>HImageEffectMatte</code> class represents a matte that varies over both space and time, it is specified as a sequence of image masks.
<code>HImageHints</code>	The <code>HImageHints</code> object allows an application to pass hints to the system how best to tailor an image to match a (possibly) restricted <code>HGraphicsConfiguration</code> .
<code>HImageMatte</code>	The <code>HImageMatte</code> class represents a matte that varies over space but is constant over time, it can be specified by an "image mask" (a single channel image) where the pixels indicate matte transparency.
<code>HListElement</code>	<code>HListElement</code> is a holder for content used with the <code>HListGroup</code> component.
<code>HListGroup</code>	The <code>HListGroup</code> is a user interface component representing a list of selectable items (<code>HListElement</code>) which contain static read-only graphical and / or textual content.
<code>HListGroupLook</code>	The <code>HListGroupLook</code> class is used by the <code>HListGroup</code> component to display both the <code>HListGroup</code> itself (potentially including a scrollbar component) and graphical or textual list content held on the <code>HListGroup</code> .
<code>HMultilineEntry</code>	The <code>HMultilineEntry</code> is a user interface component used to receive multiple lines of alphanumeric entry from the user.
<code>HMultilineEntryLook</code>	The <code>HMultilineEntryLook</code> class is used by the <code>HMultilineEntry</code> component to display the entering of text.
<code>HRange</code>	The <code>HRange</code> is a user interface component used to display a value within a fixed range (as <code>org.havi.ui.HStaticRange HStaticRange</code>) which also enables a user to navigate to it, i.e.
<code>HRangeLook</code>	The <code>HRangeLook</code> class is used to display a slider or scrollbar type range control on screen.
<code>HRangeValue</code>	The <code>HRangeValue</code> is a user interface component used to display a value within a fixed range (as <code>org.havi.ui.HStaticRange HStaticRange</code>) which enables a user to navigate to and alter the value of it, i.e.
<code>HScene</code>	An <code>HScene</code> is a container representing the displayable area on-screen within which the application can display itself and thus interact with the user.
<code>HSceneFactory</code>	The <code>HSceneFactory</code> class provides a generic mechanism for an application to request <code>HScene</code> resources from a (conceptual) window management system.

Class Summary	
HSceneTemplate	The <code>HSceneTemplate</code> class is used to obtain an <code>HScene</code> subject to a variety of constraints.
HScreen	This class describes the final output composition of a device.
HScreenConfigTemplate	This class describes a configuration of a screen device in terms of various properties and their importance to the application.
HScreenConfiguration	The <code>HScreenConfiguration</code> class describes the characteristics (settings) of an <code>HScreenDevice</code> .
HScreenDevice	An instance of the <code>HScreen</code> class represents a single independent video output signal from a device.
HScreenDimension	<code>HScreenDimension</code> denotes a screen dimension expressed as a relative value of the screen dimensions.
HScreenPoint	<code>HScreenPoint</code> denotes a screen location expressed as a relative value of the screen dimensions.
HScreenRectangle	<code>HScreenRectangle</code> denotes a screen area expressed as a relative value of the screen dimensions.
HSinglelineEntry	The <code>HSinglelineEntry</code> is a user interface component used to receive a single line of alphanumeric entry from the user and can also be used for password input.
HSinglelineEntryLook	The <code>HSinglelineEntryLook</code> class is used by the <code>HSinglelineEntry</code> component to display the entering of text.
HSound	The <code>HSound</code> class is used to represent an audio clip.
HStaticAnimation	The <code>HStaticAnimation</code> is a user interface component used to display animated graphical content but which does <i>not</i> permit the user to navigate (focus) upon it.
HStaticIcon	The <code>HStaticIcon</code> is a user interface component used to display static graphical content which does <i>not</i> permit the user to navigate (focus) upon it.
HStaticRange	The <code>HStaticRange</code> is a user interface component used to display a static value which is within a fixed range, but does <i>not</i> permit the user to navigate (focus) upon it.
HStaticText	The <code>HStaticText</code> is a user interface component used to display static read-only textual content which does <i>not</i> permit the user to navigate (focus) upon it.
HStillImageBackground-Configuration	This class represents a background configuration which supports the installation of still images.
HText	The <code>HText</code> is a user interface component used to display static read-only textual content (as <code>HStaticText</code>) which additionally enables a user to navigate to it, i.e.
HTextButton	The <code>HTextButton</code> is a user interface component representing a push-button with static read-only textual content.
HTextLook	The <code>HTextLook</code> class is used by any <code>HVisible</code> component to display static text content.
HToggleButton	The <code>HToggleButton</code> is a user interface component representing a "check box", or with the support of the <code>HToggleGroup</code> class, "radio buttons".
HToggleGroup	<code>HToggleButton</code> within the same <code>HToggleGroup</code> will behave so that a maximum of one <code>HToggleButton</code> has switchable state true, as returned by <code>getSwitchableState()</code> , so as to achieve a "radio button" effect.
HVideoComponent	<code>HVideoComponent</code> is an opaque class encapsulating the presentation of a video source <i>within</i> an application, i.e.

Class Summary	
<code>HVideoConfigTemplate</code>	The <code>HVideoConfigTemplate</code> class is used to obtain a valid <code>HVideoConfiguration</code> .
<code>HVideoConfiguration</code>	The <code>HVideoConfiguration</code> class describes the characteristics (settings) of an <code>HVideoDevice</code> .
<code>HVideoDevice</code>	The <code>HVideoDevice</code> class describes the logical video devices which can contribute to the appearance of a particular screen.
<code>HVisible</code>	The <code>HVisible</code> class is the base class for all non-interactive components.
Exceptions	
<code>HConfigurationException</code>	Thrown when an application requests an <code>HScreenConfiguration</code> that cannot be satisfied -- either because the <code>HScreenConfiguration</code> does not have the functionality, or because the requested <code>HScreenConfiguration</code> is otherwise invalid, e.g.
<code>HInvalidLookException</code>	An <code>HInvalidLookException</code> is an exception that is thrown when a particular <code>HLook</code> is not compatible with the <code>HVisible</code> component it has been associated with.
<code>HMatteException</code>	An <code>HMatteException</code> is an exception that is thrown when a Component is unable to support the desired <code>HMatte</code> effect.
<code>HPermissionDeniedException</code>	Thrown when an application attempts to control a device or feature it does not have the right to do at the time of making the call.
<code>HUIException</code>	<code>HUIException</code> is a generic exception that indicates that the desired user-interface mechanism cannot be performed for some reason.

org.havi.ui

HActionable

Syntax

```
public interface HActionable extends HNavigable, HActionInputPreferred
```

All Known Subinterfaces:

```
HSwitchable
```

All Superinterfaces:

```
HActionInputPreferred, HNavigable, HNavigationInputPreferred
```

All Known Implementing Classes:

```
HTextButton, HGraphicButton
```

Description

This interface is implemented by all HAVi UI components that can be actioned by the user.

Event Behaviour

Subclasses of `HComponent` which implement `HActionable` must respond to `HFocusEvent` and `HActionEvent` events.

Applications should assume that classes which implement `HActionable` can generate events of the types `HFocusEvent` and `HActionEvent` in response to other types of input event.

An application may add one or more `HActionListener` listeners to the component. The `actionPerformed` method of the `HActionListener` is invoked whenever the `HActionable` is actioned.

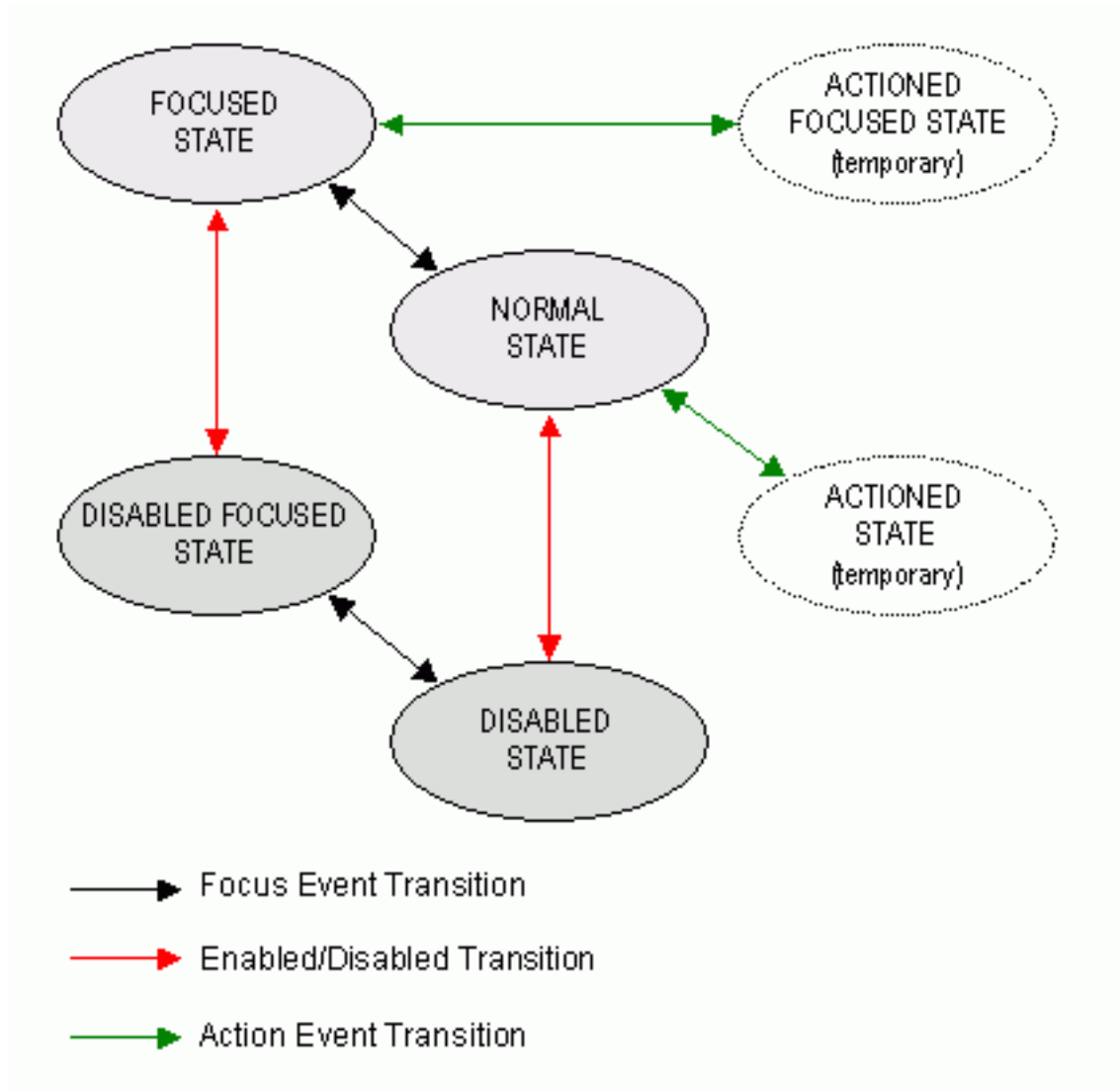
HAVi action events are discussed in detail in the `HActionInputPreferred` interface description.

Interaction States

The following interaction states are valid for this `HActionable` component:

- `NORMAL_STATE`
- `FOCUSED_STATE`
- `ACTIONED_STATE`
- `ACTIONED_FOCUSED_STATE`
- `DISABLED_STATE`
- `DISABLED_FOCUSED_STATE`

The state machine diagram below shows the valid state transitions for an `HActionable` component.



Unlike `HSwitchable` components the transition back from an actioned state (i.e. one with the `ACTIONED_STATE_BIT` bit set) is automatically fired once all registered `HActionListener` listeners have been called.

A direct consequence of this is that `HActionable` components can only achieve the `ACTIONED_STATE` and `ACTIONED_FOCUSED_STATE` states on a temporary basis.

`HActionable` components may not be disabled while actioned.

Platform Classes

The following HAVi platform classes implement or inherit the `HActionable` interface. These classes shall all generate both `HFocusEvent` and `HActionEvent` events in addition to any other events specified in the respective class descriptions.

- `HGraphicButton`
- `HTextButton`
- `HToggleButton`
- `HListGroup`

See Also:

`HNavigable`, `HActionInputPreferred`, `HActionEvent`, `HActionListener`

Methods

addActionListener(HActionListener)

```
public void addActionListener(HActionListener l)
```

Adds the specified `HActionListener` to receive `HActionEvent` events sent from this `HActionable`. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Parameters:

l - the `HActionListener`.

getActionCommand()

```
public java.lang.String getActionCommand()
```

Gets the command name for the `HActionEvent` event fired by this `HActionable`.

Returns:

A `String` representing the command name of the `HActionEvent` fired by this `HActionable`.

See Also:

`getActionCommand()`

getActionSound()

```
public HSound getActionSound()
```

Associate a sound to be played when the interaction state of the `HActionable` makes the following transitions:

- `NORMAL_STATE` to `ACTIONED_STATE`
- `FOCUSED_STATE` to `ACTIONED_FOCUSED_STATE`

Returns:

The sound played when the component is actioned.

removeActionListener(HActionListener)

```
public void removeActionListener(HActionListener l)
```

Removes the specified `HActionListener` so that it no longer receives `HActionEvent` events from this `HActionable`. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Parameters:

l - the `HActionListener`.

setActionCommand(String)

```
public void setActionCommand(java.lang.String command)
```

Sets the command name for the `HActionEvent` event fired by this `HActionable`.

Parameters:

`command` - a `String` used to set the action command.

See Also:

`getActionCommand()`

setActionSound(HSound)

```
public void setActionSound(HSound sound)
```

Associate a sound to be played when the interaction state of the `HActionable` makes the following transitions:

- `NORMAL_STATE` to `ACTIONED_STATE`
- `FOCUSED_STATE` to `ACTIONED_FOCUSED_STATE`

Parameters:

`sound` - the sound to be played, when the component is actioned. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

org.havi.ui

HActionInputPreferred

Syntax

```
public interface HActionInputPreferred
```

All Known Subinterfaces:

```
HActionable, HSwitchable
```

Description

A component which implements `HActionInputPreferred` indicates that this component expects to receive `HActionEvent` input events.

All interoperable implementations of the `HActionInputPreferred` interface must extend `HComponent`.

Note that the `java.awt.Component` method `isFocusTraversable` should always return true for a `java.awt.Component` implementing this interface.

Methods

`processHActionEvent(HActionEvent)`

```
public void processHActionEvent(HActionEvent evt)
```

Process an `HActionEvent` sent to this `HActionInputPreferred`.

Parameters:

`evt` - the `HActionEvent` to process.

org.havi.ui

HAdjustableLook

Syntax

```
public interface HAdjustableLook extends HLook
```

All Superinterfaces:

java.lang.Cloneable, HLook

All Known Implementing Classes:

HRangeLook, HListGroupLook

Description

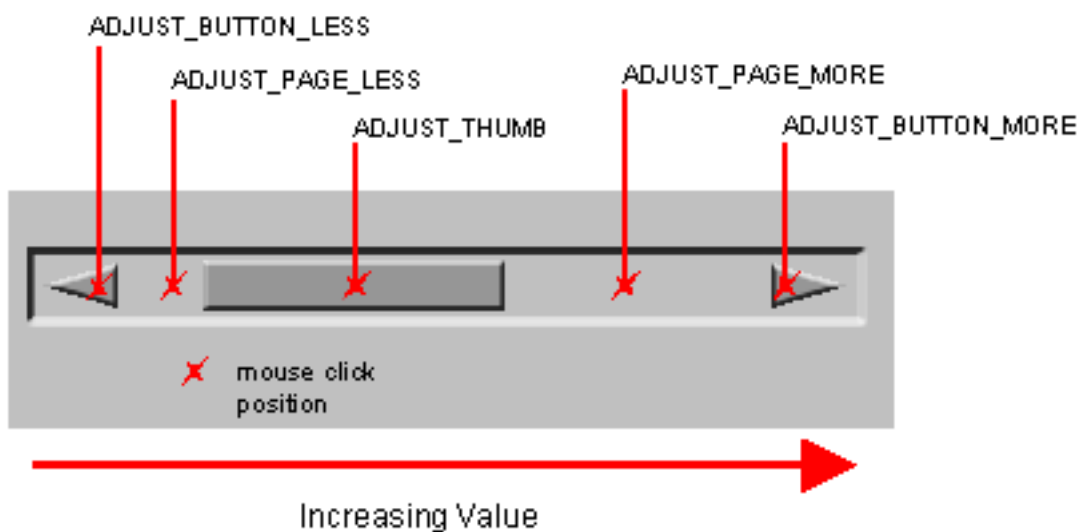
The `HAdjustableLook` interface is implemented by all platform looks which support adjustable components (i.e. those components which implement the `HAdjustmentValue` interface. The following platform looks shall implement this interface:

- `HRangeLook`
- `HListGroupLook`

The `HAdjustableLook` interface supports pointer based systems by providing a mechanism of "hit-testing" which allows the `HAdjustmentValue` component to determine which part of the on-screen representation has been clicked in, and to adjust its internal value accordingly.

The diagram below shows one possible on-screen representation of an `HAdjustmentValue` component, with `ORIENT_LEFT_TO_RIGHT` orientation.

Example hitTest() return values (for ORIENT_LEFT_TO_RIGHT orientation)



HLook implementations which implement `HAdjustableLook` may use the `getOrientation()` method to determine the appropriate constant to return from `hitTest(HAdjustmentValue, Point)` since the correct constant is dependent on the orientation of the component.

It is a valid implementation option to return `ADJUST_NONE` from the `hitTest(HAdjustmentValue, Point)` method in all cases.

It is a valid implementation option to never return `ADJUST_BUTTON_LESS` and `ADJUST_BUTTON_MORE` in the case where such active areas are not presented on screen by the `HLook`.

Fields

ADJUST_BUTTON_LESS

```
public static final int ADJUST_BUTTON_LESS
```

A constant which may be returned from the `hitTest(HAdjustmentValue, Point)` method to indicate that the pointer was clicked in an adjustment area which indicates that the adjustable value should be decremented by one unit.

Such an area should be drawn with an arrow pointing towards the minimum end of the range, according to the orientation as retrieved with `getOrientation()`.

Use of this constant is implementation-specific.

ADJUST_BUTTON_MORE

```
public static final int ADJUST_BUTTON_MORE
```

A constant which may be returned from the `hitTest(HAdjustmentValue, Point)` method to indicate that the pointer was clicked in an adjustment area which indicates that the adjustable value should be incremented by one unit.

Such an area should be drawn with an arrow pointing towards the maximum end of the range, according to the orientation as retrieved with `getOrientation()`.

Use of this constant is implementation-specific.

ADJUST_NONE

```
public static final int ADJUST_NONE
```

A constant which may be returned from the `hitTest(HAdjustmentValue, Point)` method to indicate that the pointer was not clicked over an active adjustment area.

ADJUST_PAGE_LESS

```
public static final int ADJUST_PAGE_LESS
```

A constant which may be returned from the `hitTest(HAdjustmentValue, Point)` method to indicate that the pointer was clicked in an adjustment area which indicates that the adjustable value should be decremented by one block.

ADJUST_PAGE_MORE

```
public static final int ADJUST_PAGE_MORE
```

A constant which may be returned from the `hitTest(HAdjustmentValue, Point)` method to indicate that the pointer was clicked in an adjustment area which indicates that the adjustable value should be incremented by one block.

ADJUST_THUMB

```
public static final int ADJUST_THUMB
```

A constant which may be returned from the `hitTest(HAdjustmentValue, Point)` method to indicate that the pointer was clicked in an adjustment area which indicates that the adjustable value should change according to pointer motion events received by the component, until the pointer button is released.

Methods

hitTest(HAdjustmentValue, Point)

```
public int hitTest(HAdjustmentValue component, java.awt.Point pt)
```

Returns a value which indicates the pointer click position in the on-screen representation of the adjustable component. Note that it is a valid implementation option to always return `ADJUST_NONE`.

Parameters:

`component` - the `HAdjustmentValue` component for which the hit position should be calculated.

`pt` - the pointer click point.

Returns:

one of `ADJUST_NONE`, `ADJUST_BUTTON_LESS`, `ADJUST_PAGE_LESS`, `ADJUST_THUMB`, `ADJUST_PAGE_MORE` or `ADJUST_BUTTON_MORE`.

org.havi.ui HAdjustmentInputPreferred

Syntax

```
public interface HAdjustmentInputPreferred extends HOrientable
```

All Known Subinterfaces:

```
HAdjustmentValue
```

All Superinterfaces:

```
HOrientable
```

All Known Implementing Classes:

```
HRangeValue
```

Description

A component which implements `HAdjustmentInputPreferred` indicates that this component expects to receive `HAdjustmentEvent` input events.

The system must provide a means of generating `HAdjustmentEvent` events as necessary. For platforms with a restricted number of physical keys this may involve a "virtual keyboard" or similar mechanism.

All interoperable implementations of the `HAdjustmentInputPreferred` interface must extend `HComponent`.

Note that the `java.awt.Component` method `isFocusTraversable` should always return true for a `java.awt.Component` implementing this interface.

Methods

`getAdjustMode()`

```
public boolean getAdjustMode()
```

Get the adjustment mode for this `HAdjustmentInputPreferred`. If the returned value is `true` the component is in adjustment mode, and its value may be changed on receipt of `ADJUST_LESS` and `ADJUST_MORE` events.

The component is switched into and out of adjustment mode on receiving `ADJUST_START_CHANGE` and `ADJUST_END_CHANGE` events.

Returns:

true if this component is in adjustment mode, false otherwise.

`processHAdjustmentEvent(HAdjustmentEvent)`

```
public void processHAdjustmentEvent(HAdjustmentEvent evt)
```

Process an `HAdjustmentEvent` sent to this `HAdjustmentInputPreferred`.

Parameters:

`evt` - the `HAdjustmentEvent` to process.

setAdjustMode(boolean)

```
public void setAdjustMode(boolean adjust)
```

Set the adjustment mode for this `HAdjustmentInputPreferred`.

This method is provided for the convenience of component implementors. Interoperable applications shall not call this method. It cannot be made protected because interfaces cannot have protected methods.

Parameters:

`edit` - true to switch this component into adjustment mode, false otherwise.

See Also:

`getAdjustMode()`

org.havi.ui

HAdjustmentValue

Syntax

```
public interface HAdjustmentValue extends HNavigable, HAdjustmentInputPreferred
```

All Superinterfaces:

```
HAdjustmentInputPreferred, HNavigable, HNavigationInputPreferred,  
HOrientable
```

All Known Implementing Classes:

```
HRangeValue
```

Description

This interface is implemented by all HAVi UI components which have some form of adjustable numerical value (e.g. a range control)

Event Behavior

Subclasses of `HComponent` which implement `HAdjustmentValue` must respond to `HFocusEvent` and `HAdjustmentEvent` events.

Applications should assume that classes which implement `HAdjustmentValue` can generate events of the types `HFocusEvent` and `HAdjustmentEvent` in response to other types of input event.

An application may add one or more `HAdjustmentListener` listeners to the component. The `valueChanged(HAdjustmentEvent)` method of the `HAdjustmentListener` is invoked whenever the value of the `HAdjustmentValue` is modified.

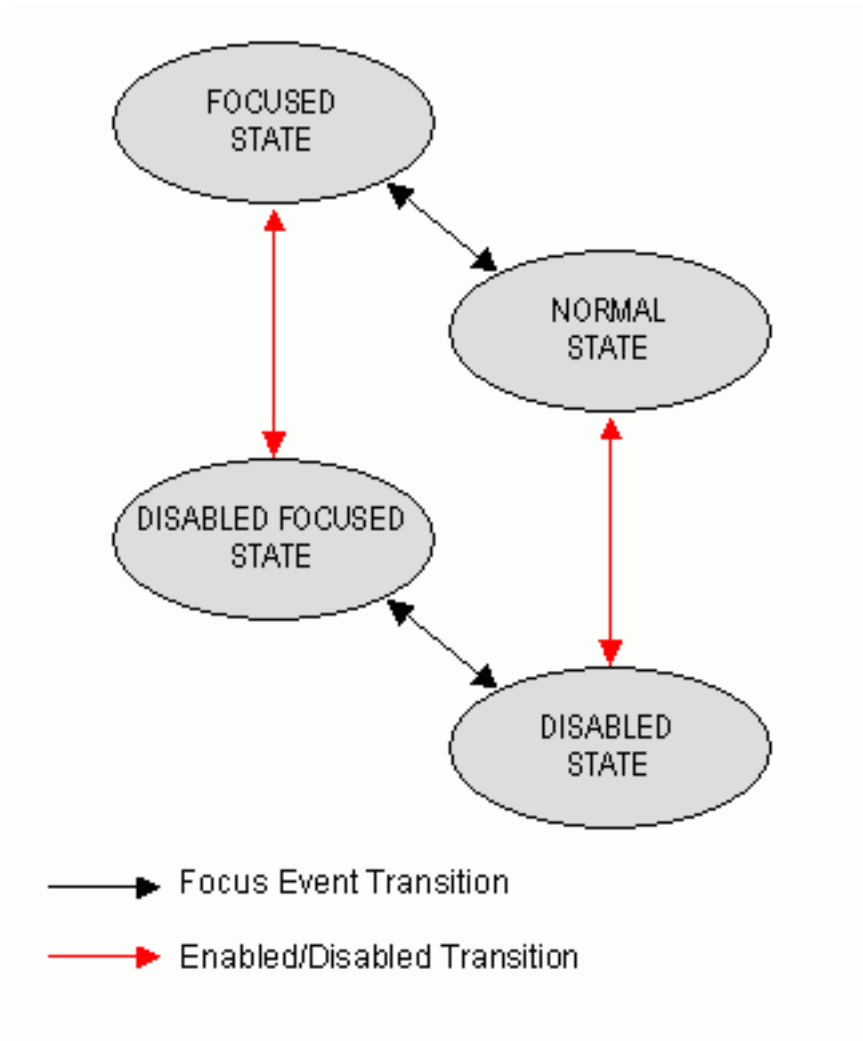
HAVi adjustment events are discussed in detail in the `HAdjustmentInputPreferred` interface description.

Interaction States

The following interaction states are valid for this `HAdjustmentValue` component:

- `NORMAL_STATE`
- `FOCUSED_STATE`
- `DISABLED_STATE`
- `DISABLED_FOCUSED_STATE`

The state machine diagram below shows the valid state transitions for an `HAdjustmentValue` component.



Platform Classes

The following HAVi platform classes implement or inherit the `HAdjustmentValue` interface. These classes shall all generate both `HFocusEvent` and `HAdjustmentEvent` events in addition to any other events specified in the respective class descriptions.

- `HRangeValue`
- `HListGroup`

See Also:

`HNavigable`, `HOrientable`, `HAdjustmentInputPreferred`, `HAdjustmentEvent`, `HAdjustmentListener`

Methods

addAdjustmentListener(HAdjustmentListener)

```
public void addAdjustmentListener(HAdjustmentListener l)
```

Adds the specified `HAdjustmentListener` to receive `HAdjustmentEvent` sent from this object. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Parameters:

1 - the `HAdjustmentListener` to be notified.

getAdjustmentSound()

```
public HSound getAdjustmentSound()
```

Get the sound to be played when the value changes.

Returns:

The sound played when the value changes

getBlockIncrement()

```
public int getBlockIncrement()
```

Get the block increment for this `HAdjustmentValue` .

Returns:

the block increment value for this `HAdjustmentValue` .

getUnitIncrement()

```
public int getUnitIncrement()
```

Get the unit increment for this `HAdjustmentValue` .

Returns:

the increment value for this `HAdjustmentValue` .

removeAdjustmentListener(HAdjustmentListener)

```
public void removeAdjustmentListener(HAdjustmentListener l)
```

Removes the specified `HAdjustmentListener` so that it no longer receives `HAdjustmentEvent` from this object. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Parameters:

1 - the `HAdjustmentListener` to be removed from notification.

setAdjustmentSound(HSound)

```
public void setAdjustmentSound(HSound sound)
```

Associate a sound to be played when the value is modified. The sound is played irrespective of whether an `HAdjustmentEvent` is sent to one or more listeners.

Parameters:

`sound` - the sound to be played, when the value is modified. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound` .

setBlockIncrement(int)

```
public void setBlockIncrement(int increment)
```

Set the block increment for this `HAdjustmentValue` .

Parameters:

`increment` - the amount by which the value of the `HAdjustmentValue` should change when an `ADJUST_PAGE_LESS` or `ADJUST_PAGE_MORE` event is received. Values of `increment` less than one shall be treated as a value of one.

setUnitIncrement(int)

```
public void setUnitIncrement(int increment)
```

Set the unit increment for this `HAdjustmentValue` .

Parameters:

`increment` - the amount by which the value of the `HAdjustmentValue` should change when an `ADJUST_LESS` or `ADJUST_MORE` event is received. Values of `increment` less than one shall be treated as a value of one.

org.havi.ui

HAnimateEffect

Syntax

```
public interface HAnimateEffect
```

All Known Implementing Classes:

```
HStaticAnimation, HFlatEffectMatte, HImageEffectMatte
```

Description

The `HAnimateEffect` interface defines effect constants and controls for time-varying animations.

Implementations of `HAnimateEffect` should have the following default behaviors:

- By default the `HAnimateEffect` should be stopped. Hence, to start an `HAnimateEffect` the `start()` method must be explicitly invoked. This mechanism allows for animations that are programmatically controlled, e.g. via the `setPosition(int)` method.
- By default the position for rendering should be the first image in the sequence, i.e. 0.
- By default the play mode should be `PLAY_REPEATING`.
- By default the repeat count should be `REPEAT_INFINITE`.
- The default rendering should simply display the single image at the current position of the animation within the sequence.

Fields

PLAY_ALTERNATING

```
public static final int PLAY_ALTERNATING
```

Indicates that the animation should be played in a repeating loop, alternating between the forward and reverse direction.

The images are rendered in the same order that they are present in the sequence (array):

0, 1, 2, 3, ... length-2, length-1

If the animation has not repeated sufficiently, then the rendering of the sequence is reversed - i.e. the images are rendered in the order

length-2, length-3, ... 1, 0

If the animation has not repeated sufficiently, then the rendering of the sequence is reversed (again) back to a forwards direction. I.e. the images are rendered in the order

1, 2, 3, ... length-2, length-1

Each rendering of the sequence of images forwards or backwards, should be considered as a single "repeat".

Note that when the sequence repeats, the last image (first image) is not rendered consecutively, i.e. twice.

PLAY_REPEATING

```
public static final int PLAY_REPEATING
```

Indicates that the animation should be played forwards (in a repeating loop).

The images are rendered in the same order that they are present in the sequence (array):

0, 1, 2, 3, ... length-1

If the animation has not repeated sufficiently, then the rendering of the sequence is restarted from the first image, i.e. the images will continue to be rendered in the order:

0, 1, 2, 3, ... length-1

Each rendering of the sequence of images 0 to (length-1), should be considered as a single "repeat".

REPEAT_INFINITE

```
public static final int REPEAT_INFINITE
```

This value, when passed to `setRepeatCount`, indicates that the animation shall repeat until the `stop()` method is invoked.

Methods

getDelay()

```
public int getDelay()
```

Gets the presentation delay for this `HAnimateEffect`.

Returns:

the presentation delay in units of 0.1 seconds.

getPlayMode()

```
public int getPlayMode()
```

Gets the playing mode for this `HAnimateEffect`.

Returns:

the play mode for this `HAnimateEffect`.

getPosition()

```
public int getPosition()
```

Get the current index into the content array which this `HAnimateEffect` is using to display content.

Returns:

the index of the content currently being displayed, in the range $0 \leq \text{index} < \text{length}$

getRepeatCount()

```
public int getRepeatCount()
```

Gets the number of times that this `HAnimateEffect` is to be played. Note that this method does *not* return the number of repeats that are remaining to be played.

Returns:

the total number of times that an `HAnimateEffect` is to be played. The returned value shall be greater than zero, or `REPEAT_INFINITE`.

isAnimated()

```
public boolean isAnimated()
```

This method indicates the animation (running) state of the `HAnimateEffect`.

Returns:

`true` if this `HAnimateEffect` is running, i.e. the `start` method has been invoked - `false` otherwise.

setDelay(int)

```
public void setDelay(int count)
```

Sets the delay between the presentation of successive pieces of content (frames).

After calling `setDelay(int)` on a currently playing `HAnimateEffect`, there is no guarantee that one or more frames will not be displayed using the previous delay until the new delay value takes effect.

Parameters:

`count` - the content presentation delay in units of 0.1 seconds duration. If `count` is less than one "unit", then it shall be treated as if it were a delay of one "unit", i.e. 0.1 seconds.

setPlayMode(int)

```
public void setPlayMode(int mode)
```

Sets the playing mode for this `HAnimateEffect`. If the animation is already running a call to `setPlayMode` will change the current value and affect the animation immediately. The position of the animation is unchanged.

Parameters:

`mode` - the play mode for this `HAnimateEffect`, which must be either `PLAY_ALTERNATING` or `PLAY_REPEATING`.

setPosition(int)

```
public void setPosition(int position)
```

Set this `HAnimateEffect` to display the content at the specified position. If the animation is already running a call to `setPosition` will change the current value and affect the animation immediately.

Parameters:

`position` - an index into the content array which specifies the next piece of content to be displayed. If `position` is less than 0, then the array element at index 0 is displayed, if `position` is greater than or equal to the length of the content array, then the array element at index `[length-1]` will be used.

setRepeatCount(int)

```
public void setRepeatCount(int count)
```

Sets the number of times that this `HAnimateEffect` should be played. If the animation is already running a call to `setRepeatCount` will change the current value and reset the current number of repeats to 0, affecting the animation immediately.

Parameters:

`count` - the number of times that an `HAnimateEffect` should be played. Valid values of the repeat count are one or more, and `REPEAT_INFINITE` .

start()

```
public void start()
```

This method starts this `HAnimateEffect` playing. If `start` is called when the animation is already running it resets the animation according to the current play mode, as returned by `getPlayMode()` .

stop()

```
public void stop()
```

This method indicates that the running `HAnimateEffect` should be stopped. After calling this method, there is no guarantee that one or more frames will not be displayed before the animation actually stops playing. If the animation is already stopped further calls to `stop` have no effect.

org.havi.ui

HAnimateLook

Syntax

```
public class HAnimateLook implements HLook
```

```
java.lang.Object
|
+--org.havi.ui.HAnimateLook
```

All Implemented Interfaces:

java.lang.Cloneable, HLook

Description

The `HAnimateLook` class is used by any `HVisible` component to display animated graphical content. This look will be provided by the platform and the exact way in which it is rendered will be platform dependant.

The `HAnimateLook` class draws the content set on an `HVisible`. It uses the `getAnimateContent(int)` `getAnimateContent(int)`

- If the sequence is empty then the animation shall be treated as a completely transparent area of specific width and height within its enclosing Container --- simply for the purposes of layout management (if applicable).
- If there is only one image referenced in the sequence then that image is rendered statically in a similar manner to `HGraphicLook`.
- If there is more than one image referenced in the sequence then these are rendered in sequence, giving the effect of an animation.

If a referenced image is inaccessible, then it shall be skipped. If no images are accessible, then the animation shall be treated as a completely transparent area of specific width and height within its enclosing Container --- for the purposes of layout management (if applicable).

The `HAnimateLook` is not required to present consecutive images in the animation with the delay specified in its associated `HStaticAnimation`. For example, if the time taken to retrieve or render an image is longer than the delay, then then it shall be rendered as soon as possible.

Implementations of `HAnimateLook` should use the appropriate methods on `HVisible` to determine which scaling and alignment modes to use when rendering content. See the class description for `HLook` for more details. `HAnimateLook` may support scalable animated graphical content. As a minimum, all implementations must support the `RESIZE_NONE` scaling mode, and all alignment modes.

Note that the results of applying the `VALIGN_JUSTIFY` and `HALIGN_JUSTIFY` alignment modes for animated graphical content are defined to identical to `VALIGN_CENTER` and `HALIGN_CENTER` modes respectively, as justification is meaningless in this context.

This is the default look that is used by `HStaticAnimation` and its subclasses. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

`HStaticAnimation`, `HVisible`, `HLook`

Constructors

HAnimateLook()

```
public HAnimateLook()
```

Creates a `HAnimateLook` object. See the class description for details of constructor parameters and default values.

Methods

getInsets(HVisible)

```
public java.awt.Insets getInsets(HVisible visible)
```

Determines the insets of this `HLook`, which indicate the size of the border. This area is reserved for the `HLook` to use for drawing borders around the associated `HVisible`.

Specified By:

`getInsets(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

the insets of this `HLook`.

getMaximumSize(HVisible)

```
public java.awt.Dimension getMaximumSize(HVisible hvisible)
```

Gets the maximum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) then the return value is the current size of the `HVisible` (as returned by `HVisible#getSize`).
2. If the `HLook` does not support scaling of content or no scaling is requested, and content is set then the

return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.

3. If there is no content set then a maximum size of `[Short.MAX_VALUE, Short.MAX_VALUE]` is returned as a `Dimension`.

Specified By:

`getMaximumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` maximum size.

See Also:

`getMaximumSize()`

getMinimumSize(HVisible)

```
public java.awt.Dimension getMinimumSize(HVisible hvisible)
```

Gets the minimum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the size of the smallest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If the `HLook` does not support scaling of content or no scaling is requested, *and* content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If no content is available but a default preferred size has been set using `setDefaultSize(Dimension)` has been called to set then the return value is this value (as obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
4. If there is no content or default size set then the return value is an implementation-specific minimum size plus any additional dimensions that the `HLook` requires for border decoration etc.

Specified By:

`getMinimumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` minimum size.

See Also:

`getMinimumSize()`

getPreferredSize(HVisible)

```
public java.awt.Dimension getPreferredSize(HVisible hvisible)
```

Gets the preferred size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If a default preferred size has been set for this `HVisible` (using `setDefaultSize(Dimension)`) then the return value is this size (obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If this `HLook` does not support scaling of content or no scaling is requested, and content is present then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If this `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the current size of the `HVisible` as returned by `getSize()`.
4. If there is no content and no default size set then the return value is the current size of the `HVisible` as returned by `getSize()`.

Specified By:

`getPreferredSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating the preferred size of the `HVisible` when drawn with this `HLook`.

See Also:

`getPreferredSize()`, `setDefaultSize(Dimension)`

isOpaque(HVisible)

```
public boolean isOpaque(HVisible visible)
```

Returns true if the entire painted area of the `HVisible` when using this look is fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`.

The default value is implementation specific and depends on the background painting mode of the given `HVisible`. The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque(HVisible)` in interface `HLook`

Parameters:

`visible` - the visible to test

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method of an `HVisible` using this look are fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`, otherwise false.

showLook(Graphics, HVisible, int)

```
public void showLook(java.awt.Graphics g, HVisible visible, int state)
```

The `showLook(Graphics, HVisible, int)` method is responsible for repainting the entire `HVisible` component, (including any content set on the component, and the component background), subject to the `clipRect` of the `Graphics` object passed to it.

The `showLook(Graphics, HVisible, int)` method should not modify the `clipRect` of the `Graphics` object that is passed to it.

For looks which draw content (e.g. `HTextLook`, `HGraphicLook` and `HAnimateLook`), if no content is associated with the component, the `showLook(Graphics, HVisible, int)` method paints the component with its current background `Color` according to the `setBackgroundMode(int)` method of `HVisible` and draws any (implementation-specific) borders. Note that by default the background mode is set so as to **not** paint a background. Furthermore on platforms which support transparent colors the background `Color` may be partially or completely transparent.

Any resources **explicitly** associated with an `HLook` should be loaded by the `HLook` during its creation, etc., or via its `setXXX()` methods. Note that the "standard" looks don't load content by default.

This method is called from the `paint(Graphics)` method of `HVisible` and must never be called from elsewhere. Components wishing to redraw themselves should call their `repaint` method in the usual way.

Specified By:

`showLook(Graphics, HVisible, int)` in interface `HLook`

Parameters:

`g` - the graphics context.

`visible` - the visible.

`state` - the state parameter indicates the state of the visible, allowing the look to render the appropriate content for that state. Note that some components (e.g. `HStaticRange`, `HRange`, `HRangeValue`) do not use state-based content).

widgetChanged(HVisible, HChangeData[])

```
public void widgetChanged(HVisible visible, HChangeData[] changes)
```

Called by the `HVisible` whenever its content, state, or any other data changes. See the class description of `HVisible` for more information about the `changes` parameter.

The implementation of this method should work out which graphical areas of the `HVisible` have changed and make any relevant calls to trigger the repainting of those areas.

A minimum implementation of this method could simply call

```
visible.repaint()
```

Specified By:

`widgetChanged(HVisible, HChangeData[])` in interface `HLook`

Parameters:

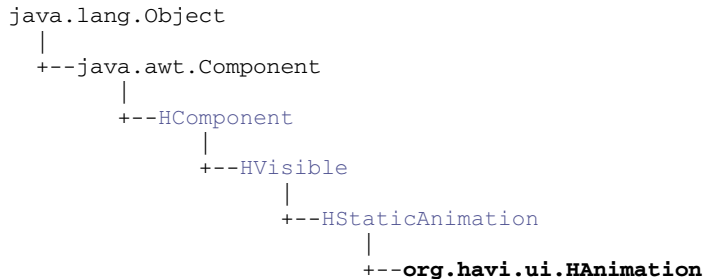
`visible` - the `HVisible` which has changed

`changes` - an array containing hint data and associated hint objects. If this argument is `null` a full repaint will be triggered.

org.havi.ui HAnimation

Syntax

public class HAnimation extends HStaticAnimation implements HNavigable



All Implemented Interfaces:

HAnimateEffect, HMatteLayer, HNavigable, HNavigationInputPreferred, HNoInputPreferred, HState, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

The `HAnimation` class is a user interface component used to display animated graphical content (as `HStaticAnimation`) which additionally enables a user to navigate to it, i.e. it can have the input focus. By default it uses the `HAnimateLook` to render itself. The `HAnimation` class supports animating images in exactly the same way as the `HStaticAnimation` class, with the following exception:

- If the `HAnimation` has different content set for the supported states a change in interaction state may cause an implementation-specific change to the animation position to deal with animation content of different length.

The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds

images	The array of images to be used as the content for every state of this component.	null	setAnimateContent (Image[], int)	getAnimateContent (int)
images-Normal	The array of images to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	setAnimateContent (Image[], int)	getAnimateContent (int)
imagesFocused	The array of images to be used as the content for the focused states of this component.	null	setAnimateContent (Image[], int)	getAnimateContent (int)
delay	The delay between the presentation of successive content in the animation, in units of 0.1 second	1 (i.e. 0.1 seconds)	setDelay (int)	getDelay ()
repeat-Count	The number of times that the animation is to be played.	REPEAT_INFINITE	setRepeatCount (int)	getRepeatCount ()
playMode	The playing mode for the animation.	PLAY_REPEATING	setPlayMode (int)	getPlayMode ()

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte (HMatte)</code>	<code>getMatte ()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager (HTextLayoutManager)</code>	<code>getTextLayoutManager ()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode (int)</code>	<code>getBackgroundMode ()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize (Dimension)</code>	<code>getDefaultSize ()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment (int)</code>	<code>getHorizontalAlignment ()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment (int)</code>	<code>getVerticalAlignment ()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode (int)</code>	<code>getResizeMode ()</code>
The initial piece of content to be presented, i.e. its position in the content array.	0	<code>setPosition (int)</code>	<code>getPosition ()</code>

By default the animation should be stopped. Hence, to start the animation its start method must be explicitly invoked. This mechanism allows for animations that are programmatically controlled, e.g. via the setPosition method.	"stopped"	<code>start() / stop()</code>	<code>isAnimated()</code>
The default "look" for this class.	A platform specific <code>HAnimateLook</code>	<code>setDefaultLook(HAnimateLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HAnimateLook</code> returned from <code>HAnimation.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The gain focus sound.	null	<code>setGainFocusSou nd(HSound)</code>	<code>getGainFocusSou nd()</code>
The lose focus sound.	null	<code>setLoseFocusSou nd(HSound)</code>	<code>getLoseFocusSou nd()</code>

See Also:

`HStaticAnimation`, `HNavigable`

Constructors

HAnimation()

```
public HAnimation()
```

Creates an `HAnimation` object. See the class description for details of constructor parameters and default values.

HAnimation(Image[], Image[], int, int, int)

```
public HAnimation(java.awt.Image[] imagesNormal, java.awt.Image[] imagesFocused, int delay,  
int playMode, int repeatCount)
```

Creates an `HAnimation` object. See the class description for details of constructor parameters and default values.

HAnimation(Image[], Image[], int, int, int, int, int, int, int)

```
public HAnimation(java.awt.Image[] imagesNormal, java.awt.Image[] imagesFocused, int delay,  
int playMode, int repeatCount, int x, int y, int width, int height)
```

Creates an `HAnimation` object. See the class description for details of constructor parameters and default values.

HAnimation(Image[], int, int, int)

```
public HAnimation(java.awt.Image[] images, int delay, int playMode, int repeatCount)
```

Creates an HAnimation object. See the class description for details of constructor parameters and default values.

HAnimation(Image[], int, int, int, int, int, int)

```
public HAnimation(java.awt.Image[] images, int delay, int playMode, int repeatCount, int x,
                  int y, int width, int height)
```

Creates an HAnimation object. See the class description for details of constructor parameters and default values.

Methods

getDefaultLook()

```
public static HAnimateLook getDefaultLook()
```

Returns the currently set default look for HAnimation components.

Returns:

The [HLook](#) that is used by default when creating a new HAnimation component.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

[getGainFocusSound\(\)](#) in interface [HNavigable](#)

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

[getLoseFocusSound\(\)](#) in interface [HNavigable](#)

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the [HNavigable](#) object that is navigated to when a particular key is pressed.

Specified By:

```
getMove(int) in interface HNavigable
```

Parameters:

keyCode - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns `null`.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

```
getNavigationKeys() in interface HNavigationInputPreferred
```

Returns:

an array of key codes, or `null` if no navigation targets are set on this component.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

```
isSelected() in interface HNavigable
```

Returns:

`true` if the component has focus, otherwise returns `false`.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HAnimation`.

Specified By:

```
processHFocusEvent(HFocusEvent) in interface HNavigationInputPreferred
```

Parameters:

evt - the `HFocusEvent` to process.

setDefaultLook(HAnimateLook)

```
public static void setDefaultLook(HAnimateLook hlook)
```

Sets the default `HLook` for further `HAnimation` Components.

Parameters:

hlook - The `HLook` that will be used by default when creating a new `HAnimation` component. Note that this parameter may be `null`, in which case newly created components shall not draw themselves until a non-`null` look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
    HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in interface `HNavigable`

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` KeyEvent. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` KeyEvent. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` KeyEvent. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` KeyEvent. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setGainFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

org.havi.ui HBackgroundConfigTemplate

Syntax

```
public class HBackgroundConfigTemplate extends HScreenConfigTemplate
```

```
java.lang.Object
|
+--HScreenConfigTemplate
|
+--org.havi.ui.HBackgroundConfigTemplate
```

Description

The `HBackgroundConfigTemplate` class is used to obtain a valid `HBackgroundConfiguration`. An application instantiates one of these objects and then sets all non-default attributes as desired. The `getBestConfiguration(HBackgroundConfigTemplate)` method found in the `HBackgroundDevice` class is then called with this `HBackgroundConfigTemplate`. A valid `HBackgroundConfiguration` is returned that meets or exceeds what was requested in the `HBackgroundConfigTemplate`.

This class may be subclassed to support additional properties of background configurations which may be requested by applications.

The `ZERO_VIDEO_IMPACT` property may be used in instances of this class to discover whether displaying background stills will have any impact on already running video. Implementations supporting the `STILL_IMAGE` preference shall return an `HStillImageBackgroundConfiguration` when requested except as described below.

- If displaying an `STILL_IMAGE` interrupts video transiently while the image is decoded then a configuration shall not be returned if the `ZERO_VIDEO_IMPACT` property is present with the priority `REQUIRED`.
- If displaying an `STILL_IMAGE` interrupts video while the image is decoded and for the entire period while the image is displayed then a configuration shall not be returned if the `ZERO_VIDEO_IMPACT` property is present with either the priorities `REQUIRED` or `PREFERRED`.

The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

`HScreenConfigTemplate`, `HGraphicsConfigTemplate`, `HVideoConfigTemplate`

Fields

CHANGEABLE_SINGLE_COLOR

```
public static final int CHANGEABLE_SINGLE_COLOR
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HBackgroundConfigTemplate` that indicates that a single color background is requested where that single color can be changed by applications.

STILL_IMAGE

```
public static final int STILL_IMAGE
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HBackgroundConfigTemplate` that indicates that a background which can support still images is requested. Where backgrounds supporting this feature are returned, they are returned as objects of the `HStillImageBackgroundConfiguration` class.

Constructors

HBackgroundConfigTemplate()

```
public HBackgroundConfigTemplate()
```

Creates an `HBackgroundConfigTemplate` object. See the class description for details of constructor parameters and default values.

Methods

getPreferencePriority(int)

```
public int getPreferencePriority(int preference)
```

Return the priority for the specified preference.

By default the preferences in a template returned from the system will have an `DONT_CARE` priority unless specified otherwise. Any configuration always satisfies these attributes.

Overrides:

`getPreferencePriority(int)` in class `HScreenConfigTemplate`

Parameters:

`preference` - the preference to be indicated. Valid values for an `HBackgroundConfigTemplate` are: `ZERO_BACKGROUND_IMPACT`, `ZERO_GRAPHICS_IMPACT`, `ZERO_VIDEO_IMPACT`, `INTERLACED_DISPLAY`, `FLICKER_FILTERING`, `VIDEO_GRAPHICS_PIXEL_ALIGNED.PIXEL_ASPECT_RATIO`, `PIXEL_RESOLUTION`, `SCREEN_RECTANGLE`, `CHANGEABLE_SINGLE_COLOR` and `STILL_IMAGE`.

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HBackgroundConfigTemplate`

Returns:

the priority for the specified preference.

isConfigSupported(HBackgroundConfiguration)

```
public boolean isConfigSupported(HBackgroundConfiguration hbc)
```

Returns a boolean indicating whether or not the specified `HBackgroundConfiguration` can be used to create a background plane that supports the features set in this template.

Parameters:

`hbc` - - the `HBackgroundConfiguration` object to test against this template.

Returns:

true if this `HBackgroundConfiguration` object can be used to create a background plane that supports the features set in this template, false otherwise.

setPreference(int, int)

```
public void setPreference(int preference, int priority)
```

Set the indicated preference to have the specified priority. If the preference has been previously set, then the previous priority for the preference shall be overwritten.

Attributes that are not filled in in a template (through `setPreference(int, int)`), shall have the priority `DONT_CARE`. Any configuration always satisfies these attributes.

Overrides:

```
setPreference(int, int) in class HScreenConfigTemplate
```

Parameters:

`preference` - the preference to be indicated. Valid values for an `HBackgroundConfigTemplate` are: `ZERO_BACKGROUND_IMPACT`, `ZERO_GRAPHICS_IMPACT`, `ZERO_VIDEO_IMPACT`, `INTERLACED_DISPLAY`, `FLICKER_FILTERING`, `VIDEO_GRAPHICS_PIXEL_ALIGNED`, `CHANGEABLE_SINGLE_COLOR` and `STILL_IMAGE`.

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HBackgroundConfigTemplate`

`priority` - the priority of the preference. Valid values are: `REQUIRED`, `PREFERRED`, `DONT_CARE`, `PREFERRED_NOT` and `REQUIRED_NOT`.

If `priority` is not a valid priority as defined here a `java.lang.IllegalArgumentException` will be thrown.

org.havi.ui HBackgroundConfiguration

Syntax

```
public class HBackgroundConfiguration extends HScreenConfiguration
```

```
java.lang.Object
|
+--HScreenConfiguration
|
+--org.havi.ui.HBackgroundConfiguration
```

Direct Known Subclasses:

```
HStillImageBackgroundConfiguration
```

Description

The `HBackgroundConfiguration` class describes the characteristics (settings) of an `HBackgroundDevice`. There can be many `HBackgroundConfiguration` objects associated with a single `HBackgroundDevice`.

The basic background configuration supports backgrounds of a single color. More sophisticated backgrounds can be supported by defining new classes inheriting from this class. Where a device has a single non-changeable background color, this class will provide applications the ability to read that color however all attempts to reserve control of the background will fail. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

[HBackgroundDevice](#)

Constructors

HBackgroundConfiguration()

```
protected HBackgroundConfiguration()
```

It is not intended that applications should directly construct `HBackgroundConfiguration` objects.

Creates an `HBackgroundConfiguration` object. See the class description for details of constructor parameters and default values.

Methods

`getColor()`

```
public java.awt.Color getColor()
```

Obtain the current color of this background. This method may be called without ownership of the resource. The value returned is not guaranteed to be the value set in the last call to `setColor(Color)` since platforms may offer a reduced color space for backgrounds and the actual value used will be returned.

Returns:

the current `Color`

`getConfigTemplate()`

```
public HBackgroundConfigTemplate getConfigTemplate()
```

Returns an `HBackgroundConfigTemplate` object that describes and uniquely identifies this `HBackgroundConfiguration`. Hence, the following sequence should return the original `HBackgroundConfiguration`

```
HBackgroundDevice.getBestMatch(HBackgroundConfiguration.getConfigTemplate())
```

Features that are implemented in the `HBackgroundConfiguration` will return `REQUIRED` priority. Features that are not implemented in the `HBackgroundConfiguration` will return `REQUIRED_NOT` priority.

Returns:

an `HBackgroundConfigTemplate` object which both describes and uniquely identifies this `HBackgroundConfiguration`.

`getDevice()`

```
public HBackgroundDevice getDevice()
```

Returns the `HBackgroundDevice` associated with this `HBackgroundConfiguration`.

Returns:

the `HBackgroundDevice` object that is associated with this `HBackgroundConfiguration`.

`setColor(Color)`

```
public void setColor(java.awt.Color color)
```

Set the current color of this background. On platforms where there is a sub-class of `java.awt.Color` supporting transparency of any kind, passing an object representing a non-opaque color is illegal. Platforms with a limited color resolution for backgrounds may approximate this value to the nearest available. The `getColor()` method will return the actual value used.

Parameters:

`color` - the color to be used for the background

Throws:

`HPermissionDeniedException` - if this `HBackgroundDevice` does not have the right to control the background

`HConfigurationException` - if the color specified is illegal for this platform.

org.havi.ui HBackgroundDevice

Syntax

```
public class HBackgroundDevice extends HScreenDevice
```

```
java.lang.Object
|
+--HScreenDevice
    |
    +--org.havi.ui.HBackgroundDevice
```

All Implemented Interfaces:

org.davic.resources.ResourceProxy, org.davic.resources.ResourceServer

Description

This class represents the ultimate background of a screen. The background is the very back of the video / graphics composition stack. It can potentially cover the entire area of a screen. Where a device supports multiple applications on screen at the same time (or even a window manager), the background is not constrained by any particular application or window. The right to control the background of a screen is a scarce resource and managed as such. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HBackgroundDevice()

```
protected HBackgroundDevice()
```

It is not intended that applications should directly construct `HBackgroundDevice` objects.

Creates an `HBackgroundDevice` object. See the class description for details of constructor parameters and default values.

Methods

getBestConfiguration(HBackgroundConfigTemplate)

```
public HBackgroundConfiguration getBestConfiguration(HBackgroundConfigTemplate hbc)
```

Returns the "best" configuration possible that passes the criteria defined in this `HBackgroundConfigTemplate` or null.

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`
3. satisfy as many as possible of the preferences whose priority was `PREFERRED`.
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT`.

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

`hbc` - - an `HBackgroundConfigTemplate` object used to obtain a valid `HBackgroundConfiguration`. If this parameter is null the default configuration for the platform shall be returned.

Returns:

an `HBackgroundConfiguration` object that passes the criteria defined in the specified `HGraphicsConfigTemplate` or null if no `HBackgroundConfiguration` passes the criteria.

getBestConfiguration(HBackgroundConfigTemplate[])

```
public HBackgroundConfiguration getBestConfiguration(HBackgroundConfigTemplate[] hbcta)
```

Returns the "best" configuration possible that passes the criteria defined in one of the `HBackgroundConfigTemplate` objects within the specified array or null. The `HBackgroundTemplate` objects should be considered for matching in priority order from 0 to `(hbcta.length - 1)`.

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`
3. satisfy as many as possible of the preferences whose priority was `PREFERRED`.
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT`.

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

hbcta - the `HBackgroundConfigTemplate` array used to obtain a valid `HBackgroundConfiguration`.

Returns:

an `HBackgroundConfiguration` that passes the criteria defined in one of the `HBackgroundConfigTemplate` objects within the specified array

getConfigurations()

```
public HBackgroundConfiguration[] getConfigurations()
```

Returns all of the `HBackgroundConfiguration` objects associated with this `HBackgroundDevice`.

Returns:

an array of `HBackgroundConfiguration` objects

See Also:

`HBackgroundConfiguration`

getCurrentConfiguration()

```
public HBackgroundConfiguration getCurrentConfiguration()
```

Returns the current `HBackgroundConfiguration` for this `HBackgroundDevice`.

Returns:

the current `HBackgroundConfiguration` for this `HBackgroundDevice`.

See Also:

`HBackgroundConfiguration`

getDefaultConfiguration()

```
public HBackgroundConfiguration getDefaultConfiguration()
```

Returns the default `HBackgroundConfiguration` associated with this `HBackgroundDevice`. This (single) default configuration should correspond to some well-behaved settings for the device, such as, a minimal configuration or factory preset settings.

Returns:

the default `HBackgroundConfiguration` of this `HBackgroundDevice`

See Also:

`HBackgroundConfiguration`

setBackgroundConfiguration(HBackgroundConfiguration)

```
public boolean setBackgroundConfiguration(HBackgroundConfiguration hbc)
```

Set the background configuration for the device.

An application is only allowed to call this method after it reserved the device explicitly and subject to the security policy of the platform. Subject to this, the following rules determine whether this method can succeed.

- If the application selects a configuration that is not conflicting with the configurations of all the other devices on the same `HScreen` then that configuration is selected.
- If an application tries to select a configuration that conflicts with a configuration of another device on this `HScreen` which this application cannot control due to platform security policy then this method shall fail with a `SecurityException`.

- If an application tries to select a configuration that conflicts with a configuration of another device on this `HScreen` which this application cannot control due to another application owning the right to control that device and the platform not giving that right to this application then this method shall fail with an `HPermissionDeniedException`.
- If an application tries to select a configuration that conflicts with a configuration of another device which this application can control due to either this or no application having reserved the device, then the configuration of the other device is automatically changed. There is no change in the resource ownership of the other device.

Any modifications made to the configurations of other devices shall be reflected by the API for the devices concerned. The `getCurrentConfiguration()` method for those devices shall return the new configuration.

On successful change to the specified configuration, the device shall fire one or more `HScreenConfigurationEvent` for all listeners that are currently registered (if the criteria for receiving such an event has been satisfied). If the new configuration differs by more than one characteristic from the previous configuration then the device may fire one or more `HScreenConfigurationEvent`. This behavior is implementation specific.

If an attempt is made to set the identical configuration to that which is current, then no such event(s) shall be fired.

Parameters:

`hbc` - the `HBackgroundConfiguration` to which this device should be set.

Returns:

A boolean indicating whether the configuration could be applied successfully. If the configuration could not be applied successfully, the configuration after this method may not match the configuration of the device prior to this method being called --- applications should take steps to determine whether a partial change of settings has been made.

Throws:

`SecurityException` - if the application does not have sufficient rights to set the configuration for this device.

`HPermissionDeniedException` - if the application does not currently have the right to set the configuration for this device.

`HConfigurationException` - if the specified configuration is not valid for this device, or if it conflicts with other devices whose configuration(s) cannot be changed by this application.

org.havi.ui HBackgroundImage

Syntax

```
public class HBackgroundImage
```

```
java.lang.Object
|
+--org.havi.ui.HBackgroundImage
```

Description

This class represents a background image. Images of this class can be used as full screen backgrounds outside the java.awt framework. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HBackgroundImage(byte[])

```
public HBackgroundImage(byte[] pixels)
```

Create an `HBackgroundImage` object from an array of bytes encoded in the same encoding format as when reading this type of image data from a file.

If this constructor succeeds then the object will automatically be in the loaded state and calling the `load(HBackgroundImageListener)` method shall immediately generate an `HBackgroundImageEvent` reporting success.

If the byte array does not contain a valid image then this constructor shall throw a `java.lang.IllegalArgumentException`.

Calling the `flush()` method on an object built with this constructor shall have no effect.

Parameters:

`pixels` - the data for the `HBackgroundImage` object encoded in the specified format for image files of this type.

HBackgroundImage(String)

```
public HBackgroundImage(java.lang.String filename)
```

Create an `HBackgroundImage` object. Loading of the data for the object is not required at this time.

Parameters:

`filename` - the name of the file to use as the source of data in a platform-specific URL format.

HBackgroundImage(URL)

```
public HBackgroundImage(java.net.URL contents)
```

Create an `HBackgroundImage` object. Loading of the data for the object is not required at this time.

Parameters:

`contents` - a URL referring to the data to load.

Methods

flush()

```
public void flush()
```

Flush all the resources used by this image. This includes any pixel data being cached as well as all underlying system resources used to store data or pixels for the image. After calling this method the image is in a state similar to when it was first created without any load method having been called. When this method is called, the image shall not be in use by an application. Resources related to any `HBackgroundDevice` are not released.

getHeight()

```
public int getHeight()
```

Determines the height of the image. This is returned in pixels as defined by the format of the image concerned. If this information is not known when this method is called then -1 is returned.

The image must have been successfully loaded to completion before this information is guaranteed to be available. It is implementation specific whether this information is available before the image is successfully loaded to completion. An image whose loading failed for any reason shall be considered as having this information unavailable.

Returns:

the height of the image

getWidth()

```
public int getWidth()
```

Determines the width of the image. This is returned in pixels as defined by the format of the image concerned. If this information is not known when this method is called then -1 is returned.

The image must have been successfully loaded to completion before this information is guaranteed to be available. It is implementation specific whether this information is available before the image is successfully loaded to completion. An image whose loading failed for any reason shall be considered as having this information unavailable.

Returns:

the width of the image

load(HBackgroundImageListener)

```
public void load(HBackgroundImageListener l)
```

Load the data for this object. This method is asynchronous. The completion of data loading is reported through the listener provided.

Parameters:

l - the listener to call when loading of data is completed.

org.havi.ui HChangeData

Syntax

```
public class HChangeData

java.lang.Object
|
+--org.havi.ui.HChangeData
```

Description

A class used as argument for `widgetChanged(HVisible, HChangeData[])`. The hint constants are defined on `HVisible`.

Fields

data

```
public java.lang.Object data
```

The data object for this `HChangeData`. The types of this object for the different hints are defined on `HVisible`.

hint

```
public int hint
```

The hint for this `HChangeData`. The hint constants are defined on `HVisible`.

Constructors

HChangeData(int, Object)

```
public HChangeData(int hint, java.lang.Object data)
```

Creates an `HChangeData` object.

Parameters:

`hint` - the hint constant for this `HChangeData`.

`data` - the data object for this `HChangeData`.

org.havi.ui HComponent

Syntax

public abstract class HComponent extends java.awt.Component implements HMatteLayer, TestOpacity

```
java.lang.Object
|
+--java.awt.Component
|
+--org.havi.ui.HComponent
```

Direct Known Subclasses:

HVideoComponent, HVisible

All Implemented Interfaces:

HMatteLayer, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

The `HComponent` class extends the `java.awt.Component` class by implementing the `HMatteLayer` interface. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (HMatte).	none (i.e. getMatte() returns null)	setMatte(HMatte)	getMatte()

Constructors

HComponent()

```
public HComponent()
```

Creates an HComponent object. See the class description for details of constructor parameters and default values.

HComponent(int, int, int, int)

```
public HComponent(int x, int y, int width, int height)
```

Creates an HComponent object. See the class description for details of constructor parameters and default values.

Methods

getMatte()

```
public HMatte getMatte()
```

Get any HMatte currently associated with this component.

Specified By:

`getMatte()` in interface HMatteLayer

Returns:

the HMatte currently associated with this component or null if there is no associated matte.

isDoubleBuffered()

```
public boolean isDoubleBuffered()
```

Returns true if all the drawing done during the update and paint methods for this specific HComponent object is automatically double buffered.

Overrides:

`java.awt.Component.isDoubleBuffered()` in class `java.awt.Component`

Returns:

true if all the drawing done during the update and paint methods for this specific HComponent object is automatically double buffered, or false if drawing is not double buffered. The default value for the double buffering setting is platform-specific.

isOpaque()

```
public boolean isOpaque()
```

Returns true if the entire HComponent area, as given by the `java.awt.Component#getBounds` method, is fully opaque, i.e. its paint method (or surrogate methods) guarantee that all pixels are painted in an opaque Color.

By default, the return value is `false`. The return value should be overridden by subclasses that can guarantee full opacity. The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque()` in interface `TestOpacity`

Returns:

`true` if all the pixels within the area given by the `java.awt.Component#getBounds` method are fully opaque, i.e. its paint method (or surrogate methods) guarantee that all pixels are painted in an opaque `Color`, otherwise `false`.

processEvent(AWTEvent)

```
protected void processEvent(java.awt.AWTEvent evt)
```

This method may be overridden to facilitate the generation of events in the `org.havi.ui.event` package from `java.awt.AWTEvents`. Events used in this way (e.g. `java.awt.event.KeyEvent`s) are NOT consumed and should be propagated to the superclass.

Subclasses of `HComponent` must always call the superclass if they override this function.

Overrides:

`java.awt.Component.processEvent(java.awt.AWTEvent)` in class `java.awt.Component`

Parameters:

`evt` - the `java.awt.AWTEvent` to handle.

setMatte(HMatte)

```
public void setMatte(HMatte m)
```

Applies an `HMatte` to this component, for matte compositing. Any existing animated matte must be stopped before this method is called or an `HMatteException` will be thrown.

Specified By:

`setMatte(HMatte)` in interface `HMatteLayer`

Parameters:

`m` - The `HMatte` to be applied to this component -- note that only one matte may be associated with the component, thus any previous matte will be replaced. If `m` is null, then any matte associated with the component is removed and further calls to `getMatte()` shall return null. The component shall behave as if it had a fully opaque `HFlatMatte` associated with it (i.e. an `HFlatMatte` with the default value of 1.0.)

Throws:

`HMatteException` - if the `HMatte` cannot be associated with the component. This can occur:

- if the specific matte type is not supported
- if the platform does not support any matte type
- if the component is associated with an already running `HFlatEffectMatte` or `HImageEffectMatte`. The exception is thrown even if `m` is null.

See Also:

`HMatte`

org.havi.ui

HComponentOrdering

Syntax

```
public interface HComponentOrdering
```

All Known Implementing Classes:

`HContainer`, `HScene`

Description

This interface is implemented for all HAVi component containers that support the manipulation of the z-ordering of their children.

See Also:

`HScene`, `HContainer`

Methods

addAfter(Component, Component)

```
public java.awt.Component addAfter(java.awt.Component component, java.awt.Component front)
```

Adds a `java.awt.Component` to this `HComponentOrdering` directly behind a previously added `java.awt.Component`.

If `component` has already been added to this container, then `addAfter` moves `component` behind `front`. If `front` and `component` are the same component which was already added to this container, `addAfter` does not change the ordering of the components and returns `component`.

This method affects the Z-order of the `java.awt.Component` children within the `HComponentOrdering`, and may also implicitly change the numeric ordering of those children.

Parameters:

`component` - is the `java.awt.Component` to be added to the `HComponentOrdering`

`front` - is the `java.awt.Component`, which `component` will be placed behind, i.e. `front` will be directly in front of the added `java.awt.Component`

Returns:

If the `java.awt.Component` is successfully added, then it will be returned from this call. If the `java.awt.Component` is not successfully added, e.g. `front` is not a `java.awt.Component` currently added to the `HComponentOrdering`, then `null` will be returned.

This method must be implemented in a thread safe manner.

addBefore(Component, Component)

```
public java.awt.Component addBefore(java.awt.Component component,  
    java.awt.Component behind)
```

Adds a `java.awt.Component` to this `HComponentOrdering` directly in front of a previously added `java.awt.Component`.

If `component` has already been added to this container, then `addBefore` moves `component` in front of `behind`. If `behind` and `component` are the same component which was already added to this container, `addBefore` does not change the ordering of the components and returns `component`.

This method affects the Z-order of the `java.awt.Component` children within the `HComponentOrdering`, and may also implicitly change the numeric ordering of those children.

Parameters:

`component` - is the `java.awt.Component` to be added to the `HComponentOrdering`

`behind` - is the `java.awt.Component`, which `component` will be placed in front of, i.e.

`behind` will be directly behind the added `java.awt.Component`

Returns:

If the `java.awt.Component` is successfully added, then it will be returned from this call. If the `java.awt.Component` is not successfully added, e.g. `behind` is not a `java.awt.Component` currently added to the `HComponentOrdering`, then `null` will be returned.

This method must be implemented in a thread safe manner.

pop(Component)

```
public boolean pop(java.awt.Component component)
```

Moves the specified `java.awt.Component` one component nearer in the Z-order, i.e. swapping it with the `java.awt.Component` that was directly in front of it.

If `component` is already at the front of the Z-order, the order is unchanged and `pop` returns `true`.

Parameters:

`component` - The `java.awt.Component` to be moved.

Returns:

returns `true` on success, `false` on failure, for example if the `java.awt.Component` has yet to be added to the `HComponentOrdering`.

popInFrontOf(Component, Component)

```
public boolean popInFrontOf(java.awt.Component move, java.awt.Component behind)
```

Puts the specified `java.awt.Component` in front of another `java.awt.Component` in the Z-order of this `HComponentOrdering`.

If `move` and `behind` are the same component which has been added to the container `popInFront` does not change the Z-order and returns `true`.

Parameters:

`move` - The `java.awt.Component` to be moved directly in front of the "behind" Component in the Z-order of this `HComponentOrdering`.

`behind` - The `java.awt.Component` which the "move" Component should be placed directly in front of.

Returns:

returns `true` on success, `false` on failure, for example when either `java.awt.Component` has yet to be added to the `HComponentOrdering`. If this method fails, the Z-order is unchanged.

popToFront(Component)

```
public boolean popToFront(java.awt.Component component)
```

Brings the specified `java.awt.Component` to the "front" of the Z-order in this `HComponentOrdering`.

If component is already at the front of the Z-order, the order is unchanged and `popToFront` returns `true`.

Parameters:

`component` - The `java.awt.Component` to bring to the "front" of the Z-order of this `HComponentOrdering`.

Returns:

returns `true` on success, `false` on failure, for example when the `java.awt.Component` has yet to be added to the `HComponentOrdering`. If this method fails, the Z-order is unchanged.

push(Component)

```
public boolean push(java.awt.Component component)
```

Moves the specified `java.awt.Component` one component further away in the Z-order, i.e. swapping it with the `java.awt.Component` that was directly behind it.

If component is already at the back of the Z-order, the order is unchanged and `push` returns `true`.

Parameters:

`component` - The `java.awt.Component` to be moved.

Returns:

returns `true` on success, `false` on failure, for example if the `java.awt.Component` has yet to be added to the `HComponentOrdering`.

pushBehind(Component, Component)

```
public boolean pushBehind(java.awt.Component move, java.awt.Component front)
```

Puts the specified `java.awt.Component` behind another `java.awt.Component` in the Z-order of this `HComponentOrdering`.

If `move` and `front` are the same component which has been added to the container `pushBehind` does not change the Z-order and returns `true`.

Parameters:

`move` - The `java.awt.Component` to be moved directly behind the "front" Component in the Z-order of this `HComponentOrdering`.

`front` - The `java.awt.Component` which the "move" Component should be placed directly behind.

Returns:

returns `true` on success, `false` on failure, for example when either `java.awt.Component` has yet to be added to the `HComponentOrdering`.

pushToBack(Component)

```
public boolean pushToBack(java.awt.Component component)
```

Place the specified `java.awt.Component` at the "back" of the Z-order in this `HComponentOrdering`.

If component is already at the back the Z-order is unchanged and `pushToBack` returns `true`.

Parameters:

`component` - The `java.awt.Component` to place at the "back" of the Z-order of this `HComponentOrdering`.

Returns:

returns `true` on success, `false` on failure, for example when the `java.awt.Component` has yet to be added to the `HComponentOrdering`. If the component was not added to the container `pushToBack` does not change the Z-order.

org.havi.ui HConfigurationException

Syntax

```
public class HConfigurationException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
|
+--java.lang.Exception
|
+--org.havi.ui.HConfigurationException
```

All Implemented Interfaces:

java.io.Serializable

Description

Thrown when an application requests an `HScreenConfiguration` that cannot be satisfied -- either because the `HScreenConfiguration` does not have the functionality, or because the requested `HScreenConfiguration` is otherwise invalid, e.g. it is an `HScreenConfiguration` due to a different `HScreenDevice` than the one it is being applied to. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
message	Message explaining why the exception was thrown	null	-	java.lang.Throwable#getMessage

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HConfigurationException()

```
public HConfigurationException()
```

Creates an `HConfigurationException` object. See the class description for details of constructor parameters and default values.

HConfigurationException(String)

```
public HConfigurationException(java.lang.String message)
```

Creates an HConfigurationException object with a specified reason string.

Parameters:

`message` - the reason why the exception was raised

org.havi.ui HContainer

Syntax

```
public class HContainer extends java.awt.Container implements HMatteLayer, HComponentOrdering,
    TestOpacity
```

```
java.lang.Object
|
+--java.awt.Component
    |
    +--java.awt.Container
        |
        +--org.havi.ui.HContainer
```

All Implemented Interfaces:

`HComponentOrdering`, `HMatteLayer`, `java.awt.image.ImageObserver`, `java.awt.MenuContainer`, `java.io.Serializable`, `TestOpacity`

Description

The `HContainer` class extends the `java.awt.Container` class by implementing the `HMatteLayer` interface and providing additional Z-ordering capabilities, which are required since components in the HAVi user-interface are explicitly allowed to overlap each other.

Note that these Z-ordering capabilities (`addBefore`, `addAfter`, `pop`, `popInFrontOf`, `popToFront`, `push`, `pushBehind` and `pushToBack`) must be implemented by (implicitly) reordering the child Components within the `HContainer`, so that the standard AWT convention that the Z-order is defined as the order in which Components are added to a given Container is maintained. For example, one implementation of `popToFront` might be to make the specified Component become the first Component added to the parent Container by removing all Components from that Container, adding the specified Container first, and then adding the remaining Components in their current relative order to that Container. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
height	height of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte (HMatte)</code>	<code>getMatte ()</code>
<code>LayoutManager</code>	null (in contrast to <code>java.awt.Container</code>)	<code>java.awt.Container#setLayout</code>	<code>java.awt.Container#getLayout</code>

Constructors

`HContainer()`

```
public HContainer()
```

Creates an `HContainer` object. See the class description for details of constructor parameters and default values.

`HContainer(int, int, int, int)`

```
public HContainer(int x, int y, int width, int height)
```

Creates an `HContainer` object. See the class description for details of constructor parameters and default values.

Methods

`addAfter(Component, Component)`

```
public java.awt.Component addAfter(java.awt.Component component, java.awt.Component front)
```

Adds a `java.awt.Component` to this `HContainer` directly behind a previously added `java.awt.Component`.

If `component` has already been added to this container, then `addAfter` moves `component` behind `front`. If `front` and `component` are the same component which was already added to this container, `addAfter` does not change the ordering of the components and returns `component`.

This method affects the Z-order of the `java.awt.Component` children within the `HContainer`, and may also implicitly change the numeric ordering of those children.

Specified By:

`addAfter(Component, Component)` in interface `HComponentOrdering`

Parameters:

`component` - is the `java.awt.Component` to be added to the `HContainer`

`front` - is the `java.awt.Component`, which `component` will be placed behind, i.e. `front` will be directly in front of the added `java.awt.Component`

Returns:

If the `java.awt.Component` is successfully added, then it will be returned from this call. If the `java.awt.Component` is not successfully added, e.g. `front` is not a `java.awt.Component` currently added to the `HContainer`, then `null` will be returned.

This method must be implemented in a thread safe manner.

addBefore(Component, Component)

```
public java.awt.Component addBefore(java.awt.Component component,
                                   java.awt.Component behind)
```

Adds a `java.awt.Component` to this `HContainer` directly in front of a previously added `java.awt.Component`.

If `component` has already been added to this container, then `addBefore` moves `component` in front of `behind`. If `behind` and `component` are the same component which was already added to this container, `addBefore` does not change the ordering of the components and returns `component`.

This method affects the Z-order of the `java.awt.Component` children within the `HContainer`, and may also implicitly change the numeric ordering of those children.

Specified By:

`addBefore(Component, Component)` in interface `HComponentOrdering`

Parameters:

`component` - is the `java.awt.Component` to be added to the `HContainer`

`behind` - is the `java.awt.Component`, which `component` will be placed in front of, i.e. `behind` will be directly behind the added `java.awt.Component`

Returns:

If the `java.awt.Component` is successfully added, then it will be returned from this call. If the `java.awt.Component` is not successfully added, e.g. `behind` is not a `java.awt.Component` currently added to the `HContainer`, then `null` will be returned.

This method must be implemented in a thread safe manner.

getMatte()

```
public HMatte getMatte()
```

Get any `HMatte` currently associated with this component.

Specified By:

`getMatte()` in interface `HMatteLayer`

Returns:

the `HMatte` currently associated with this component or `null` if there is no associated matte.

group()

```
public void group()
```

Groups the `HContainer` and its components. If the container is already grouped this method has no effect

See Also:

`ungroup()`, `isGrouped()`

isDoubleBuffered()

```
public boolean isDoubleBuffered()
```

Returns `true` if all the drawing done during the update and paint methods for this specific `HContainer` object is automatically double buffered.

Overrides:

`java.awt.Component.isDoubleBuffered()` in class `java.awt.Component`

Returns:

`true` if all the drawing done during the update and paint methods for this specific `HComponent` object is automatically double buffered, or `false` if drawing is not double buffered. The default value for the double buffering setting is platform-specific.

isGrouped()

```
public boolean isGrouped()
```

Tests whether the `HContainer` and its components are grouped. By default the container is not grouped with its components.

Returns:

returns `true` if the `HContainer` and its components are grouped, `false` otherwise.

See Also:

`group()`, `ungroup()`

isOpaque()

```
public boolean isOpaque()
```

Returns `true` if the entire `HContainer` area, as given by the `java.awt.Component#getBounds` method, is fully opaque, i.e. its paint method (or surrogate methods) guarantee that all pixels are painted in an opaque `Color`.

By default, the return value is `false`. The return value should be overridden by subclasses that can guarantee full opacity. The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque()` in interface `TestOpacity`

Returns:

`true` if all the pixels within the area given by the `java.awt.Component#getBounds` method are fully opaque, i.e. its paint method (or surrogate methods) guarantee that all pixels are painted in an opaque `Color`, otherwise `false`.

pop(Component)

```
public boolean pop(java.awt.Component component)
```

Moves the specified `java.awt.Component` one component nearer in the Z-order, i.e. swapping it with the `java.awt.Component` that was directly in front of it.

If `component` is already at the front of the Z-order, the order is unchanged and `pop` returns `true`.

Specified By:

`pop(Component)` in interface `HComponentOrdering`

Parameters:

`component` - The `java.awt.Component` to be moved.

Returns:

returns `true` on success, `false` on failure, for example if the `java.awt.Component` has yet to be added to the `HContainer`.

popInFrontOf(Component, Component)

```
public boolean popInFrontOf(java.awt.Component move, java.awt.Component behind)
```

Puts the specified `java.awt.Component` in front of another `java.awt.Component` in the Z-order of this `HContainer`.

If `move` and `behind` are the same component which has been added to the container `popInFront` does not change the Z-order and returns `true`.

Specified By:

`popInFrontOf(Component, Component)` in interface `HComponentOrdering`

Parameters:

`move` - The `java.awt.Component` to be moved directly in front of the "behind" Component in the Z-order of this `HContainer`.

`behind` - The `java.awt.Component` which the "move" Component should be placed directly in front of.

Returns:

returns `true` on success, `false` on failure, for example when either `java.awt.Component` has yet to be added to the `HContainer`. If this method fails, the Z-order is unchanged.

popToFront(Component)

```
public boolean popToFront(java.awt.Component component)
```

Brings the specified `java.awt.Component` to the "front" of the Z-order in this `HContainer`.

If `component` is already at the front of the Z-order, the order is unchanged and `popToFront` returns `true`.

Specified By:

`popToFront(Component)` in interface `HComponentOrdering`

Parameters:

`component` - The `java.awt.Component` to bring to the "front" of the Z-order of this `HContainer`.

Returns:

returns `true` on success, `false` on failure, for example when the `java.awt.Component` has yet to be added to the `HContainer`. If this method fails, the Z-order is unchanged.

push(Component)

```
public boolean push(java.awt.Component component)
```

Moves the specified `java.awt.Component` one component further away in the Z-order, i.e. swapping it with the `java.awt.Component` that was directly behind it.

If `component` is already at the back of the Z-order, the order is unchanged and `push` returns `true`.

Specified By:

`push(Component)` in interface `HComponentOrdering`

Parameters:

`component` - The `java.awt.Component` to be moved.

Returns:

returns `true` on success, `false` on failure, for example if the `java.awt.Component` has yet to be added to the `HContainer`.

pushBehind(Component, Component)

```
public boolean pushBehind(java.awt.Component move, java.awt.Component front)
```

Puts the specified `java.awt.Component` behind another `java.awt.Component` in the Z-order of this `HContainer`.

If `move` and `front` are the same component which has been added to the container `pushBehind` does not change the Z-order and returns `true`.

Specified By:

`pushBehind(Component, Component)` in interface `HComponentOrdering`

Parameters:

`move` - The `java.awt.Component` to be moved directly behind the "front" Component in the Z-order of this `HContainer`.

`front` - The `java.awt.Component` which the "move" Component should be placed directly behind.

Returns:

returns `true` on success, `false` on failure, for example when either `java.awt.Component` has yet to be added to the `HContainer`.

pushToBack(Component)

```
public boolean pushToBack(java.awt.Component component)
```

Place the specified `java.awt.Component` at the "back" of the Z-order in this `HContainer`.

If component is already at the back the Z-order is unchanged and `pushToBack` returns `true`.

Specified By:

`pushToBack(Component)` in interface `HComponentOrdering`

Parameters:

`component` - The `java.awt.Component` to place at the "back" of the Z-order of this `HContainer`.

Returns:

returns `true` on success, `false` on failure, for example when the `java.awt.Component` has yet to be added to the `HContainer`. If the component was not added to the container `pushToBack` does not change the Z-order.

setMatte(HMatte)

```
public void setMatte(HMatte m)
```

Applies an `HMatte` to this component, for matte compositing. Any existing animated matte must be stopped before this method is called or an `HMatteException` will be thrown.

Specified By:

`setMatte(HMatte)` in interface `HMatteLayer`

Parameters:

`m` - The `HMatte` to be applied to this component -- note that only one matte may be associated with the component, thus any previous matte will be replaced. If `m` is null, then any matte associated with the component is removed and further calls to `getMatte()` shall return null. The component shall behave as if it had a fully opaque `HFlatMatte` associated with it (i.e an `HFlatMatte` with the default value of 1.0.)

Throws:

`HMatteException` - if the `HMatte` cannot be associated with the component. This can occur:

- if the specific matte type is not supported
- if the platform does not support any matte type
- if the component is associated with an already running `HFlatEffectMatte` or `HImageEffectMatte`. The exception is thrown even if `m` is null.

See Also:

`HMatte`

ungroup()

```
public void ungroup()
```

Ungroups the `HContainer` and its components. If the container is already ungrouped, this method has no effect.

See Also:

`group()`, `isGrouped()`

org.havi.ui HDefaultTextLayoutManager

Syntax

```
public class HDefaultTextLayoutManager implements HTextLayoutManager
```

```
java.lang.Object
|
+--org.havi.ui.HDefaultTextLayoutManager
```

All Implemented Interfaces:

```
HTextLayoutManager
```

Description

The `HDefaultTextLayoutManager` provides the default text rendering mechanism for the `HStaticText`, `HText` and `HTextButton` classes.

The `HDefaultTextLayoutManager` handles alignment and justification of text in both horizontal and vertical directions as specified by the current alignment modes set on `HVisible`. It does not support scaling of text content, and the scaling mode of an associated `HVisible` is ignored.

The string passed to the `render(String, Graphics, HVisible, Insets)` method may be multi-line, where each line is separated by a "\n" (0x0A). If the string does not fit in the space available, the string shall be truncated and an ellipsis ("...") appended to indicate the truncation.

The `HDefaultTextLayoutManager` should query the `HVisible` passed to its `render(String, Graphics, HVisible, Insets)` method to determine the basic font to render text in. If the specified font cannot be accessed the default behavior is to replace it with the nearest builtin font. Each missing character is replaced with an "!" character.

The antialiasing behavior of `HDefaultTextLayoutManager` is platform dependent. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

See Also:

`HTextLayoutManager`, `HStaticText`, `HText`, `HTextButton`, `HTextLook`, `HVisible`

Constructors

HDefaultTextLayoutManager()

```
public HDefaultTextLayoutManager()
```

Creates an `HDefaultTextLayoutManager` object. See the class description for details of constructor parameters and default values.

Methods

render(String, Graphics, HVisible, Insets)

```
public void render(java.lang.String markedUpString, java.awt.Graphics g, HVisible v,  
                  java.awt.Insets insets)
```

Render the string. The `HTextLayoutManager` should use the passed `HVisible` object to determine any additional information required to render the string, e.g. `Font`, `Color` etc.

The text should be laid out in the layout area, which is defined by the bounds of the specified `HVisible`, after subtracting the insets. If the insets are `null` the full bounding rectangle is used as the area to render text into.

The `HTextLayoutManager` should not modify the clipping rectangle of the `Graphics` object.

Specified By:

`render(String, Graphics, HVisible, Insets)` in interface `HTextLayoutManager`

Parameters:

`markedUpString` - the string to render.

`g` - the graphics context, including a clipping rectangle which encapsulates the area within which rendering is permitted. If a valid insets value is passed to this method then text must only be rendered into the bounds of the widget after the insets are subtracted. If the insets value is `null` then text is rendered into the entire bounding area of the `HVisible`. It is implementation specific whether or not the renderer takes into account the intersection of the clipping rectangle in each case for optimization purposes.

`v` - the `HVisible` into which to render.

`insets` - the insets to determine the area in which to layout the text, or `null`.

org.havi.ui HEmulatedGraphicsConfiguration

Syntax

```
public class HEmulatedGraphicsConfiguration extends HGraphicsConfiguration
```

```
java.lang.Object
|
+--HScreenConfiguration
|
+--HGraphicsConfiguration
|
+--org.havi.ui.HEmulatedGraphicsConfiguration
```

Description

An `HEmulatedGraphicsConfiguration` is a configuration for a "virtual" graphics device that may perform one or more emulations, e.g. in the ATSC context an `HEmulatedGraphicsDevice` might implement multiple `HEmulatedGraphicsConfiguration`, corresponding to each of the possible relationships to the high-definition display modes. The `HEmulatedGraphicsConfiguration` would be used to configure a device appropriately for rendering into, whilst mapping the emulated device onto the "true" physical display, e.g. by down-sampling to standard-definition display.

In essence the `HEmulatedGraphicsConfiguration` may be considered as a pair of `HGraphicsConfiguration` objects: one describing the configuration of the emulation and the second describing the corresponding configuration of the implementation.

Hence, an `HGraphicsConfiguration` may be considered as a special case of the `HEmulatedGraphicsConfiguration` class, where the emulation and implementation are equivalent. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

`HEmulatedGraphicsDevice`, `HGraphicsConfiguration`

Constructors

HEmulatedGraphicsConfiguration()

```
protected HEmulatedGraphicsConfiguration()
```


It is not intended that applications should directly construct `HEmulatedGraphicsConfiguration` objects.

Creates an `HEmulatedGraphicsConfiguration` object. See the class description for details of constructor parameters and default values.

Methods

`getConfigTemplate()`

```
public HGraphicsConfigTemplate getConfigTemplate()
```

Returns an `HGraphicsConfigTemplate` describing the virtual (emulation) characteristics of the `HEmulatedGraphicsDevice`.

Overridden method from `HGraphicsConfiguration` -- for an `HEmulatedGraphicsConfiguration` this returns a description of the emulation characteristics.

Overrides:

`getConfigTemplate()` in class `HGraphicsConfiguration`

Returns:

an `HGraphicsConfigTemplate` describing the virtual (emulation) characteristics of the `HEmulatedGraphicsDevice`.

See Also:

`HGraphicsConfigTemplate`, `HGraphicsConfiguration`, `HEmulatedGraphicsDevice`

`getEmulation()`

```
public HGraphicsConfigTemplate getEmulation()
```

Returns an `HGraphicsConfigTemplate` describing the virtual (emulation) characteristics of the `HEmulatedGraphicsDevice`.

Returns:

an `HGraphicsConfigTemplate` describing the virtual (emulation) characteristics of the `HEmulatedGraphicsDevice`.

See Also:

`HGraphicsConfigTemplate`, `HEmulatedGraphicsDevice`

`getImplementation()`

```
public HGraphicsConfigTemplate getImplementation()
```

Returns an `HGraphicsConfigTemplate` describing the physical (implementation) characteristics of the `HEmulatedGraphicsDevice`.

Returns:

an `HGraphicsConfigTemplate` describing the physical (implementation) characteristics of the `HEmulatedGraphicsDevice`.

See Also:

`HGraphicsConfigTemplate`, `HEmulatedGraphicsDevice`

org.havi.ui HEmulatedGraphicsDevice

Syntax

```
public abstract class HEmulatedGraphicsDevice extends HGraphicsDevice
```

```
java.lang.Object
|
+--HScreenDevice
|
+--HGraphicsDevice
|
+--org.havi.ui.HEmulatedGraphicsDevice
```

All Implemented Interfaces:

org.davic.resources.ResourceProxy, org.davic.resources.ResourceServer

Description

An `HEmulatedGraphicsDevice` is a "virtual" graphics device that has the capability to be configured to perform one (of many) possible emulations. For example, in the DVB context a 4:3 television might have an `HEmulatedGraphicsDevice` that had an `HEmulatedGraphicsConfiguration` that emulated a virtual 14:9 display. The 14:9 `HEmulatedGraphicsConfiguration` would be used for rendering into from AWT, whilst being displayed on the "true" 4:3 physical display. The relationship between the emulation and implementation is encapsulated within the `HEmulatedGraphicsConfiguration`.

An `HEmulatedGraphicsDevice` transforms both AWT pixel-oriented drawing operations and AWT user-input event coordinates, this is performed outside of the Java application (typically in hardware).

An `HEmulatedGraphicsDevice` may (of necessity) modify coordinates for Components and/or events to the nearest physical / virtual pixel --- authors should not depend on single pixel accuracy.

There is no difference to a Java application between an `HGraphicsDevice` and an `HEmulatedGraphicsDevice`, except for the implication of possible rounding errors in integer pixel positions, e.g. Component placement and/or resolution of events.

Java2D mechanisms should behave as per their normal semantics, with respect to display on-screen.

Constructors

HEmulatedGraphicsDevice()

```
protected HEmulatedGraphicsDevice()
```

It is not intended that applications should directly construct `HEmulatedGraphicsDevice` objects.

Creates an `HEmulatedGraphicsDevice` object. See the class description for details of constructor parameters and default values.

Methods

setGraphicsConfiguration(HEmulatedGraphicsConfiguration)

```
public boolean setGraphicsConfiguration(HEmulatedGraphicsConfiguration hegc)
```

Set the graphics configuration for the device.

Parameters:

hegc - the `HEmulatedGraphicsConfiguration` to which this device should be set.

Returns:

A boolean indicating whether the configuration could be applied successfully. If the configuration could not be applied successfully, the configuration after this method may not match the configuration of the device prior to this method being called --- applications should take steps to determine whether a partial change of settings has been made.

Throws:

`SecurityException` - if the application does not have sufficient rights to set the configuration for this device.

`HPermissionDeniedException` - (`HPermissionDeniedException`) if the application does not currently have the right to set the configuration for this device.

`HConfigurationException` - (`HConfigurationException`) if the specified configuration is not valid for this device.

org.havi.ui

HEventMulticaster

Syntax

```
public class HEventMulticaster implements HBackgroundImageListener,
    HScreenConfigurationListener, HScreenLocationModifiedListener,
    java.awt.event.WindowListener, HActionListener, HAdjustmentListener, HFocusListener,
    HItemListener, HTextListener, HKeyListener, org.davic.resources.ResourceStatusListener

java.lang.Object
|
+--org.havi.ui.HEventMulticaster
```

All Implemented Interfaces:

```
java.awt.event.ActionListener, java.util.EventListener, java.awt.event.FocusListener,
HActionListener, HAdjustmentListener, HBackgroundImageListener,
HFocusListener, HItemListener, HKeyListener, HScreenConfigurationListener,
HScreenLocationModifiedListener, HTextListener, java.awt.event.KeyListener,
org.davic.resources.ResourceStatusListener, java.awt.event.WindowListener
```

Description

The `HEventMulticaster` class is intended to handle event dispatching for the following HAVi events:

- `HBackgroundImageEvent`
- `HScreenConfigurationEvent`
- `HScreenLocationModifiedEvent`
- `HActionEvent`
- `HFocusEvent`
- `HItemEvent`
- `HTextEvent`
- `HKeyEvent`
- `HAdjustmentEvent`
- `java.awt.event.WindowEvent`
- `org.davic.resources.ResourceStatusEvent`

It is an implementation option for this class to insert other classes in the inheritance tree (for example `java.awt.AWTEventMulticaster`). It is allowed that this may result in `HEventMulticaster` inheriting additional methods beyond those specified here.

Note: the `org.davic.resources.ResourceStatusListener` specification does not require `EventListener` to be present. In a HAVi UI implementation, `ResourceStatusListener` shall extend `EventListener`.

The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

HBackgroundImageListener, HScreenConfigurationListener,
HScreenLocationModifiedListener, HActionListener, HAdjustmentListener,
HFocusListener, HItemListener, HTextListener, HKeyListener,
java.awt.event.WindowListener, org.davic.resources.ResourceStatusListener

Fields

a

protected final java.util.EventListener a

b

protected final java.util.EventListener b

Constructors

HEventMulticaster(EventListener, EventListener)

protected HEventMulticaster(java.util.EventListener a, java.util.EventListener b)

Creates an event multicaster instance which chains listener-a with listener-b.

Parameters:

a - listener-a

b - listener-b

Methods

actionPerformed(ActionEvent)

public void actionPerformed(java.awt.event.ActionEvent e)

Handles the ActionEvent by invoking the actionPerformed methods on listener-a and listener-b.

Specified By:

java.awt.event.ActionListener.actionPerformed(java.awt.event.ActionEvent) in interface
java.awt.event.ActionListener

Parameters:

e - the ActionEvent event

add(HActionListener, HActionListener)

```
public static HActionListener add(HActionListener a, HActionListener b)
```

Adds `HActionListener -a` with `HActionListener -b` and returns the resulting multicast listener.

Parameters:

a - `HActionListener-a`

b - `HActionListener-b`

add(HAdjustmentListener, HAdjustmentListener)

```
public static HAdjustmentListener add(HAdjustmentListener a, HAdjustmentListener b)
```

Adds `HAdjustmentListener -a` with `HAdjustmentListener -b` and returns the resulting multicast listener.

Parameters:

a - `HAdjustmentListener-a`

b - `HAdjustmentListener-b`

add(HBackgroundImageListener, HBackgroundImageListener)

```
public static HBackgroundImageListener add(HBackgroundImageListener a,  
                                           HBackgroundImageListener b)
```

Adds `HBackgroundImageListener -a` with `HBackgroundImageListener -b` and returns the resulting multicast listener.

Parameters:

a - `HBackgroundImageListener-a`

b - `HBackgroundImageListener-b`

add(HFocusListener, HFocusListener)

```
public static HFocusListener add(HFocusListener a, HFocusListener b)
```

Adds `HFocusListener -a` with `HFocusListener -b` and returns the resulting multicast listener.

Parameters:

a - `HFocusListener-a`

b - `HFocusListener-b`

add(HItemListener, HItemListener)

```
public static HItemListener add(HItemListener a, HItemListener b)
```

Adds `HItemListener -a` with `HItemListener -b` and returns the resulting multicast listener.

Parameters:

a - `HItemListener-a`

b - `HItemListener-b`

add(HKeyListener, HKeyListener)

```
public static HKeyListener add(HKeyListener a, HKeyListener b)
```

Adds `HKeyListener -a` with `HKeyListener -b` and returns the resulting multicast listener.

Parameters:

- a - HKeyListener-a
- b - HKeyListener-b

add(HScreenConfigurationListener, HScreenConfigurationListener)

```
public static HScreenConfigurationListener add(HScreenConfigurationListener a,
                                             HScreenConfigurationListener b)
```

Adds `HScreenConfigurationListener -a` with `HScreenConfigurationListener -b` and returns the resulting multicast listener.

Parameters:

- a - HScreenConfigurationListener-a
- b - HScreenConfigurationListener-b

add(HScreenConfigurationListener, HScreenConfigurationListener, HScreenConfigTemplate)

```
public static HScreenConfigurationListener add(HScreenConfigurationListener a,
                                             HScreenConfigurationListener b, HScreenConfigTemplate tb)
```

Adds `HScreenConfigurationListener -a` with `HScreenConfigurationListener -b`, which is notified when the `HScreenDevice` configuration is modified so that it is no longer compatible with the `HScreenConfigTemplate tb`. It returns the resulting multicast listener.

Parameters:

- a - HScreenConfigurationListener-a
- b - HScreenConfigurationListener-b
- tb - HScreenConfigTemplate associated with HScreenConfigurationListener-b

add(HScreenLocationModifiedListener, HScreenLocationModifiedListener)

```
public static HScreenLocationModifiedListener add(HScreenLocationModifiedListener a,
                                                HScreenLocationModifiedListener b)
```

Adds `HScreenLocationModifiedListener -a` with `HScreenLocationModifiedListener -b` and returns the resulting multicast listener.

Parameters:

- a - HScreenLocationModifiedListener-a
- b - HScreenLocationModifiedListener-b

add(HTextListener, HTextListener)

```
public static HTextListener add(HTextListener a, HTextListener b)
```

Adds `HTextListener -a` with `HTextListener -b` and returns the resulting multicast listener.

Parameters:

- a - HTextListener-a
- b - HTextListener-b

add(ResourceStatusListener, ResourceStatusListener)

```
public static org.davic.resources.ResourceStatusListener
    add(org.davic.resources.ResourceStatusListener a,
        org.davic.resources.ResourceStatusListener b)
```

Adds ResourceStatusListener-a with listener-b and returns the resulting multicast listener. In a HAVi UI implementation, ResourceStatusListener shall extend EventListener.

Parameters:

a - listener-a

b - listener-b

add(WindowListener, WindowListener)

```
public static java.awt.event.WindowListener add(java.awt.event.WindowListener a,
        java.awt.event.WindowListener b)
```

Adds WindowListener-a with WindowListener-b and returns the resulting multicast listener.

Parameters:

a - WindowListener-a

b - WindowListener-b

addInternal(EventListener, EventListener)

```
protected static java.util.EventListener addInternal(java.util.EventListener a,
        java.util.EventListener b)
```

Returns the resulting multicast listener from adding listener-a and listener-b together. If listener-a is null, it returns listener-b; if listener-b is null, it returns listener-a. If neither are null, then it creates and returns a new HEventMulticaster instance which chains a with b.

Parameters:

a - event listener-a

b - event listener-b

caretMoved(HTextEvent)

```
public void caretMoved(HTextEvent e)
```

Handles the HTextEvent by invoking the caretMoved(HTextEvent) methods on listener-a and listener-b.

Specified By:

caretMoved(HTextEvent) in interface HTextListener

Parameters:

e - the HTextEvent event

currentItemChanged(HItemEvent)

```
public void currentItemChanged(HItemEvent e)
```

Handles the HItemEvent by invoking the currentItemChanged(HItemEvent) methods on listener-a and listener-b.

Specified By:

currentItemChanged(HItemEvent) in interface HItemListener

Parameters:

e - the HItemEvent event

focusGained(FocusEvent)

```
public void focusGained(java.awt.event.FocusEvent e)
```

Handles the FocusEvent by invoking the focusGained methods on listener-a and listener-b.

Specified By:

```
java.awt.event.FocusListener.focusGained(java.awt.event.FocusEvent) in interface
```

```
java.awt.event.FocusListener
```

Parameters:

e - the FocusEvent event

focusLost(FocusEvent)

```
public void focusLost(java.awt.event.FocusEvent e)
```

Handles the FocusEvent by invoking the focusLost methods on listener-a and listener-b.

Specified By:

```
java.awt.event.FocusListener.focusLost(java.awt.event.FocusEvent) in interface
```

```
java.awt.event.FocusListener
```

Parameters:

e - the FocusEvent event

imageLoaded(HBackgroundImageEvent)

```
public void imageLoaded(HBackgroundImageEvent e)
```

Handles the `HBackgroundImageEvent` by invoking the `imageLoaded(HBackgroundImageEvent)` methods on listener-a and listener-b.

Specified By:

```
imageLoaded(HBackgroundImageEvent) in interface HBackgroundImageListener
```

Parameters:

e - the HBackgroundImageEvent event

imageLoadFailed(HBackgroundImageEvent)

```
public void imageLoadFailed(HBackgroundImageEvent e)
```

Handles the `HBackgroundImageEvent` by invoking the `imageLoadFailed(HBackgroundImageEvent)` methods on listener-a and listener-b.

Specified By:

```
imageLoadFailed(HBackgroundImageEvent) in interface
```

```
HBackgroundImageListener
```

Parameters:

e - the HBackgroundImageEvent event

keyPressed(KeyEvent)

```
public void keyPressed(java.awt.event.KeyEvent e)
```

Handles the `HKeyEvent` by invoking the `keyPressed` methods on listener-a and listener-b.

Specified By:

```
java.awt.event.KeyListener.keyPressed(java.awt.event.KeyEvent) in interface
```

```
java.awt.event.KeyListener
```

Parameters:

e - the HKeyEvent event

keyReleased(KeyEvent)

```
public void keyReleased(java.awt.event.KeyEvent e)
```

Handles the `HKeyEvent` by invoking the `keyReleased` methods on listener-a and listener-b.

Specified By:

`java.awt.event.KeyListener.keyReleased(java.awt.event.KeyEvent)` in interface
`java.awt.event.KeyListener`

Parameters:

e - the HKeyEvent event

keyTyped(KeyEvent)

```
public void keyTyped(java.awt.event.KeyEvent e)
```

Handles the `HKeyEvent` by invoking the `keyTyped` methods on listener-a and listener-b.

Specified By:

`java.awt.event.KeyListener.keyTyped(java.awt.event.KeyEvent)` in interface
`java.awt.event.KeyListener`

Parameters:

e - the HKeyEvent event

remove(EventListener)

```
protected java.util.EventListener remove(java.util.EventListener old1)
```

Removes a listener from this multicaster and returns the resulting multicast listener.

Parameters:

old1 - the listener to be removed

remove(HActionListener, HActionListener)

```
public static HActionListener remove(HActionListener l, HActionListener old1)
```

Removes the old `HActionListener` from `HActionListener-l` and returns the resulting multicast listener.

Parameters:

l - HActionListener-l

old1 - the HActionListener being removed

remove(HAdjustmentListener, HAdjustmentListener)

```
public static HAdjustmentListener remove(HAdjustmentListener l, HAdjustmentListener old1)
```

Removes the old `HAdjustmentListener` from `HAdjustmentListener-l` and returns the resulting multicast listener.

Parameters:

l - HAdjustmentListener-l

old1 - the HAdjustmentListener being removed

remove(HBackgroundImageListener, HBackgroundImageListener)

```
public static HBackgroundImageListener remove(HBackgroundImageListener l,
                                             HBackgroundImageListener oldl)
```

Removes the old `HBackgroundImageListener` from `HBackgroundImageListener -l` and returns the resulting multicast listener.

Parameters:

- `l` - `HBackgroundImageListener-l`
- `oldl` - the `HBackgroundImageListener` being removed

remove(HFocusListener, HFocusListener)

```
public static HFocusListener remove(HFocusListener l, HFocusListener oldl)
```

Removes the old `HFocusListener` from `HFocusListener -l` and returns the resulting multicast listener.

Parameters:

- `l` - `HFocusListener-l`
- `oldl` - the `HFocusListener` being removed

remove(HItemListener, HItemListener)

```
public static HItemListener remove(HItemListener l, HItemListener oldl)
```

Removes the old `HItemListener` from `HItemListener -l` and returns the resulting multicast listener.

Parameters:

- `l` - `HItemListener-l`
- `oldl` - the `HItemListener` being removed

remove(HKeyListener, HKeyListener)

```
public static HKeyListener remove(HKeyListener l, HKeyListener oldl)
```

Removes the old `HKeyListener` from `HKeyListener -l` and returns the resulting multicast listener.

Parameters:

- `l` - `HKeyListener-l`
- `oldl` - the `HKeyListener` being removed

remove(HScreenConfigurationListener, HScreenConfigurationListener)

```
public static HScreenConfigurationListener remove(HScreenConfigurationListener l,
                                                  HScreenConfigurationListener oldl)
```

Removes the old `HScreenConfigurationListener` from `HScreenConfigurationListener -l` and returns the resulting multicast listener.

Parameters:

- `l` - `HScreenConfigurationListener-l`
- `oldl` - the `HScreenConfigurationListener` being removed

remove(HScreenLocationModifiedListener, HScreenLocationModifiedListener)

```
public static HScreenLocationModifiedListener remove(HScreenLocationModifiedListener l,
    HScreenLocationModifiedListener oldl)
```

Removes the old `HScreenLocationModifiedListener` from `HScreenLocationModifiedListener` -l and returns the resulting multicast listener.

Parameters:

- l - HScreenLocationModifiedListener-l
- oldl - the HScreenLocationModifiedListener being removed

remove(HTextListener, HTextListener)

```
public static HTextListener remove(HTextListener l, HTextListener oldl)
```

Removes the old `HTextListener` from `HTextListener` -l and returns the resulting multicast listener.

Parameters:

- l - HTextListener-l
- oldl - the HTextListener being removed

remove(ResourceStatusListener, ResourceStatusListener)

```
public static org.davic.resources.ResourceStatusListener
    remove(org.davic.resources.ResourceStatusListener l,
    org.davic.resources.ResourceStatusListener oldl)
```

Removes the old `ResourceStatusListener` from `ResourceStatusListener`-l and returns the resulting multicast listener. In a HAVi UI implementation, `ResourceStatusListener` shall extend `EventListener`.

Parameters:

- l - ResourceStatusListener-l
- oldl - the ResourceStatusListener being removed

remove(WindowListener, WindowListener)

```
public static java.awt.event.WindowListener remove(java.awt.event.WindowListener l,
    java.awt.event.WindowListener oldl)
```

Removes the old `WindowListener` from `WindowListener`-l and returns the resulting multicast listener.

Parameters:

- l - WindowListener-l
- oldl - the WindowListener being removed

removeInternal(EventListener, EventListener)

```
protected static java.util.EventListener removeInternal(java.util.EventListener l,
    java.util.EventListener oldl)
```

Returns the resulting multicast listener after removing the old listener from listener-l. If listener-l equals the old listener OR listener-l is null, returns null. Else if listener-l is an instance of `HEventMulticaster`, then it removes the old listener from it. Else, returns listener l.

Parameters:

- l - the listener being removed from
- oldl - the listener being removed

report(HScreenConfigurationEvent)

```
public void report(HScreenConfigurationEvent e)
```

Handles the `HScreenConfigurationEvent` by invoking the `report(HScreenConfigurationEvent)` methods on listener-a and listener-b.

Specified By:

```
report(HScreenConfigurationEvent) in interface HScreenConfigurationListener
```

Parameters:

e - the `HScreenConfigurationEvent` event

report(HScreenLocationModifiedEvent)

```
public void report(HScreenLocationModifiedEvent e)
```

Handles the `HScreenLocationModifiedEvent` by invoking the `report(HScreenLocationModifiedEvent)` methods on listener-a and listener-b.

Specified By:

```
report(HScreenLocationModifiedEvent) in interface  
HScreenLocationModifiedListener
```

Parameters:

e - the `HScreenLocationModifiedEvent` event

selectionChanged(HItemEvent)

```
public void selectionChanged(HItemEvent e)
```

Handles the `HItemEvent` by invoking the `selectionChanged(HItemEvent)` methods on listener-a and listener-b.

Specified By:

```
selectionChanged(HItemEvent) in interface HItemListener
```

Parameters:

e - the `HItemEvent` event

statusChanged(ResourceStatusEvent)

```
public void statusChanged(org.davic.resources.ResourceStatusEvent e)
```

Handles the `ResourceStatusEvent` by invoking the `statusChanged` methods on listener-a and listener-b.

Specified By:

```
org.davic.resources.ResourceStatusListener.statusChanged(org.davic.resources.ResourceStat  
usEvent) in interface org.davic.resources.ResourceStatusListener
```

Parameters:

e - the `ResourceStatusEvent` event

textChanged(HTextEvent)

```
public void textChanged(HTextEvent e)
```

Handles the `HTextEvent` by invoking the `textChanged(HTextEvent)` methods on listener-a and listener-b.

Specified By:

`textChanged(HTextEvent)` in interface `HTextListener`

Parameters:

e - the `HTextEvent` event

valueChanged(HAdjustmentEvent)

```
public void valueChanged(HAdjustmentEvent e)
```

Handles the `HAdjustmentEvent` by invoking the `valueChanged(HAdjustmentEvent)` methods on listener-a and listener-b.

Specified By:

`valueChanged(HAdjustmentEvent)` in interface `HAdjustmentListener`

Parameters:

e - the `HAdjustmentEvent` event

windowActivated(WindowEvent)

```
public void windowActivated(java.awt.event.WindowEvent e)
```

Handles the `windowActivated` event by invoking the `windowActivated` methods on listener-a and listener-b.

Specified By:

`java.awt.event.WindowListener.windowActivated(java.awt.event.WindowEvent)` in interface `java.awt.event.WindowListener`

Parameters:

e - the window event

windowClosed(WindowEvent)

```
public void windowClosed(java.awt.event.WindowEvent e)
```

Handles the `windowClosed` event by invoking the `windowClosed` methods on listener-a and listener-b.

Specified By:

`java.awt.event.WindowListener.windowClosed(java.awt.event.WindowEvent)` in interface `java.awt.event.WindowListener`

Parameters:

e - the window event

windowClosing(WindowEvent)

```
public void windowClosing(java.awt.event.WindowEvent e)
```

Handles the `windowClosing` event by invoking the `windowClosing` methods on listener-a and listener-b.

Specified By:

`java.awt.event.WindowListener.windowClosing(java.awt.event.WindowEvent)` in interface `java.awt.event.WindowListener`

Parameters:

e - the window event

windowDeactivated(WindowEvent)

```
public void windowDeactivated(java.awt.event.WindowEvent e)
```

Handles the windowDeactivated event by invoking the windowDeactivated methods on listener-a and listener-b.

Specified By:

java.awt.event.WindowListener.windowDeactivated(java.awt.event.WindowEvent) in interface java.awt.event.WindowListener

Parameters:

e - the window event

windowDeiconified(WindowEvent)

```
public void windowDeiconified(java.awt.event.WindowEvent e)
```

Handles the windowDeiconified event by invoking the windowDeiconified methods on listener-a and listener-b.

Specified By:

java.awt.event.WindowListener.windowDeiconified(java.awt.event.WindowEvent) in interface java.awt.event.WindowListener

Parameters:

e - the window event

windowIconified(WindowEvent)

```
public void windowIconified(java.awt.event.WindowEvent e)
```

Handles the windowIconified event by invoking the windowIconified methods on listener-a and listener-b.

Specified By:

java.awt.event.WindowListener.windowIconified(java.awt.event.WindowEvent) in interface java.awt.event.WindowListener

Parameters:

e - the window event

windowOpened(WindowEvent)

```
public void windowOpened(java.awt.event.WindowEvent e)
```

Handles the windowOpened event by invoking the windowOpened methods on listener-a and listener-b.

Specified By:

java.awt.event.WindowListener.windowOpened(java.awt.event.WindowEvent) in interface java.awt.event.WindowListener

Parameters:

e - the window event

org.havi.ui HFlatEffectMatte

Syntax

```
public class HFlatEffectMatte implements HMatte, HAnimateEffect
```

```
java.lang.Object
|
+--org.havi.ui.HFlatEffectMatte
```

All Implemented Interfaces:

```
HAnimateEffect, HMatte
```

Description

The `HFlatEffectMatte` class represents a matte that is constant over space but varies over time. It is specified as a sequence of floating point values in the range 0.0 to 1.0 where:

- 0.0 is fully transparent
- values between 0.0 and 1.0 are partially transparent to the nearest supported transparency value.
- 1.0 is fully opaque

The data for any `HFlatEffectMatte` may be changed "on the fly" using the `setMatteData(float[])` method. However, some implementations may be asynchronously referencing their content (i.e. through a separate implementation-specific animation thread). Therefore the following restrictions apply to the `setMatteData(float[])` method:

- The method must be synchronized with any implementation-specific animation thread such that content cannot be changed while a different thread is using it.
- If the animation was running the method should stop the animation in a synchronized manner before changing content.
- The method should reset the animation to a starting position defined by the current play mode. The repeat count of the animation should be reset to 0.
- If the animation was running the method should start the animation.

The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
data	The transparency value for this flat effect matte.	null (the matte should be treated as being temporally unvarying and opaque)	<code>setMatteData(float[])</code>	<code>getMatteData()</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
The initial piece of content to be presented, i.e. its position in the content array.	0	<code>setPosition(int)</code>	<code>getPosition()</code>

By default the animation should be stopped. Hence, to start the animation its start method must be explicitly invoked. This mechanism allows for animations that are programmatically controlled, e.g. via the setPosition method.

"stopped"

start() / isAnimated()
stop()

Constructors

HFlatEffectMatte()

```
public HFlatEffectMatte()
```

Creates an `HFlatEffectMatte` object. See the class description for details of constructor parameters and default values.

HFlatEffectMatte(float[])

```
public HFlatEffectMatte(float[] data)
```

Creates an `HFlatEffectMatte` object. See the class description for details of constructor parameters and default values.

Methods

getDelay()

```
public int getDelay()
```

Gets the presentation delay for this `HFlatEffectMatte`.

Specified By:

`getDelay()` in interface `HAnimateEffect`

Returns:

the presentation delay in units of 0.1 seconds.

getMatteData()

```
public float[] getMatteData()
```

Returns the matte data used for this matte.

Returns:

the data used for this matte (an array of numbers), or null if no matte data has been set.

getPlayMode()

```
public int getPlayMode()
```

Gets the playing mode for this `HFlatEffectMatte`.

Specified By:

`getPlayMode()` in interface `HAnimateEffect`

Returns:

the play mode for this `HFlatEffectMatte` .

getPosition()

```
public int getPosition()
```

Get the current index into the content array which this `HFlatEffectMatte` is using to display content.

Specified By:

```
getPosition() in interface HAnimateEffect
```

Returns:

the index of the content currently being displayed, in the range $0 \leq \text{index} < \text{length}$

getRepeatCount()

```
public int getRepeatCount()
```

Gets the number of times that this `HFlatEffectMatte` is to be played. Note that this method does *not* return the number of repeats that are remaining to be played.

Specified By:

```
getRepeatCount() in interface HAnimateEffect
```

Returns:

the total number of times that an `HFlatEffectMatte` is to be played. The returned value shall be greater than zero, or `REPEAT_INFINITE` .

isAnimated()

```
public boolean isAnimated()
```

This method indicates the animation (running) state of the `HFlatEffectMatte` .

Specified By:

```
isAnimated() in interface HAnimateEffect
```

Returns:

`true` if this `HFlatEffectMatte` is running, i.e. the `start` method has been invoked - `false` otherwise.

setDelay(int)

```
public void setDelay(int count)
```

Sets the delay between the presentation of successive pieces of content (frames).

After calling `setDelay(int)` on a currently playing `HFlatEffectMatte` , there is no guarantee that one or more frames will not be displayed using the previous delay until the new delay value takes effect.

Specified By:

```
setDelay(int) in interface HAnimateEffect
```

Parameters:

`count` - the content presentation delay in units of 0.1 seconds duration. If `count` is less than one "unit", then it shall be treated as if it were a delay of one "unit", i.e. 0.1 seconds.

setMatteData(float[])

```
public void setMatteData(float[] data)
```

Sets the data for this matte. Any previously set data is replaced. If this method is called when the animation is running the data is changed immediately and the current animation position is reset according to the active play mode. The changes affect the animation immediately.

Parameters:

`data` - the data for this matte. Specify a null object to remove the associated data for this matte. If the length of the data array is zero, an `IllegalArgumentException` is thrown.

setPlayMode(int)

```
public void setPlayMode(int mode)
```

Sets the playing mode for this `HFlatEffectMatte`. If the animation is already running a call to `setPlayMode` will change the current value and affect the animation immediately. The position of the animation is unchanged.

Specified By:

`setPlayMode(int)` in interface `HAnimateEffect`

Parameters:

`mode` - the play mode for this `HFlatEffectMatte`, which must be either `PLAY_ALTERNATING` or `PLAY_REPEATING`.

setPosition(int)

```
public void setPosition(int position)
```

Set this `HFlatEffectMatte` to display the content at the specified position. If the animation is already running a call to `setPosition` will change the current value and affect the animation immediately.

Specified By:

`setPosition(int)` in interface `HAnimateEffect`

Parameters:

`position` - an index into the content array which specifies the next piece of content to be displayed. If `position` is less than 0, then the array element at index 0 is displayed, if `position` is greater than or equal to the length of the content array, then the array element at index `[length-1]` will be used.

setRepeatCount(int)

```
public void setRepeatCount(int count)
```

Sets the number of times that this `HFlatEffectMatte` should be played. If the animation is already running a call to `setRepeatCount` will change the current value and reset the current number of repeats to 0, affecting the animation immediately.

Specified By:

`setRepeatCount(int)` in interface `HAnimateEffect`

Parameters:

`count` - the number of times that an `HFlatEffectMatte` should be played. Valid values of the repeat count are one or more, and `REPEAT_INFINITE`.

start()

```
public void start()
```

This method starts this `HFlatEffectMatte` playing. If `start` is called when the animation is already running it resets the animation according to the current play mode, as returned by `getPlayMode()`.

Specified By:

`start()` in interface `HAnimateEffect`

stop()

`public void stop()`

This method indicates that the running `HFlatEffectMatte` should be stopped. After calling this method, there is no guarantee that one or more frames will not be displayed before the animation actually stops playing. If the animation is already stopped further calls to `stop` have no effect.

Specified By:

`stop()` in interface `HAnimateEffect`

org.havi.ui

HFlatMatte

Syntax

public class HFlatMatte implements HMatte

```
java.lang.Object
|
+--org.havi.ui.HFlatMatte
```

All Implemented Interfaces:

HMatte

Description

The `HFlatMatte` class represents a matte that is constant over space and time. It is specified as a floating point value in the range 0.0 to 1.0 where:

- 0.0 is fully transparent
- values between 0.0 and 1.0 are partially transparent to the nearest supported transparency value.
- 1.0 is fully opaque

The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
data	The transparency value for this flat effect matte.	1.0	<code>setMatteData(float)</code>	<code>getMatteData()</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HFlatMatte()

```
public HFlatMatte()
```

Creates an `HFlatMatte` object. See the class description for details of constructor parameters and default values.

HFlatMatte(float)

```
public HFlatMatte(float data)
```

Creates an `HFlatMatte` object. See the class description for details of constructor parameters and default values.

Methods

getMatteData()

```
public float getMatteData()
```

Returns the data used for this matte.

Returns:

the data used for this matte (a single number).

setMatteData(float)

```
public void setMatteData(float data)
```

Sets the data for this matte. Any previously set data is replaced.

Parameters:

`data` - the data for this matte.

org.havi.ui

HFontCapabilities

Syntax

```
public class HFontCapabilities

java.lang.Object
|
+--org.havi.ui.HFontCapabilities
```

Description

The `HFontCapabilities` class allows applications to query the rendering support for various character ranges and individual characters within specified fonts.

Fields

ALPHABETIC_PRESENTATION_FORMS_A

```
public static final int ALPHABETIC_PRESENTATION_FORMS_A
```

This corresponds to the character range (U+FB00..U+FB4F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

ARABIC_EXTENDED

```
public static final int ARABIC_EXTENDED
```

This corresponds to the character range (U+653..U+6FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

ARABIC_PRESENTATION_FORMS_A

```
public static final int ARABIC_PRESENTATION_FORMS_A
```

This corresponds to the character range (U+FB50..U+FDFF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

ARABIC_PRESENTATION_FORMS_B

```
public static final int ARABIC_PRESENTATION_FORMS_B
```

This corresponds to the character range (U+FE70..U+FEFE) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

ARMENIAN

```
public static final int ARMENIAN
```

This corresponds to the character range (U+530..U+58F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

ARROWS

```
public static final int ARROWS
```

This corresponds to the character range (U+2190..U+21FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BASIC_ARABIC

```
public static final int BASIC_ARABIC
```

This corresponds to the character range (U+600..U+652) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BASIC_GEORGIAN

```
public static final int BASIC_GEORGIAN
```

This corresponds to the character range (U+10D0..U+10FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BASIC_GREEK

```
public static final int BASIC_GREEK
```

This corresponds to the character range (U+0370..U+03CF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BASIC_HEBREW

```
public static final int BASIC_HEBREW
```

This corresponds to the character range (U+5D0..U+5EA) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BASIC_LATIN

```
public static final int BASIC_LATIN
```

This corresponds to the character range (U+0020..U+007E) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BENGALI

```
public static final int BENGALI
```

This corresponds to the character ranges (U+980..U+9FF) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BLOCK_ELEMENTS

```
public static final int BLOCK_ELEMENTS
```

This corresponds to the character range (U+2580..U+259F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BOPOMOFO

```
public static final int BOPOMOFO
```

This corresponds to the character range (U+3100..U+312F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

BOX_DRAWING

```
public static final int BOX_DRAWING
```

This corresponds to the character range (U+2500..U+257F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CJK_COMPATIBILITY

```
public static final int CJK_COMPATIBILITY
```

This corresponds to the character range (U+3300..U+33FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CJK_COMPATIBILITY_FORMS

```
public static final int CJK_COMPATIBILITY_FORMS
```

This corresponds to the character range (U+FE30..U+FE4F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CJK_COMPATIBILITY_IDEOGRAPHS

```
public static final int CJK_COMPATIBILITY_IDEOGRAPHS
```

This corresponds to the character range (U+F900..U+FAFF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CJK_MISCELLANEOUS

```
public static final int CJK_MISCELLANEOUS
```

This corresponds to the character range (U+3190..U+319F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CJK_SYMBOLS_AND_PUNCTUATION

```
public static final int CJK_SYMBOLS_AND_PUNCTUATION
```

This corresponds to the character range (U+3000..U+303F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CJK_UNIFIED_IDEOGRAPHS

```
public static final int CJK_UNIFIED_IDEOGRAPHS
```

This corresponds to the character range (U+4E00..U+9FFF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

COMBINING_DIACRITICAL_MARKS

```
public static final int COMBINING_DIACRITICAL_MARKS
```

This corresponds to the character range (U+0300..U+036F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

COMBINING_DIACRITICAL_MARKS_FOR_SYMBOLS

```
public static final int COMBINING_DIACRITICAL_MARKS_FOR_SYMBOLS
```

This corresponds to the character range (U+20D0..U+20FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

COMBINING_HALF_MARKS

```
public static final int COMBINING_HALF_MARKS
```

This corresponds to the character range (U+FE20..U+FE2F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CONTROL_PICTURES

```
public static final int CONTROL_PICTURES
```

This corresponds to the character range (U+2400..U+243F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CURRENCY_SYMBOLS

```
public static final int CURRENCY_SYMBOLS
```

This corresponds to the character range (U+20A0..U+20CF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

CYRILLIC

```
public static final int CYRILLIC
```

This corresponds to the character range (U+400..U+4FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

DEVANAGARI

```
public static final int DEVANAGARI
```

This corresponds to the character ranges (U+0900..U+097F) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

DINGBATS

```
public static final int DINGBATS
```

This corresponds to the character range (U+2700..U+27BF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

ENCLOSED_ALPHANUMERICS

public static final int ENCLOSED_ALPHANUMERICS

This corresponds to the character range (U+2460..U+24FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

ENCLOSED_CJK_LETTERS_AND_MONTHS

public static final int ENCLOSED_CJK_LETTERS_AND_MONTHS

This corresponds to the character range (U+3200..U+32FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

GENERAL_PUNCTUATION

public static final int GENERAL_PUNCTUATION

This corresponds to the character range (U+2000..U+206F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

GEOMETRICAL_SHAPES

public static final int GEOMETRICAL_SHAPES

This corresponds to the character range (U+25A0..U+25FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

GEORGIAN_EXTENDED

public static final int GEORGIAN_EXTENDED

This corresponds to the character range (U+10A0..U+10CF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

GREEK_EXTENDED

public static final int GREEK_EXTENDED

This corresponds to the character range (U+1F00..U+1FFF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

GREEK_SYMBOLS_AND_COPTIC

public static final int GREEK_SYMBOLS_AND_COPTIC

This corresponds to the character range (U+3D0..U+3FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

GUJARATI

public static final int GUJARATI

This corresponds to the character ranges (U+0A80..U+0AFF) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

GURMUKHI

```
public static final int GURMUKHI
```

This corresponds to the character ranges (U+0A00..U+0A7F) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

HALFWIDTH_AND_FULLWIDTH_FORMS

```
public static final int HALFWIDTH_AND_FULLWIDTH_FORMS
```

This corresponds to the character range (U+FF00..U+FFEF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

HANGUL

```
public static final int HANGUL
```

This corresponds to the character range (U+3400..U+3D2D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

HANGUL_COMPATIBILITY_JAMO

```
public static final int HANGUL_COMPATIBILITY_JAMO
```

This corresponds to the character range (U+3130..U+318F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

HANGUL_JAMO

```
public static final int HANGUL_JAMO
```

This corresponds to the character range (U+1100..U+11FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

HANGUL_SUPPLEMENTARY_A

```
public static final int HANGUL_SUPPLEMENTARY_A
```

This corresponds to the character range (U+3D2E..U+44B7) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

HANGUL_SUPPLEMENTARY_B

```
public static final int HANGUL_SUPPLEMENTARY_B
```

This corresponds to the character range (U+44B8..U+4DFF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

HEBREW_EXTENDED

```
public static final int HEBREW_EXTENDED
```

This corresponds to the character ranges (U+590..U+5CF) and (U+5EB..U+5FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

HIRAGANA

```
public static final int HIRAGANA
```

This corresponds to the character range (U+3040..U+309F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

IPA_EXTENSIONS

```
public static final int IPA_EXTENSIONS
```

This corresponds to the character range (U+0250..U+02AF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

KANNADA

```
public static final int KANNADA
```

This corresponds to the character ranges (U+0C80..U+0CFF) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

KATAKANA

```
public static final int KATAKANA
```

This corresponds to the character range (U+30A0..U+30FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

LAO

```
public static final int LAO
```

This corresponds to the character range (U+0E80..U+0EFF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

LATIN_1_SUPPLEMENT

```
public static final int LATIN_1_SUPPLEMENT
```

This corresponds to the character range (U+00A0..U+00FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

LATIN_EXTENDED_A

```
public static final int LATIN_EXTENDED_A
```

This corresponds to the character range (U+0100..U+017F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

LATIN_EXTENDED_ADDITIONAL

```
public static final int LATIN_EXTENDED_ADDITIONAL
```

This corresponds to the character range (U+1E00..U+1EFF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

LATIN_EXTENDED_B

```
public static final int LATIN_EXTENDED_B
```

This corresponds to the character range (U+0180..U+024F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

LETTERLIKE_SYMBOLS

```
public static final int LETTERLIKE_SYMBOLS
```

This corresponds to the character range (U+2100..U+214F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

MALAYALAM

```
public static final int MALAYALAM
```

This corresponds to the character ranges (U+0D00..U+0D7F) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

MATHEMATICAL_OPERATORS

```
public static final int MATHEMATICAL_OPERATORS
```

This corresponds to the character range (U+2200..U+22FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

MISCELLANEOUS_SYMBOLS

```
public static final int MISCELLANEOUS_SYMBOLS
```

This corresponds to the character range (U+2600..U+26FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

MISCELLANEOUS_TECHNICAL

```
public static final int MISCELLANEOUS_TECHNICAL
```

This corresponds to the character range (U+2300..U+23FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

NUMBER_FORMS

```
public static final int NUMBER_FORMS
```

This corresponds to the character range (U+2150..U+218F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

OPTICAL_CHARACTER_RECOGNITION

```
public static final int OPTICAL_CHARACTER_RECOGNITION
```

This corresponds to the character range (U+2440..U+245F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

ORIYA

```
public static final int ORIYA
```

This corresponds to the character ranges (U+0B00..U+0B7F) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

PRIVATE_USE_AREA

```
public static final int PRIVATE_USE_AREA
```

This corresponds to the character range (U+E000..U+F8FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

SMALL_FORM_VARIANTS

```
public static final int SMALL_FORM_VARIANTS
```

This corresponds to the character range (U+FE50..U+FE6F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

SPACING_MODIFIER_LETTERS

```
public static final int SPACING_MODIFIER_LETTERS
```

This corresponds to the character range (U+02B0..U+02FF) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

SPECIALS

```
public static final int SPECIALS
```

This corresponds to the character range (U+FFF0..U+FFFD) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

SUPERSCRIPTS_AND_SUBSCRIPTS

```
public static final int SUPERSCRIPTS_AND_SUBSCRIPTS
```

This corresponds to the character range (U+2070..U+209F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

TAMIL

```
public static final int TAMIL
```

This corresponds to the character ranges (U+0B80..U+0BFF) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

TELUGU

```
public static final int TELUGU
```

This corresponds to the character ranges (U+0C00..U+0C7F) and (U+200C..U+200D) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

THAI

```
public static final int THAI
```

This corresponds to the character range (U+0E00..U+0E7F) as defined in ISO/IEC 10646-1:1993(E) normative Annex A

Constructors

HFontCapabilities()

```
protected HFontCapabilities()
```

It is not intended that applications should directly construct `HFontCapabilities` objects.

This method is protected to allow the platform to override it in a different package scope.

Methods

downloadFont(Font)

```
public static void downloadFont(java.awt.Font f)
```

Download a font which is only temporarily available on a platform. If called for fonts which are permanently available on a platform, this method has no effect. This method blocks while the font is downloaded. If the font is not accessible then this method has no effect and the normal Java font behavior is followed. The platform will use a platform dependent approximation of this font if needed. If a font is already downloaded then it shall not be downloaded again.

Parameters:

`f` - the font to load.

Throws:

`java.io.IOException` - if an error occurs while trying to download a font.

fontAccessible(Font)

```
public static boolean fontAccessible(java.awt.Font f)
```

Tests if the specified font is accessible in a form usable with this graphics configuration. For platforms which define a mechanism for (possibly temporary) download of fonts, this method shall check fonts available through that mechanism. This does not cause the font to be downloaded but indicates whether a download will succeed. If information needed to determine the existence of the font needs to be downloaded then that information shall be downloaded as part of the execution of this method. This method shall block while any such downloading happens. An error in the downloading of any such information shall be reported as the font not existing.

Parameters:

`f` - the font to test.

Returns:

`true` if the font is accessible, otherwise `false`.

getSupportedCharacterRanges(Font)

```
public static int[] getSupportedCharacterRanges(java.awt.Font font)
```

Returns the set of character ranges as defined in ISO/IEC 10646-1:1993(E) normative Annex A that this font supports, or a null array if the capabilities of the font are unknown.

Support for a character range does not imply that ALL characters within that range are available in the specified font.

When deciding whether a particular character range (U+XXXX..U+YYYY) is supported, characters which are in the GENERAL PUNCTUATION range shall not be considered for character ranges other than GENERAL PUNCTUATION.

Parameters:

`font` - The font to query for its support for Unicode ranges.

Returns:

An array of integer values, as defined in ISO/IEC 10646-1:1993(E) normative Annex A that this font supports, or null.

isCharAvailable(Font, char)

```
public static boolean isCharAvailable(java.awt.Font font, char c)
```

Returns whether a specific character is available within the specified font, and can be used as defined in ISO/IEC 10646-1:1993(E) specification by the rendering system, e.g. if rendering of bi-directional text, using BI-DIRECTIONAL_FORMAT_MARKS is supported

Parameters:

`font` - The font to query for its support for the specified character.

`c` - The character whose presence should be tested.

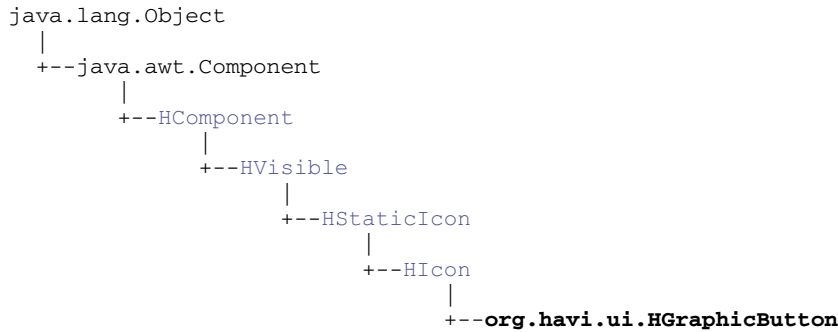
Returns:

`true` is the character is available within the font and can be rendered as defined in the ISO/IEC 10646-1:1993(E) specification, `false` otherwise.

org.havi.ui HGraphicButton

Syntax

```
public class HGraphicButton extends HIcon implements HActionable
```



Direct Known Subclasses:

`HToggleButton`

All Implemented Interfaces:

`HActionable`, `HActionInputPreferred`, `HMatteLayer`, `HNavigable`,
`HNavigationInputPreferred`, `HNoInputPreferred`, `HState`,
`java.awt.image.ImageObserver`, `java.awt.MenuContainer`, `java.io.Serializable`, `TestOpacity`

Description

The `HGraphicButton` is a user interface component representing a push-button with static read-only graphical content. This component can be navigated to, i.e. it can have the input focus, and it can also be actioned as defined by the `HActionable` interface. By default it uses the `HGraphicLook` class to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
height	height of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>

image	The image to be used as the content for every state of this component.	null	setGraphicContent(Image, int)	getGraphicContent(int)
imageNormal	The image to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	setGraphicContent(Image, int)	getGraphicContent(int)
imageFocus	The image to be used as the content for the focused states of this component.	null	setGraphicContent(Image, int)	getGraphicContent(int)
imageAction	The image to be used as the content for the actioned states of this component.	null	setGraphicContent(Image, int)	getGraphicContent(int)

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
The default "look" for this class.	A platform specific <code>HGraphicLook</code>	<code>setDefaultLook(HGraphicLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HGraphicLook</code> returned from <code>HGraphicButton.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The gain focus sound.	null	<code>setGainFocusSound(HSound)</code>	<code>getGainFocusSound()</code>

The lose focus sound.	null	<code>setLoseFocusSound(HSound)</code>	<code>getLoseFocusSound()</code>
The action sound.	null	<code>setActionSound(HSound)</code>	<code>getActionSound()</code>

See Also:

`HStaticIcon`, `HIcon`, `HNavigable`, `HActionable`

Constructors

HGraphicButton()

```
public HGraphicButton()
```

Creates an `HGraphicButton` object. See the class description for details of constructor parameters and default values.

HGraphicButton(Image)

```
public HGraphicButton(java.awt.Image image)
```

Creates an `HGraphicButton` object. See the class description for details of constructor parameters and default values.

HGraphicButton(Image, Image, Image)

```
public HGraphicButton(java.awt.Image imageNormal, java.awt.Image imageFocused,
    java.awt.Image imageActioned)
```

Creates an `HGraphicButton` object. See the class description for details of constructor parameters and default values.

HGraphicButton(Image, Image, Image, int, int, int, int)

```
public HGraphicButton(java.awt.Image imageNormal, java.awt.Image imageFocused,
    java.awt.Image imageActioned, int x, int y, int width, int height)
```

Creates an `HGraphicButton` object. See the class description for details of constructor parameters and default values.

HGraphicButton(Image, int, int, int, int)

```
public HGraphicButton(java.awt.Image image, int x, int y, int width, int height)
```

Creates an `HGraphicButton` object. See the class description for details of constructor parameters and default values.

Methods

addActionListener(HActionListener)

```
public void addActionListener(HActionListener l)
```

Adds the specified `HActionListener` to receive `HActionEvent` events sent from this `HGraphicButton`. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Specified By:

`addActionListener(HActionListener)` in interface `HActionable`

Parameters:

l - the `HActionListener`.

getActionCommand()

```
public java.lang.String getActionCommand()
```

Gets the command name for the `HActionEvent` event fired by this `HGraphicButton`.

Specified By:

`getActionCommand()` in interface `HActionable`

Returns:

A `String` representing the command name of the `HActionEvent` fired by this `HGraphicButton`.

See Also:

`getActionCommand()`

getActionSound()

```
public HSound getActionSound()
```

Associate a sound to be played when the interaction state of the `HGraphicButton` makes the following transitions:

- `NORMAL_STATE` to `ACTIONED_STATE`
- `FOCUSED_STATE` to `ACTIONED_FOCUSED_STATE`

Specified By:

`getActionSound()` in interface `HActionable`

Returns:

The sound played when the component is actioned.

getDefaultLook()

```
public static HGraphicLook getDefaultLook()
```

Returns the currently set default `HLook` for `HGraphicButton` components.

Returns:

The `HLook` that is used by default when creating a new `HGraphicButton`.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

`getGainFocusSound()` in interface `HNavigable`

Overrides:

`getGainFocusSound()` in class `HIcon`

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

`getLoseFocusSound()` in interface `HNavigable`

Overrides:

`getLoseFocusSound()` in class `HIcon`

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

`getMove(int)` in interface `HNavigable`

Overrides:

`getMove(int)` in class `HIcon`

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns null.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

`getNavigationKeys()` in interface `HNavigationInputPreferred`

Overrides:

`getNavigationKeys()` in class `HIcon`

Returns:

an array of key codes, or null if no navigation targets are set on this component.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

`isSelected()` in interface `HNavigable`

Overrides:

`isSelected()` in class `HIcon`

Returns:

`true` if the component has focus, otherwise returns `false`.

processHActionEvent(HActionEvent)

```
public void processHActionEvent(HActionEvent evt)
```

Process an `HActionEvent` sent to this `HGraphicButton`.

Specified By:

`processHActionEvent(HActionEvent)` in interface `HActionInputPreferred`

Parameters:

`evt` - the `HActionEvent` to process.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HGraphicButton`.

Specified By:

`processHFocusEvent(HFocusEvent)` in interface `HNavigationInputPreferred`

Overrides:

`processHFocusEvent(HFocusEvent)` in class `HIcon`

Parameters:

`evt` - the `HFocusEvent` to process.

removeHActionListener(HActionListener)

```
public void removeHActionListener(HActionListener l)
```

Removes the specified `HActionListener` so that it no longer receives `HActionEvent` events from this `HGraphicButton`. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Specified By:

`removeHActionListener(HActionListener)` in interface `HActionable`

Parameters:

`l` - the `HActionListener`.

setActionCommand(String)

```
public void setActionCommand(java.lang.String command)
```

Sets the command name for the `HActionEvent` event fired by this `HGraphicButton`.

Specified By:

`setActionCommand(String)` in interface `HActionable`

Parameters:

`command` - a `String` used to set the action command.

See Also:

`getActionCommand()`

setActionSound(HSound)

```
public void setActionSound(HSound sound)
```

Associate a sound to be played when the interaction state of the `HGraphicButton` makes the following transitions:

- `NORMAL_STATE` to `ACTIONED_STATE`
- `FOCUSED_STATE` to `ACTIONED_FOCUSED_STATE`

Specified By:

`setActionSound(HSound)` in interface `HActionable`

Parameters:

`sound` - the sound to be played, when the component is actioned. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setDefaultLook(HGraphicLook)

```
public static void setDefaultLook(HGraphicLook hlook)
```

Sets the default `HLook` for further `HGraphicButton` components.

Parameters:

`hlook` - The `HLook` that will be used by default when creating a new `HGraphicButton` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
    HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in interface `HNavigable`

Overrides:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in class `HIcon`

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` `KeyEvent`. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` `KeyEvent`. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` `KeyEvent`. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` `KeyEvent`. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setGainFocusSound(HSound)` in interface `HNavigable`

Overrides:

`setGainFocusSound(HSound)` in class `HIcon`

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Overrides:

`setLoseFocusSound(HSound)` in class `HIcon`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Overrides:

`setMove(int, HNavigable)` in class `HIcon`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

org.havi.ui

HGraphicLook

Syntax

public class HGraphicLook implements HLook

```
java.lang.Object
|
+--org.havi.ui.HGraphicLook
```

All Implemented Interfaces:

java.lang.Cloneable, HLook

Description

The `HGraphicLook` class is used by any `HVisible` component to display static graphical content. This look will be provided by the platform and the exact way in which it is rendered will be platform dependant.

The `HGraphicLook` class draws the content set on an `HVisible`. It uses the `getGraphicContent(int)` method with the current state of the `HVisible` to determine the content to render.

Implementations of `HGraphicLook` should use the appropriate methods on `HVisible` to determine which scaling and alignment modes to use when rendering content. See the class description for `HLook` for more details. `HGraphicLook` may support scalable graphical content. As a minimum, all implementations must support the `RESIZE_NONE` scaling mode, and all alignment modes.

Note that the results of applying the `VALIGN_JUSTIFY` and `HALIGN_JUSTIFY` alignment modes for graphical content are defined to identical to `VALIGN_CENTER` and `HALIGN_CENTER` modes respectively, as justification is meaningless in this context.

This is the default look that is used by `HStaticIcon` and its subclasses. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

`HStaticIcon`, `HVisible`, `HLook`

Constructors

HGraphicLook()

```
public HGraphicLook()
```

Creates a `HGraphicLook` object. See the class description for details of constructor parameters and default values.

Methods

getInsets(HVisible)

```
public java.awt.Insets getInsets(HVisible visible)
```

Determines the insets of this `HLook`, which indicate the size of the border. This area is reserved for the `HLook` to use for drawing borders around the associated `HVisible`.

Specified By:

`getInsets(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

the insets of this `HLook`.

getMaximumSize(HVisible)

```
public java.awt.Dimension getMaximumSize(HVisible hvisible)
```

Gets the maximum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) then the return value is the current size of the `HVisible` (as returned by `HVisible#getSize`).
2. If the `HLook` does not support scaling of content or no scaling is requested, and content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If there is no content set then a maximum size of `[Short.MAX_VALUE, Short.MAX_VALUE]` is returned as a `Dimension`.

Specified By:

`getMaximumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` maximum size.

See Also:

`getMaximumSize()`

getMinimumSize(HVisible)

```
public java.awt.Dimension getMinimumSize(HVisible hvisible)
```

Gets the minimum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the size of the smallest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If the `HLook` does not support scaling of content or no scaling is requested, *and* content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If no content is available but a default preferred size has been set using `setDefaultSize(Dimension)` has been called to set then the return value is this value (as obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
4. If there is no content or default size set then the return value is an implementation-specific minimum size plus any additional dimensions that the `HLook` requires for border decoration etc.

Specified By:

`getMinimumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` minimum size.

See Also:

`getMinimumSize()`

getPreferredSize(HVisible)

```
public java.awt.Dimension getPreferredSize(HVisible hvisible)
```

Gets the preferred size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If a default preferred size has been set for this `HVisible` (using `setDefaultSize(Dimension)`) then the return value is this size (obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If this `HLook` does not support scaling of content or no scaling is requested, and content is present then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If this `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the

return value is the current size of the `HVisible` as returned by `getSize`).

4. If there is no content and no default size set then the return value is the current size of the `HVisible` as returned by `getSize`).

Specified By:

`getPreferredSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating the preferred size of the `HVisible` when drawn with this `HLook` .

See Also:

`getPreferredSize()` , `setDefaultSize(Dimension)`

isOpaque(HVisible)

```
public boolean isOpaque(HVisible visible)
```

Returns true if the entire painted area of the `HVisible` when using this look is fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`.

The default value is implementation specific and depends on the background painting mode of the given `HVisible` . The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque(HVisible)` in interface `HLook`

Parameters:

`visible` - the visible to test

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method of an `HVisible` using this look are fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`, otherwise false.

showLook(Graphics, HVisible, int)

```
public void showLook(java.awt.Graphics g, HVisible visible, int state)
```

The `showLook(Graphics, HVisible, int)` method is responsible for repainting the entire `HVisible` component, (including any content set on the component, and the component background), subject to the `clipRect` of the `Graphics` object passed to it.

The `showLook(Graphics, HVisible, int)` method should not modify the `clipRect` of the `Graphics` object that is passed to it.

For looks which draw content (e.g. `HTextLook` , `HGraphicLook` and `HAnimateLook`), if no content is associated with the component, the `showLook(Graphics, HVisible, int)` method paints the component with its current background `Color` according to the `setBackgroundMode(int)` method of `HVisible` and draws any (implementation-specific) borders. Note that by default the background mode is set so as to **not** paint a background. Furthermore on platforms which support transparent colors the background `Color` may be partially or completely transparent.

Any resources **explicitly** associated with an `HLook` should be loaded by the `HLook` during its creation, etc., or via its `setXXX()` methods. Note that the "standard" looks don't load content by default.

This method is called from the `paint(Graphics)` method of `HVisible` and must never be called from elsewhere. Components wishing to redraw themselves should call their repaint method in the usual way.

Specified By:

```
showLook(Graphics, HVisible, int) in interface HLook
```

Parameters:

`g` - the graphics context.

`visible` - the visible.

`state` - the state parameter indicates the state of the visible, allowing the look to render the appropriate content for that state. Note that some components (e.g. `HStaticRange`, `HRange`, `HRangeValue`) do not use state-based content).

widgetChanged(HVisible, HChangeData[])

```
public void widgetChanged(HVisible visible, HChangeData[] changes)
```

Called by the `HVisible` whenever its content, state, or any other data changes. See the class description of `HVisible` for more information about the `changes` parameter.

The implementation of this method should work out which graphical areas of the `HVisible` have changed and make any relevant calls to trigger the repainting of those areas.

A minimum implementation of this method could simply call

```
visible.repaint()
```

Specified By:

```
widgetChanged(HVisible, HChangeData[] ) in interface HLook
```

Parameters:

`visible` - the `HVisible` which has changed

`changes` - an array containing hint data and associated hint objects. If this argument is `null` a full repaint will be triggered.

org.havi.ui HGraphicsConfigTemplate

Syntax

```
public class HGraphicsConfigTemplate extends HScreenConfigTemplate
```

```
java.lang.Object
|
+--HScreenConfigTemplate
|
+--org.havi.ui.HGraphicsConfigTemplate
```

Description

The `HGraphicsConfigTemplate` class is used to obtain a valid `HGraphicsConfiguration`. An application instantiates one of these objects and then sets all non-default attributes as desired. The `getBestConfiguration(HGraphicsConfigTemplate)` method found in the `HGraphicsDevice` class is then called with this `HGraphicsConfigTemplate`. A valid `HGraphicsConfiguration` is returned that meets or exceeds what was requested in the `HGraphicsConfigTemplate`.

This class may be subclassed to support additional properties of graphics configurations which may be requested by applications. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

`HScreenConfigTemplate`, `HBackgroundConfigTemplate`, `HVideoConfigTemplate`

Fields

IMAGE_SCALING_SUPPORT

```
public static final int IMAGE_SCALING_SUPPORT
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HGraphicsConfigTemplate` that indicates that the graphics configuration should or shall support rapid (hardware) image scaling.

MATTE_SUPPORT

```
public static final int MATTE_SUPPORT
```


A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HGraphicsConfigTemplate` that indicates that the graphics configuration should or shall support the HAVi mattes feature.

VIDEO_MIXING

```
public static final int VIDEO_MIXING
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HGraphicsConfigTemplate` that indicates that the graphics configuration should or shall support transparency in the graphics system such that the output of a video decoder is visible. This includes the following configurations :-

- Configurations where there is a well defined transformation between video pixels and graphics pixels (e.g. pixels are the same size).
- Configurations where an application displays graphics over video but where the video is considered as a background and hence no transformation between the two sets of pixels is required.

Applications may specify a particular video configuration with which mixing must be supported. In this case, the video configuration is specified as an `HVideoConfiguration` object. If no specific video configuration is required then it is not required to specify such a configuration and null can be used.

This preference is used by the platform as a constraint in selecting configurations. Templates generated by the platform and then returned to applications (e.g. from a `getConfigTemplate` method) shall not have this preference filled in by the platform.

Constructors

HGraphicsConfigTemplate()

```
public HGraphicsConfigTemplate()
```

Creates an `HGraphicsConfigTemplate` object. See the class description for details of constructor parameters and default values.

Methods

getPreferenceObject(int)

```
public java.lang.Object getPreferenceObject(int preference)
```

Return the preference object for the specified preference.

Instances of `HGraphicsConfigTemplate` which have not had this preference set shall return null for this object. Note that instances constructed by the platform and returned to applications are required to have all preferences (except where explicitly identified) set by the platform before it is returned.

Overrides:

`getPreferenceObject(int)` in class `HScreenConfigTemplate`

Parameters:

preference - the preference to be indicated. Valid values for an `HGraphicsConfigTemplate` are: `VIDEO_GRAPHICS_PIXEL_ALIGNED`, `PIXEL_ASPECT_RATIO`, `PIXEL_RESOLUTION`, `SCREEN_RECTANGLE`, and `VIDEO_MIXING`.

Subclasses may add further valid values. A `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HGraphicsConfigTemplate`, or if preference does not have an associated value object.

Returns:

the preference object for the specified preference.

getPreferencePriority(int)

```
public int getPreferencePriority(int preference)
```

Return the priority for the specified preference.

By default the preferences in a template returned from the system will have an `DONT_CARE` priority unless specified otherwise. Any configuration always satisfies these attributes.

Overrides:

`getPreferencePriority(int)` in class `HScreenConfigTemplate`

Parameters:

preference - the preference to be indicated. Valid values for an `HGraphicsConfigTemplate` are: `ZERO_BACKGROUND_IMPACT`, `ZERO_GRAPHICS_IMPACT`, `ZERO_VIDEO_IMPACT`, `INTERLACED_DISPLAY`, `FLICKER_FILTERING`, `VIDEO_GRAPHICS_PIXEL_ALIGNED`, `PIXEL_ASPECT_RATIO`, `PIXEL_RESOLUTION`, `SCREEN_RECTANGLE`, `VIDEO_MIXING`, `MATTE_SUPPORT` and `IMAGE_SCALING_SUPPORT`.

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HGraphicsConfigTemplate`.

Returns:

the priority for the specified preference.

isConfigSupported(HGraphicsConfiguration)

```
public boolean isConfigSupported(HGraphicsConfiguration hgc)
```

Returns a boolean indicating whether or not the specified `HGraphicsConfiguration` can be used to create a graphics plane that supports the features set in this template.

Parameters:

hgc -- the `HGraphicsConfiguration` object to test against this template.

Returns:

true if this `HGraphicsConfiguration` object can be used to create a graphics plane that supports the features set in this template, false otherwise.

setPreference(int, int)

```
public void setPreference(int preference, int priority)
```

Set the indicated preference to have the specified priority. If the preference has been previously set, then the previous priority for the preference shall be overwritten.

Attributes that are not filled in in a template (through `setPreference(int, int)`), shall have the priority `DONT_CARE`. Any configuration always satisfies these attributes.

Overrides:

`setPreference(int, int)` in class `HScreenConfigTemplate`

Parameters:

`preference` - the preference to be indicated. Valid values for an `HGraphicsConfigTemplate` are: `ZERO_BACKGROUND_IMPACT`, `ZERO_GRAPHICS_IMPACT`, `ZERO_VIDEO_IMPACT`, `INTERLACED_DISPLAY`, `FLICKER_FILTERING`, `MATTE_SUPPORT` and `IMAGE_SCALING_SUPPORT`.

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HGraphicsConfigTemplate`

`priority` - the priority of the preference. Valid values include: `REQUIRED`, `PREFERRED`, `DONT_CARE`, `PREFERRED_NOT` and `REQUIRED_NOT`.

If `priority` is not a valid priority as defined here a `java.lang.IllegalArgumentException` will be thrown.

setPreference(int, Object, int)

`public void setPreference(int preference, java.lang.Object object, int priority)`

Set the indicated preference (and associated value object) to have the specified priority. If the preference has been previously set, then the previous object and priority shall be overwritten.

Attributes that are not filled in in a template (through `setPreference(int, int)`), shall have the priority `DONT_CARE`. Any configuration always satisfies these attributes.

An application which wishes to remove a preference from an existing template (e.g. one generated by the platform) may call this method with null for the object parameter.

Overrides:

`setPreference(int, Object, int)` in class `HScreenConfigTemplate`

Parameters:

`preference` - the preference to be indicated. Valid values for an `HScreenConfigTemplate` are: `PIXEL_ASPECT_RATIO`, `PIXEL_RESOLUTION`, `SCREEN_RECTANGLE`, `VIDEO_GRAPHICS_PIXEL_ALIGNED` and `VIDEO_MIXING`.

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HScreenConfigTemplate`

`object` - the Object associated with the given preference, or null.

`priority` - the priority of the preference. Valid values include: `REQUIRED`, `PREFERRED`, `DONT_CARE`, `PREFERRED_NOT` and `REQUIRED_NOT`.

If `priority` is not a valid priority as defined here a `java.lang.IllegalArgumentException` will be thrown.

org.havi.ui HGraphicsConfiguration

Syntax

```
public class HGraphicsConfiguration extends HScreenConfiguration
```

```
java.lang.Object
|
+--HScreenConfiguration
|
+--org.havi.ui.HGraphicsConfiguration
```

Direct Known Subclasses:

```
HEmulatedGraphicsConfiguration
```

Description

The `HGraphicsConfiguration` class describes the characteristics (settings) of an `HGraphicsDevice`. There can be many `HGraphicsConfiguration` objects associated with a single `HGraphicsDevice`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

```
HGraphicsDevice
```

Constructors

HGraphicsConfiguration()

```
protected HGraphicsConfiguration()
```

It is not intended that applications should directly construct `HGraphicsConfiguration` objects.

Creates an `HGraphicsConfiguration` object. See the class description for details of constructor parameters and default values.

Methods

dispose(Color)

```
public void dispose(java.awt.Color c)
```

This method is used by an application when a color returned from those versions of the method `getPunchThroughToBackgroundColor` with a `Color` as a parameter is no longer required. It is the responsibility of applications to ensure that no pixels which they had drawn using this color are still displayed on the screen before calling this method. The result of using such a `Color` after calling this method is implementation dependent. Using a color obtained from another source apart from the specified methods will result in this method having no effect.

Parameters:

`c` - the `Color` which is no longer required.

getAllFonts()

```
public java.awt.Font[] getAllFonts()
```

List the fonts that are always available on the device, but does not list fonts that may be (temporarily) available for download from other sources.

Returns:

an array of `java.awt.Font` objects which are always available on the device.

getCompatibleImage(Image, HImageHints)

```
public java.awt.Image getCompatibleImage(java.awt.Image input, HImageHints ih)
```

Generate a `java.awt.Image` which *may* be a modified copy of the image passed as `input`. Such a copy is modified as necessary such that it is compatible with the current `HGraphicsConfiguration`. For example this may involve dithering the image to a restricted color palette. In the case where no modification is required a reference to the original image `input` will be returned instead of a separate new `java.awt.Image`.

Note: Unmodified Images, or Images modified for other `HGraphicsConfiguration` should still be able to be rendered within this `HGraphicsConfiguration`, but may not be as efficient (rapid) in terms of rendering, and may not be presented optimally. For example, an 8 bit per RGB pixel image loaded onto a configuration with a 4 bit per RGB pixel framebuffer may have its pixel values truncated, if this Image is then displayed on an alternate configuration with 16 bits per RGB pixel then it will obviously not be displayed optimally.

The `HImageHints` provide a mechanism to indicate how any conversion to a constrained graphics environment might best be performed, by describing the general image contents.

It is implementation (and algorithmically) dependent whether this method operates on partial, or complete Image pixel data.

Parameters:

`input` - the `java.awt.Image` to be modified

`ih` - an `HImageHints` object that indicates the expected type of the input Image, so that its presentation can be optimally adjusted.

Returns:

a `java.awt.Image` which has been determined to be optimally suited for presentation on the `HGraphicsDevice` associated with this `HGraphicsConfiguration`. Note that on some `HGraphicsConfiguration` a reference to the original Image may be returned, this is especially true for systems with high-end graphics capabilities.

GetComponentHScreenRectangle(Component)

```
public HScreenRectangle GetComponentHScreenRectangle(java.awt.Component component)
```

Returns the on-screen location of a given visible `java.awt.Component` as an `HScreenRectangle` for this `HGraphicsDevice`.

Parameters:

`component` - the `java.awt.Component` whose on-screen area is to be determined.

Returns:

the on-screen location of component as an `HScreenRectangle` for this `HGraphicsDevice`, or null if the component is not currently added to the `HScene` (or one of its "child" containers).

See Also:

`HScreenRectangle`

getConfigTemplate()

```
public HGraphicsConfigTemplate getConfigTemplate()
```

Returns an `HGraphicsConfigTemplate` object that describes and uniquely identifies this `HGraphicsConfiguration`.

Hence, the following sequence should return the original `HGraphicsConfiguration`.

```
HGraphicsDevice.getBestMatch(HGraphicsConfiguration.getConfigTemplate())
```

Features that are implemented in the `HGraphicsConfiguration` will return `REQUIRED` priority. Features that are not implemented in the `HGraphicsConfiguration` will return `REQUIRED_NOT` priority.

Returns:

an `HGraphicsConfigTemplate` object which both describes and uniquely identifies this `HGraphicsConfiguration`.

getDevice()

```
public HGraphicsDevice getDevice()
```

Returns the `HGraphicsDevice` associated with this `HGraphicsConfiguration`.

Returns:

the `HGraphicsDevice` object that is associated with this `HGraphicsConfiguration`,

getPixelCoordinatesHScreenRectangle(HScreenRectangle, Container)

```
public java.awt.Rectangle getPixelCoordinatesHScreenRectangle(HScreenRectangle sr,
    java.awt.Container cont)
```

Returns a `java.awt.Rectangle` which contains the graphics (AWT) pixel area for an `HScreenRectangle` relative to the supplied `java.awt.Container`.

Parameters:

`sr` - the screen location expressed as an `HScreenRectangle`.

`cont` - the `java.awt.Container` in whose coordinate system the screen location should be expressed.

Returns:

a `java.awt.Rectangle` which contains the graphics (AWT) pixel area for an `HScreenRectangle` relative to the supplied `java.awt.Container`. The returned x, y, width, height values in the `java.awt.Rectangle` should be such that a

- `r = getPixelCoordinatesHScreenRectangle(sr, cont);`
- `cont.add(component);`
- `component.setBounds(r.x, r.y, r.width, r.height);`
should ensure that the dimensions of the component on-screen should correspond to the given `HScreenRectangle` , subject to clipping by its parent container, `cont`.

Note that the `HScreenRectangle` (`HScreenPoint`) coordinates are in floats - conversion to pixel coordinate systems necessarily implies a potential loss of precision - however, such conversion should be to the "nearest" integer pixel coordinate.

getPunchThroughToBackgroundColor(Color, int)

```
public java.awt.Color getPunchThroughToBackgroundColor(java.awt.Color color,
    int percentage)
```

This method returns a `Color` that may be used in standard graphics drawing operations, which has the effect of "punching through" all Components that are behind the Component in which the drawing operation is performed. This includes any visual Components acquired from JMF players. What is behind this `HGraphicsConfiguration` is revealed through the drawn "hole" blended with the graphics color specified as the first parameter to this method. Platforms with restricted color spaces may make approximations as required to obtain the best match possible.

Parameters:

`color` - the graphics color to blend

`percentage` - the blending value for this color with respect to what is outside this `HGraphicsConfiguration` . The specified value will be clamped to the range 0 to 100.

Returns:

a `Color` with the desired effect or null for configurations which do not or are currently unable to support this rendering mode.

getPunchThroughToBackgroundColor(Color, int, HVideoDevice)

```
public java.awt.Color getPunchThroughToBackgroundColor(java.awt.Color color,
    int percentage, HVideoDevice v)
```

This method returns a `Color` that may be used in standard graphics drawing operations, which has the effect of modifying the existing color of a pixel to make it partially (or wholly) transparent to the background. The existing pixel percentage transparency to the background at that point shall be equivalent to the (closest) percentage value as specified in the `getPunchThroughToBackgroundColor` percentage parameter.

The existing RGB values of the pixel are unchanged as far as possible, within the limits of the platform. Platforms with restricted color spaces may make approximations as required to obtain the best possible match.

The precise contents of the background are as defined by the platform including any `HBackgroundDevice` , etc.

Parameters:

`color` - the graphics color to blend

`percentage` - the alpha value for this color with respect to what is outside this `HGraphicsConfiguration` . The specified value will be clamped to the range 0 to 100.

Returns:

a `Color` with the desired effect or null for configurations which do not or are currently unable to support this rendering mode.

getPunchThroughToBackgroundColor(int)

```
public java.awt.Color getPunchThroughToBackgroundColor(int percentage)
```

This method returns a `Color` that may be used in standard graphics drawing operations, which has the effect of modifying the existing color of a pixel to make it partially (or wholly) transparent to the background. The existing pixel percentage transparency to the background at that point shall be equivalent to the (closest) percentage value as specified in the `getPunchThroughToBackgroundColor` percentage parameter. A value of 0% is fully transparent and 100% is fully opaque.

The existing RGB values of the pixel are unchanged as far as possible, within the limits of the platform. Platforms with restricted color spaces may make approximations as required to obtain the best possible match.

The precise contents of the background are as defined by the platform including any `HBackgroundDevice`, etc.

Parameters:

`percentage` - the new blending value for each pixel drawn with this color with respect to what is outside this `HGraphicsConfiguration`. The specified value will be clamped to the range 0 to 100.

Returns:

a `Color` with the desired effect or null for configurations which do not or are currently unable to support this rendering mode.

getPunchThroughToBackgroundColor(int, HVideoDevice)

```
public java.awt.Color getPunchThroughToBackgroundColor(int percentage, HVideoDevice hvd)
```

This method returns a `Color` that may be used in standard graphics drawing operations, which has the effect of "punching through" the `HGraphicsDevice` in which the drawing operation is performed. The specified `HVideoDevice` is revealed through the drawn "hole". The value specified replaces the blending value (with respect to this `HVideoDevice`) of each pixel drawn with this color. The existing RGB values of the pixel are unchanged as far as possible within the limits of the platform. Platforms with restricted color spaces may make approximations as required to obtain the best match possible.

Parameters:

`percentage` - the new alpha value for each pixel drawn with this color with respect to the the `HVideoDevice` specified. The specified value will be clamped to the range 0 to 100.

`hvd` - the `HVideoDevice` to reveal.

Returns:

a `Color` with the desired effect or null for configurations which do not or are currently unable to support this rendering mode.

org.havi.ui HGraphicsDevice

Syntax

```
public class HGraphicsDevice extends HScreenDevice
```

```
java.lang.Object
|
+--HScreenDevice
|
+--org.havi.ui.HGraphicsDevice
```

Direct Known Subclasses:

```
HEmulatedGraphicsDevice
```

All Implemented Interfaces:

```
org.davic.resources.ResourceProxy, org.davic.resources.ResourceServer
```

Description

The `HGraphicsDevice` class describes the raster graphics devices that are available for a particular `HScreen`. Each `HGraphicsDevice` has one or more `HGraphicsConfiguration` objects associated with it. These objects specify the different configurations (settings) in which the `HGraphicsDevice` can be used. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

```
HGraphicsConfiguration, HScreenDevice, HScreen
```

Constructors

HGraphicsDevice()

```
protected HGraphicsDevice()
```

It is not intended that applications should directly construct `HGraphicsDevice` objects.

Creates an `HGraphicsDevice` object. See the class description for details of constructor parameters and default values.

Methods

getBestConfiguration(HGraphicsConfigTemplate)

```
public HGraphicsConfiguration getBestConfiguration(HGraphicsConfigTemplate hgct)
```

The `getBestConfiguration` method attempts to return an `HGraphicsConfiguration` that matches the specified `HGraphicsConfigTemplate`. If this is not possible it will attempt to construct an `HEmulatedGraphicsConfiguration` where the emulated configuration best matches this `HGraphicsConfigTemplate`. If this is not possible, null is returned. Note that the algorithm used for this behavior, and the extent and behavior of `HEmulatedGraphicsConfiguration` are platform specific.

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`
3. satisfy as many as possible of the preferences whose priority was `PREFERRED`.
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT`.

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

`hgct` - an `HGraphicsConfigTemplate` object used to obtain a valid `HGraphicsConfiguration`. If this parameter is null the default configuration for the platform shall be returned.

Returns:

an `HGraphicsConfiguration` that passes the criteria defined in the specified `HGraphicsConfigTemplate` or null if no `HGraphicsConfiguration` or `HEmulatedGraphicsConfiguration` passes the criteria.

getBestConfiguration(HGraphicsConfigTemplate[])

```
public HGraphicsConfiguration getBestConfiguration(HGraphicsConfigTemplate[] hgcta)
```

The `getBestConfiguration` method attempts to return an `HGraphicsConfiguration` that matches the specified `HGraphicsConfigTemplate` objects within the specified array. The `HGraphicsTemplate` objects should be considered for matching in priority order from 0 to $(hgcta.length - 1)$. If this is not possible, it will attempt to construct an `HEmulatedGraphicsConfiguration` where the emulated configuration best matches the specified `HGraphicsConfigTemplate` objects. If this is not possible, null is returned.

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`

3. satisfy as many as possible of the preferences whose priority was `PREFERRED` .
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT` .

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

`hgcta` - the `HGraphicsConfigTemplate` array used to obtain a valid `HGraphicsConfiguration` .

Returns:

an `HGraphicsConfiguration` that passes the criteria defined in one of the `HGraphicsConfigTemplate` objects within the specified array. The class of the object returned can also be a class inheriting from `HGraphicsConfiguration` (e.g. `HEmulatedGraphicsConfiguration`).

getConfigurations()

```
public HGraphicsConfiguration[] getConfigurations()
```

Returns all of the `HGraphicsConfiguration` objects associated with this `HGraphicsDevice` .

Returns:

an array of `HGraphicsConfiguration` objects that are associated with this `HGraphicsDevice` . The class of the objects returned can also be a class inheriting from `HGraphicsConfiguration` (e.g. `HEmulatedGraphicsConfiguration`).

See Also:

`HGraphicsConfiguration`

getCurrentConfiguration()

```
public HGraphicsConfiguration getCurrentConfiguration()
```

Returns the current `HGraphicsConfiguration` for this `HGraphicsDevice` .

Returns:

the current `HGraphicsConfiguration` for this `HGraphicsDevice` . The class of the object returned can also be a class inheriting from `HGraphicsConfiguration` (e.g. `HEmulatedGraphicsConfiguration`).

See Also:

`HGraphicsConfiguration`

getDefaultConfiguration()

```
public HGraphicsConfiguration getDefaultConfiguration()
```

Returns the default `HGraphicsConfiguration` associated with this `HGraphicsDevice` . This (single) default configuration should correspond to some well-behaved settings for the device, such as, a minimal configuration, or factory preset settings.

Returns:

the default `HGraphicsConfiguration` of this `HGraphicsDevice` . The class of the object returned can also be a class inheriting from `HGraphicsConfiguration` (e.g. `HEmulatedGraphicsConfiguration`).

setGraphicsConfiguration(HGraphicsConfiguration)

```
public boolean setGraphicsConfiguration(HGraphicsConfiguration hgc)
```

Set the graphics configuration for the device.

An application is only allowed to call this method after it reserved the device explicitly and subject to the security policy of the platform. Subject to this, the following rules determine whether this method can succeed.

- If the application selects a configuration that is not conflicting with the configurations of all the other devices on the same `HScreen` then that configuration is selected.
- If an application tries to select a configuration that conflicts with a configuration of another device on this `HScreen` which this application cannot control due to platform security policy then this method shall fail with a `SecurityException`.
- If an application tries to select a configuration that conflicts with a configuration of another device on this `HScreen` which this application cannot control due to another application owning the right to control that device and the platform not giving that right to this application then this method shall fail with an `HPermissionDeniedException`.
- If an application tries to select a configuration that conflicts with a configuration of another device which this application can control due to either this or no application having reserved the device, then the configuration of the other device is automatically changed. There is no change in the resource ownership of the other device.

Applications can prevent or limit changes to configurations of other, not intended, devices by using constants `ZERO_GRAPHICS_IMPACT` and `ZERO_VIDEO_IMPACT` in their configuration templates. The first one will cause no changes to already running graphical applications. This means that no changes may be applied to the graphics device. Similarly the second constant will result in no changes to the video device.

Any modifications made to the configurations of other devices shall be reflected by the API for the devices concerned. The `getCurrentConfiguration()` method for those devices shall return the new configuration.

On successful change to the specified configuration, the device shall fire one or more `HScreenConfigurationEvent` for all listeners that are currently registered (if the criteria for receiving such an event has been satisfied). If the new configuration differs by more than one characteristic from the previous configuration then the device may fire one or more `HScreenConfigurationEvent`. This behavior is implementation specific.

If an attempt is made to set the identical configuration to that which is current, then no such event(s) shall be fired.

Parameters:

`hgc` - the `HGraphicsConfiguration` to which this device should be set.

Returns:

A boolean indicating whether the configuration could be applied successfully. If the configuration could not be applied successfully, the configuration after this method may not match the configuration of the device prior to this method being called --- applications should take steps to determine whether a partial change of settings has been made.

Throws:

`SecurityException` - if the application does not have sufficient rights to set the configuration for this device.

{ @link - org.havi.ui.HPermissionDeniedException HPermissionDeniedException} if the application does not currently have the right to set the configuration for this device.

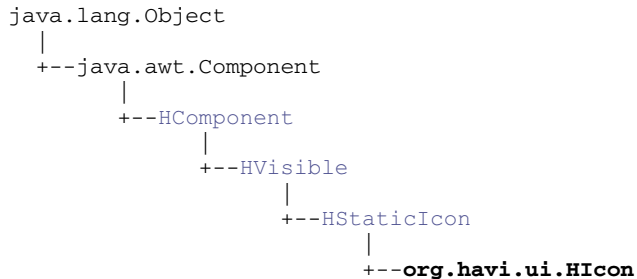
{ @link - org.havi.ui.HConfigurationException HConfigurationException} if the specified configuration is not valid for this device, or if it conflicts with other devices whose configuration(s) cannot be changed by this application.

`HConfigurationException`, `HPermissionDeniedException`

org.havi.ui HIcon

Syntax

public class HIcon extends HStaticIcon implements HNavigable



Direct Known Subclasses:

HGraphicButton

All Implemented Interfaces:

HMatteLayer, HNavigable, HNavigationInputPreferred, HNoInputPreferred, HState, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

The `HIcon` is a user interface component used to display static graphical content (as `HStaticIcon`) which also enables a user to navigate to it, i.e. it can have the input focus. By default it uses the `HGraphicLook` to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
image	The image to be used as the content for every state of this component.	null	setGraphicContent(Image, int)	getGraphicContent(int)

imageNormal	The image to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	<code>setGraphicContent(Image, int)</code>	<code>getGraphicContent(int)</code>
imageFocus	The image to be used as the content for the focused states of this component.	null	<code>setGraphicContent(Image, int)</code>	<code>getGraphicContent(int)</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
The default "look" for this class.	A platform specific <code>HGraphicLook</code>	<code>setDefaultLook(HGraphicLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HGraphicLook</code> returned from <code>HIcon.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The gain focus sound.	null	<code>setGainFocusSound(HSound)</code>	<code>getGainFocusSound()</code>
The lose focus sound.	null	<code>setLoseFocusSound(HSound)</code>	<code>getLoseFocusSound()</code>

See Also:

`HStaticIcon`, `HNavigable`

Constructors

HIcon()

```
public HIcon()
```

Creates an `HIcon` object. See the class description for details of constructor parameters and default values.

HIcon(Image)

```
public HIcon(java.awt.Image image)
```

Creates an `HIcon` object. See the class description for details of constructor parameters and default values.

HIcon(Image, Image, int, int, int, int)

```
public HIcon(java.awt.Image imageNormal, java.awt.Image imageFocus, int x, int y,
             int width, int height)
```

Creates an `HIcon` object. See the class description for details of constructor parameters and default values.

HIcon(Image, int, int, int, int)

```
public HIcon(java.awt.Image image, int x, int y, int width, int height)
```

Creates an `HIcon` object. See the class description for details of constructor parameters and default values.

Methods

getDefaultLook()

```
public static HGraphicLook getDefaultLook()
```

Returns the currently set default look for `HIcon` components.

Returns:

The look that is used by default when creating a new `HIcon` component.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

`getGainFocusSound()` in interface `HNavigable`

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

```
getLoseFocusSound() in interface HNavigable
```

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

```
getMove(int) in interface HNavigable
```

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns null.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

```
getNavigationKeys() in interface HNavigationInputPreferred
```

Returns:

an array of key codes, or null if no navigation targets are set on this component.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

```
isSelected() in interface HNavigable
```

Returns:

true if the component has focus, otherwise returns false.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HIcon`.

Specified By:

```
processHFocusEvent(HFocusEvent) in interface HNavigationInputPreferred
```

Parameters:

`evt` - the `HFocusEvent` to process.

setDefaultLook(HGraphicLook)

```
public static void setDefaultLook(HGraphicLook hlook)
```

Sets the default `HLook` for further `HIcon` Components.

Parameters:

`hlook` - The `HLook` that will be used by default when creating a new `HIcon` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
                             HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in interface `HNavigable`

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` KeyEvent. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` KeyEvent. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` KeyEvent. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` KeyEvent. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setGainFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

org.havi.ui HImageEffectMatte

Syntax

```
public class HImageEffectMatte implements HMatte, HAnimateEffect
```

```
java.lang.Object
|
+--org.havi.ui.HImageEffectMatte
```

All Implemented Interfaces:

```
HAnimateEffect, HMatte
```

Description

The `HImageEffectMatte` class represents a matte that varies over both space and time, it is specified as a sequence of image masks.

The data for any `HImageEffectMatte` may be changed "on the fly" using the `setMatteData (Image[])` method. However, some implementations may be asynchronously referencing their content (i.e. through a separate implementation-specific animation thread). Therefore the following restrictions apply to the `setMatteData (Image[])` method:

- The method must be synchronized with any implementation-specific animation thread such that content cannot be changed while a different thread is using it.
- If the animation was running the method should stop the animation in a synchronized manner before changing content.
- The method should reset the animation to a starting position defined by the current play mode. The repeat count of the animation should be reset to 0.
- If the animation was running the method should start the animation.

The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
data	The transparency data for this image effect matte.	null (the matte should be treated as being spatially and temporally unvarying and opaque)	<code>setMatteData (Image[])</code>	<code>getMatteData ()</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
The initial piece of content to be presented, i.e. its position in the content array.	0	<code>setPosition (int)</code>	<code>getPosition ()</code>
By default the animation should be stopped. Hence, to start the animation its start method must be explicitly invoked. This mechanism allows for animations that are programmatically controlled, e.g. via the <code>setPosition</code> method.	"stopped"	<code>start () / stop ()</code>	<code>isAnimated ()</code>

The pixel offset for each image within the `HImageEffectMatte`, relative to the top, left corner of its associated component.

A `java.awt.Point (0, 0)`

`setOffset-`
`set (Point,`
`int)`
`getOffset (i`
`nt)`

Constructors

HImageEffectMatte()

```
public HImageEffectMatte()
```

Creates an `HImageEffectMatte` object. See the class description for details of constructor parameters and default values.

HImageEffectMatte(Image[])

```
public HImageEffectMatte(java.awt.Image[] data)
```

Creates an `HImageEffectMatte` object. See the class description for details of constructor parameters and default values.

Methods

getDelay()

```
public int getDelay()
```

Gets the presentation delay for this `HImageEffectMatte`.

Specified By:

`getDelay()` in interface `HAnimateEffect`

Returns:

the presentation delay in units of 0.1 seconds.

getMatteData()

```
public java.awt.Image[] getMatteData()
```

Returns the data used for this matte.

Returns:

the data used for this matte (an array of images) or null if no matte data has been set.

getOffset(int)

```
public java.awt.Point getOffset(int index)
```

Get the offset of a specified frame of the matte relative to its component in pixels.

Parameters:

`index` - the zero-index to the data for which the offset should be recovered. If `index` is not valid for this matte an `IndexOutOfBoundsException` exception is thrown.

Returns:

the offset of the specified frame of the matte relative to its component in pixels (as a Point)

getPlayMode()

```
public int getPlayMode()
```

Gets the playing mode for this `HImageEffectMatte` .

Specified By:

`getPlayMode()` in interface `HAnimateEffect`

Returns:

the play mode for this `HImageEffectMatte` .

getPosition()

```
public int getPosition()
```

Get the current index into the content array which this `HImageEffectMatte` is using to display content.

Specified By:

`getPosition()` in interface `HAnimateEffect`

Returns:

the index of the content currently being displayed, in the range $0 \leq \text{index} < \text{length}$

getRepeatCount()

```
public int getRepeatCount()
```

Gets the number of times that this `HImageEffectMatte` is to be played. Note that this method does *not* return the number of repeats that are remaining to be played.

Specified By:

`getRepeatCount()` in interface `HAnimateEffect`

Returns:

the total number of times that an `HImageEffectMatte` is to be played. The returned value shall be greater than zero, or `REPEAT_INFINITE` .

isAnimated()

```
public boolean isAnimated()
```

This method indicates the animation (running) state of the `HImageEffectMatte` .

Specified By:

`isAnimated()` in interface `HAnimateEffect`

Returns:

`true` if this `HImageEffectMatte` is running, i.e. the `start` method has been invoked - `false` otherwise.

setDelay(int)

```
public void setDelay(int count)
```

Sets the delay between the presentation of successive pieces of content (frames).

After calling `setDelay(int)` on a currently playing `HImageEffectMatte`, there is no guarantee that one or more frames will not be displayed using the previous delay until the new delay value takes effect.

Specified By:

`setDelay(int)` in interface `HAnimateEffect`

Parameters:

`count` - the content presentation delay in units of 0.1 seconds duration. If `count` is less than one "unit", then it shall be treated as if it were a delay of one "unit", i.e. 0.1 seconds.

setMatteData(Image[])

```
public void setMatteData(java.awt.Image[] data)
```

Sets the data for this matte (an array of images). Any previously set data is replaced. If this method is called when the animation is running the data is changed immediately and the current animation position is reset according to the active play mode. The changes affect the animation immediately.

Note that if the size of an image is smaller than the size of the component to which the matte is applied, the empty space behaves as if it were an opaque flat matte of value 1.0. By default images are aligned at the top left corner of the component. This can be changed with the `setOffset(Point, int)` method

Parameters:

`data` - the data for this matte. Specify a null object to remove the associated data for this matte. If the length of the data array is zero, an `IllegalArgumentException` is thrown. If an element of the data array is null, or an image referred to is still being loaded, then that image will be skipped when the animation is playing.

setOffset(Point, int)

```
public void setOffset(java.awt.Point p, int index)
```

Set the offset of a specified frame of the matte relative to its component in pixels.

Parameters:

`p` - the offset of the specified frame of the matte relative to the top left corner of its component in pixels. If `p` is null a `NullPointerException` is thrown.

`index` - the zero-index to the data for which the offset should be applied. If `index` is not valid for this matte an `IndexOutOfBoundsException` exception is thrown.

setPlayMode(int)

```
public void setPlayMode(int mode)
```

Sets the playing mode for this `HImageEffectMatte`. If the animation is already running a call to `setPlayMode` will change the current value and affect the animation immediately. The position of the animation is unchanged.

Specified By:

`setPlayMode(int)` in interface `HAnimateEffect`

Parameters:

`mode` - the play mode for this `HImageEffectMatte`, which must be either `PLAY_ALTERNATING` or `PLAY_REPEATING`.

setPosition(int)

```
public void setPosition(int position)
```

Set this `HImageEffectMatte` to display the content at the specified position. If the animation is already running a call to `setPosition` will change the current value and affect the animation immediately.

Specified By:

```
setPosition(int) in interface HAnimateEffect
```

Parameters:

`position` - an index into the content array which specifies the next piece of content to be displayed. If `position` is less than 0, then the array element at index 0 is displayed, if `position` is greater than or equal to the length of the content array, then the array element at index `[length-1]` will be used.

setRepeatCount(int)

```
public void setRepeatCount(int count)
```

Sets the number of times that this `HImageEffectMatte` should be played. If the animation is already running a call to `setRepeatCount` will change the current value and reset the current number of repeats to 0, affecting the animation immediately.

Specified By:

```
setRepeatCount(int) in interface HAnimateEffect
```

Parameters:

`count` - the number of times that an `HImageEffectMatte` should be played. Valid values of the repeat count are one or more, and `REPEAT_INFINITE`.

start()

```
public void start()
```

This method starts this `HImageEffectMatte` playing. If `start` is called when the animation is already running it resets the animation according to the current play mode, as returned by `getPlayMode()`.

Specified By:

```
start() in interface HAnimateEffect
```

stop()

```
public void stop()
```

This method indicates that the running `HImageEffectMatte` should be stopped. After calling this method, there is no guarantee that one or more frames will not be displayed before the animation actually stops playing. If the animation is already stopped further calls to `stop` have no effect.

Specified By:

```
stop() in interface HAnimateEffect
```

org.havi.ui HImageHints

Syntax

```
public class HImageHints
    java.lang.Object
    |
    +--org.havi.ui.HImageHints
```

Description

The `HImageHints` object allows an application to pass hints to the system how best to tailor an image to match a (possibly) restricted `HGraphicsConfiguration`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

The image type.	<code>NATURAL_IMAGE</code>	---	---
-----------------	----------------------------	-----	-----

Fields

BUSINESS_GRAPHICS

```
public static final int BUSINESS_GRAPHICS
```

The image is business graphics, with strong, well-defined, blocks of solid color, etc. Not suitable for dithering, suitable for nearest color matching.

CARTOON

```
public static final int CARTOON
```

The image is a cartoon, with strong, well-defined, blocks of solid color, etc. Not suitable for dithering, suitable for nearest color matching.

LINE_ART

```
public static final int LINE_ART
```

The image is a two-tone lineart, with colors varying between foreground and background, etc. Not suitable for dithering. Possibly suitable for color-map adjustment, etc., if applicable.

NATURAL_IMAGE

```
public static final int NATURAL_IMAGE
```

The image is a "natural" scene, with subtle gradations of color, etc. Suitable for dithering.

Constructors

HImageHints()

```
public HImageHints()
```

Creates an HImageHints object. See the class description for details of constructor parameters and default values.

Methods

getType()

```
public int getType()
```

Get the expected type of the image being loaded.

setType(int)

```
public void setType(int type)
```

Set the expected type of the image being loaded.

Parameters:

`type` - the expected type of image

org.havi.ui HImageMatte

Syntax

```
public class HImageMatte implements HMatte
```

```
java.lang.Object
|
+--org.havi.ui.HImageMatte
```

All Implemented Interfaces:

[HMatte](#)

Description

The [HImageMatte](#) class represents a matte that varies over space but is constant over time, it can be specified by an "image mask" (a single channel image) where the pixels indicate matte transparency. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
data	The transparency value for this image matte.	null (the matte should be treated as being spatially unvarying and opaque)	setMatteData(Image)	getMatteData()

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
The pixel offset for the image matte, relative to the top, left corner of its associated component.	A java.awt.Point (0, 0)	setOffset(Point)	getOffset()

Constructors

HImageMatte()

```
public HImageMatte()
```

Creates an [HImageMatte](#) object. See the class description for details of constructor parameters and default values.

HImageMatte(Image)

```
public HImageMatte(java.awt.Image data)
```

Creates an [HImageMatte](#) object. See the class description for details of constructor parameters and default values.

Methods

getMatteData()

```
public java.awt.Image getMatteData()
```

Returns the data used for this matte.

Returns:

the data used for this matte (an image) or null if no matte data has been set.

getOffset()

```
public java.awt.Point getOffset()
```

Get the offset of the matte relative to its component in pixels.

Returns:

the offset of the specified frame of the matte relative to its component in pixels (as a Point)

setMatteData(Image)

```
public void setMatteData(java.awt.Image data)
```

Sets the data for this matte. Any previously set data is replaced.

Parameters:

`data` - the data for this matte. Specify a null object to remove the associated data for this matte.

setOffset(Point)

```
public void setOffset(java.awt.Point p)
```

Set the offset of the matte relative to its component in pixels.

Parameters:

`p` - the offset of the matte relative to its component in pixels. If `p` is null a `NullPointerException` is thrown.

org.havi.ui HInvalidLookException

Syntax

```
public class HInvalidLookException extends HUIException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--HUIException
            |
            +--org.havi.ui.HInvalidLookException
```

All Implemented Interfaces:

java.io.Serializable

Description

An HInvalidLookException is an exception that is thrown when a particular HLook is not compatible with the HVisible component it has been associated with. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
message	Message explaining why the exception was thrown	null	-	java.lang.Throwable#getMessage

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HInvalidLookException()

```
public HInvalidLookException()
```

Creates an HInvalidLookException object. See the class description for details of constructor parameters and default values.

HInvalidLookException(String)

```
public HInvalidLookException(java.lang.String message)
```

Creates an HInvalidLookException object with a specified reason string.

Parameters:

message - the reason why the exception was raised

org.havi.ui

HItemValue

Syntax

```
public interface HItemValue extends HNavigable, HSelectionInputPreferred
```

All Superinterfaces:

```
HNavigable, HNavigationInputPreferred, HOrientable, HSelectionInputPreferred
```

All Known Implementing Classes:

```
HListGroup
```

Description

This interface is implemented by all HAVi UI components which have some form of selectable content (e.g. a list group).

Event Behavior

Subclasses of `HComponent` which implement `HItemValue` must respond to `HFocusEvent` and `HItemEvent` events.

Applications should assume that classes which implement `HItemValue` can generate events of the types `HFocusEvent` and `HItemEvent` in response to other types of input event.

An application may add one or more `HItemListener` listeners to the component. The `selectionChanged(HItemEvent)` method of the `HItemListener` is invoked whenever the selection managed by the `HItemValue` is changed.

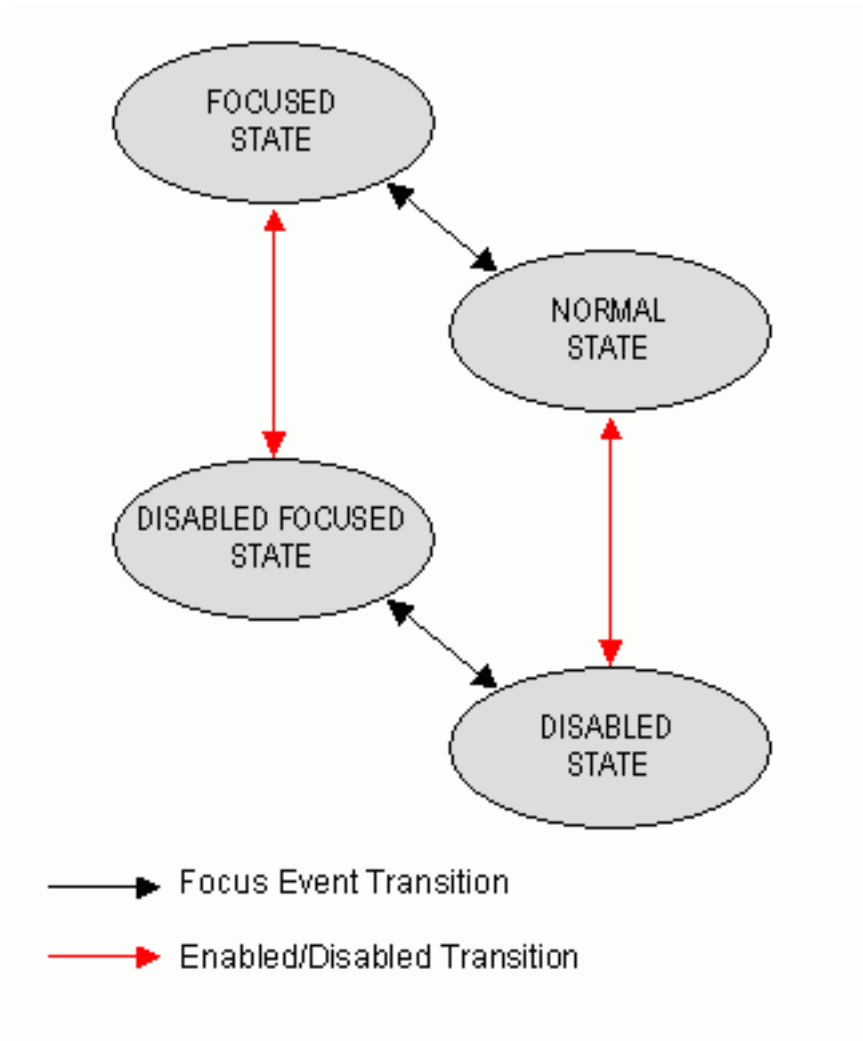
HAVi item events are discussed in detail in the `HSelectionInputPreferred` interface description.

Interaction States

The following interaction states are valid for this `HItemValue` component:

- `NORMAL_STATE`
- `FOCUSED_STATE`
- `DISABLED_STATE`
- `DISABLED_FOCUSED_STATE`

The state machine diagram below shows the valid state transitions for an `HItemValue` component.



Platform Classes

The following HAVi platform classes implement or inherit the `HItemValue` interface. These classes shall all generate both `HFocusEvent` and `HItemEvent` events in addition to any other events specified in the respective class descriptions.

- `HListGroup`

See Also:

`HNavigable`, `HOrientable`, `HSelectionInputPreferred`, `HItemEvent`, `HItemListener`

Methods

addItemListener(HItemListener)

```
public void addItemListener(HItemListener l)
```

Adds the specified `HItemListener` to receive `HItemEvent` sent from this object. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Parameters:

`l` - the `HItemListener` to be notified.

getSelectionSound()

```
public HSound getSelectionSound()
```

Get the sound to be played when the selection changes.

Returns:

The sound played when the selection changes

removeItemListener(HItemListener)

```
public void removeItemListener(HItemListener l)
```

Removes the specified `HItemListener` so that it no longer receives `HItemEvent` from this object. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Parameters:

`l` - the `HItemListener` to be removed from notification.

setSelectionSound(HSound)

```
public void setSelectionSound(HSound sound)
```

Associate a sound to be played when the selection is modified. The sound is played irrespective of whether an `HItemEvent` is sent to one or more listeners.

Parameters:

`sound` - the sound to be played, when the selection is modified. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

org.havi.ui HKeyboardInputPreferred

Syntax

```
public interface HKeyboardInputPreferred
```

All Known Subinterfaces:

```
    HTextValue
```

Description

A component which implements `HKeyboardInputPreferred` indicates that this component expects to receive both `HKeyEvent` and `HTextEvent` input events.

All interoperable implementations of the `HKeyboardInputPreferred` interface must extend `HComponent`.

The set of characters which the component expects to receive via `HKeyEvent` events is defined by the return code from the `getType()` method.

When this component has focus, platforms without a physical means of generating key events with the desired range of characters will provide another means for keyboard entry e.g. by offering an on-screen "virtual" keyboard. Applications can query the system about the support of specific keyCodes through the `isSupported(int)` method.

Note that the `java.awt.Component` method `isFocusTraversable` should always return true for a `java.awt.Component` implementing this interface.

Fields

INPUT_ALPHA

```
public static final int INPUT_ALPHA
```

This constant indicates that the component only requires alphanumeric input, as determined by the `java.lang.Character` `isLetter` method.

INPUT_ALPHANUMERIC

```
public static final int INPUT_ALPHANUMERIC
```

This constant indicates that the component only requires alphanumeric input, as determined by the `java.lang.Character` `isLetterOrDigit` method.

INPUT_ANY

```
public static final int INPUT_ANY
```

Indicates that the component requires any possible character as input, as determined by the `java.lang.Character` `isDefined` method.

INPUT_CUSTOMIZED

```
public static final int INPUT_CUSTOMIZED
```

Indicates that the component requires as input the characters present in the array returned from the `getValidInput()` method.

INPUT_NUMERIC

```
public static final int INPUT_NUMERIC
```

This constant indicates that the component only requires alphanumeric input, as determined by the `java.lang.Character isDigit` method.

Methods

getEditMode()

```
public boolean getEditMode()
```

Get the editing mode for this `HKeyboardInputPreferred`. If the returned value is `true` the component is in edit mode, and its textual content may be changed through user interaction such as keyboard events.

The component is switched into and out of edit mode on receiving `TEXT_START_CHANGE` and `TEXT_END_CHANGE` events.

Returns:

`true` if this component is in edit mode, `false` otherwise.

getType()

```
public int getType()
```

Retrieve the desired input type for this component. This value should be set to indicate to the system which input keys are required by this component.

Returns:

one of `INPUT_ALPHANUMERIC`, `INPUT_NUMERIC`, `INPUT_ALPHA`, or `INPUT_CUSTOMIZED`.

getValidInput()

```
public char[] getValidInput()
```

Retrieve the customized input character range. The return value of this method should reflect the range of input keys which the component wishes to see, should `getType()` return `INPUT_CUSTOMIZED`. This method may return `null` if and only if it can guarantee that customized input is *never* required.

If customized input can be used but no specific customized input is set, this method should return the same range as the `INPUT_ALPHANUMERIC` input type, i.e. that range of characters for which the `java.lang.Character isLetterOrDigit` returns `true`.

Returns:

an array containing the characters which this component expects the platform to provide, or `null` to indicate that customized characters are not used.

processHKeyEvent(HKeyEvent)

```
public void processHKeyEvent(HKeyEvent evt)
```

Process an `HKeyEvent` sent to this `HKeyboardInputPreferred`.

Parameters:

`evt` - the `HKeyEvent` to process.

processHTextEvent(HTextEvent)

```
public void processHTextEvent(HTextEvent evt)
```

Process an `HTextEvent` sent to this `HKeyboardInputPreferred`.

Parameters:

`evt` - the `HTextEvent` to process.

setEditMode(boolean)

```
public void setEditMode(boolean edit)
```

Set the editing mode for this `HKeyboardInputPreferred`.

This method is provided for the convenience of component implementors. Interoperable applications shall not call this method. It cannot be made protected because interfaces cannot have protected methods.

Parameters:

`edit` - true to switch this component into edit mode, false otherwise.

See Also:

`getEditMode()`

org.havi.ui HListElement

Syntax

```
public class HListElement
    java.lang.Object
    |
    +--org.havi.ui.HListElement
```

Description

`HListElement` is a holder for content used with the `HListGroup` component. It must contain a text string, and may also contain a single graphical image.

Applications should **not** directly manipulate `HListElement` objects. They are intended to be used in conjunction with an `HListGroup` which maintains a list of them, and is responsible for their rendering via the `HListGroupLook` class. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
label	text content of this item	no default	-	<code>getLabel()</code>
icon	image content of this item	null	-	<code>getIcon()</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

[HListGroup](#), [HListGroupLook](#)

Constructors

HListElement(Image, String)

```
public HListElement(java.awt.Image icon, java.lang.String label)
```

Creates an `HListElement` object. See the class description for details of constructor parameters and default values.

Parameters:

- `icon` - The icon for this `HListElement`.
- `label` - The label for this `HListElement`.

HListElement(String)

```
public HListElement(java.lang.String label)
```

Creates an HListElement object. See the class description for details of constructor parameters and default values.

Parameters:

`label` - The label for this HListElement.

Methods

getIcon()

```
public java.awt.Image getIcon()
```

Retrieve the icon for this HListElement.

Returns:

the graphical icon for this HListElement, or `null` if no icon was set.

getLabel()

```
public java.lang.String getLabel()
```

Retrieve the label for this HListElement.

Returns:

the text label for this HListElement.

setIcon(Image)

```
public void setIcon(java.awt.Image icon)
```

Set the icon for this HListElement. If `icon` is `null`, the HListElement will be in the same state as if no icon was set.

Parameters:

`icon` - The icon for this HListElement.

setLabel(String)

```
public void setLabel(java.lang.String label)
```

Set the label for this HListElement.

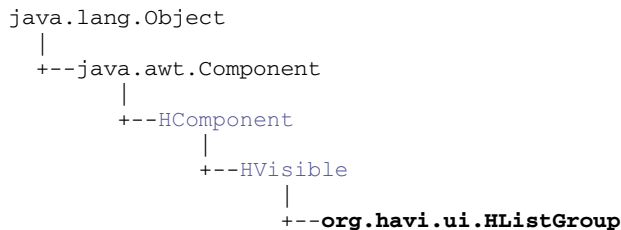
Parameters:

`label` - The label for this HListElement.

org.havi.ui HListGroup

Syntax

```
public class HListGroup extends HVisible implements HItemValue
```



All Implemented Interfaces:

HItemValue, HMatteLayer, HNavigable, HNavigationInputPreferred, HOrientable, HSelectionInputPreferred, HState, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

The `HListGroup` is a user interface component representing a list of selectable items (`HListElement`) which contain static read-only graphical and / or textual content.

This component can be navigated to, i.e. it can have the input focus. It also responds to `HItemEvent` events as follows:

- When the component has focus, sending an `ITEM_START_CHANGE` event to the component causes it to enter selection mode.
- When the component has focus, sending an `ITEM_END_CHANGE` event to the component causes it to leave selection mode.
- When the component has focus and is in selection mode, the current item can be set by sending `ITEM_SET_CURRENT`, `ITEM_SET_PREVIOUS` and `ITEM_SET_NEXT` events to the component.
- When the component has focus and is in selection mode, sending an `ITEM_TOGGLE_SELECTED` event causes the current item to be toggled between a selected and unselected state.
- Irrespective of focus and selection mode, sending an `ITEM_SELECTION_CLEARED` event to the component causes the current selection set to be cleared. The position of the current item is unchanged.

`HListGroup` has the following properties which make it slightly different from the other platform components.

- uses the `HTextLayoutManager` to render text from the elements. `HListGroup` is not required to respect the default horizontal and vertical content alignments specified by `HVisible`. For `HListGroup` these defaults are implementation specific. Application programmers who require a specific alignment policy must therefore make explicit calls to `setHorizontalAlignment(int)` and `setVerticalAlignment(int)` to enforce the alignments required.
- the resize mode as defined by `HVisible` determines how the icons are scaled.
- focus traversal applies to the entire list component. The elements in the list are not components in their own right and never receive focus. The concept of the current element is handled through `HItemEvent` events.
- for the purpose of layout management of the `HListGroup` component, the following constraints are applied:
 5. the minimum size is the size to present one element or an implementation specific minimum (32 x 32 for example) if no elements are present.
 6. the preferred size is that set by `setDefaultSize(Dimension)` rounded down to the nearest element (minimum of one) or the size required to present 5 elements if a default size is not set.
 7. the maximum size is that required to present all elements.

By default this component uses the `HListGroupLook` class to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
height	height of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte (HMatte)</code>	<code>getMatte ()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager (HTextLayoutManager)</code>	<code>getTextLayoutManager ()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode (int)</code>	<code>getBackgroundMode ()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize (Dimension)</code>	<code>getDefaultSize ()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment (int)</code>	<code>getHorizontalAlignment ()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment (int)</code>	<code>getVerticalAlignment ()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode (int)</code>	<code>getResizeMode ()</code>
The default "look" for this class.	A platform specific <code>HListGroupLook</code>	<code>setDefaultLook (HListGroupLook)</code>	<code>getDefaultLook ()</code>

The "look" for this object.	The <code>HListGroupLook</code> returned from <code>HListGroup.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The gain focus sound.	<code>null</code>	<code>setGainFocusSound(HSound)</code>	<code>getGainFocusSound()</code>
The lose focus sound.	<code>null</code>	<code>setLoseFocusSound(HSound)</code>	<code>getLoseFocusSound()</code>
The selection sound.	<code>null</code>	<code>setSelectionSound(HSound)</code>	<code>getSelectionSound()</code>

See Also:

`HListElement`, `HListGroupLook`, `HNavigable`, `HItemValue`

Fields**ADD_INDEX_END**

```
public static final int ADD_INDEX_END
```

A constant for use with `addItem(HListElement, int)` and `addItems(HListElement[], int)` which specifies that the new items should be appended to the end of the list.

DEFAULT_ICON_HEIGHT

```
public static final int DEFAULT_ICON_HEIGHT
```

A constant for use with `setIconSize(Dimension)` and `getIconSize()`. When no call to `setIconSize(Dimension)` has been made then `getIconSize()` will return this value for its default height. The default icon height for all orientations is implementation specific.

DEFAULT_ICON_WIDTH

```
public static final int DEFAULT_ICON_WIDTH
```

A constant for use with `setIconSize(Dimension)` and `getIconSize()`. When no call to `setIconSize(Dimension)` has been made then `getIconSize()` will return this value for its default width. The default icon width for all orientations is implementation specific.

DEFAULT_LABEL_HEIGHT

```
public static final int DEFAULT_LABEL_HEIGHT
```

A constant for use with `setLabelSize(Dimension)` and `getLabelSize()`. When no call to `setLabelSize(Dimension)` has been made then `getLabelSize()` will return this value for its default height. The default label height for all orientations is the current font height.

DEFAULT_LABEL_WIDTH

```
public static final int DEFAULT_LABEL_WIDTH
```

A constant for use with `setLabelSize(Dimension)` and `getLabelSize()`. When no call to `setLabelSize(Dimension)` has been made then `getLabelSize()` will return this value for its default width. The default label width for all orientations is implementation specific.

ITEM_NOT_FOUND

```
public static final int ITEM_NOT_FOUND
```

A constant which may be returned from `getIndex(HListElement)` if the requested element is not found in the content.

Constructors

HListGroup()

```
public HListGroup()
```

Creates an `HListGroup` object. See the class description for details of constructor parameters and default values.

HListGroup(HListElement[])

```
public HListGroup(HListElement[] items)
```

Creates an `HListGroup` object. See the class description for details of constructor parameters and default values.

HListGroup(HListElement[], int, int, int, int)

```
public HListGroup(HListElement[] items, int x, int y, int width, int height)
```

Creates an `HListGroup` object. See the class description for details of constructor parameters and default values.

Methods

addItem(HListElement, int)

```
public void addItem(HListElement item, int index)
```

Add an item to this `HListGroup`. The item is inserted after the specified `HListElement` in the content list. If no content exists a new content list is created to contain the new item and the value of the `index` parameter is ignored.

If the act of adding a new item causes the current active item index to change, an `HAdjustmentEvent` shall be sent.

Note that items are stored in the content list by reference, they are not copied.

Parameters:

`item` - the item to add.

`index` - the index of the currently existing item which the new items should be placed after, or `ADD_INDEX_END` to append the new items to the end of the list. If this value is not a valid item index for this list a `java.lang.IndexOutOfBoundsException` shall be thrown.

addItemListener(HItemListener)

```
public void addItemListener(HItemListener l)
```

Adds the specified `HItemListener` to receive `HItemEvent` sent from this object. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Specified By:

`addItemListener(HItemListener)` in interface `HItemValue`

Parameters:

`l` - the `HItemListener` to be notified.

addItem(HListElement[], int)

```
public void addItem(HListElement[] items, int index)
```

Add an array of items to this `HListGroup`. The items are inserted in the same order as they are in the array after the item specified. If no content exists a new content list is created to contain the new items and the value of the `index` parameter is ignored.

If the act of adding a new item causes the current active item index to change, an `HAdjustmentEvent` shall be sent.

Note that items are stored in the content list by reference, they are not copied.

Parameters:

`item` - the item to add.

`index` - the index of the currently existing item which the new items should be placed after, or `ADD_INDEX_END` to append the new items to the end of the list. If this value is not a valid item index for this list a `java.lang.IndexOutOfBoundsException` shall be thrown.

clearSelection()

```
public void clearSelection()
```

Destroy the selection. This method deselects any selected `HListElement`, but does not remove them from the `HListGroup`. After calling this method calls to `getSelection()` shall return `null` until a new selection is made.

If the selection was not already empty, an `HItemEvent` shall be sent to any registered listeners.

See Also:

`getSelection()`

getCurrentIndex()

```
public int getCurrentIndex()
```

Retrieve the current active item index, if one is currently chosen. The current index is the index of the `HListElement` which would be selected or deselected should the user action the `HListGroup`. If there is no current element or there is no content set this method shall return `ITEM_NOT_FOUND`

Returns:

the current item index, or `ITEM_NOT_FOUND` if no such item exists.

getCurrentItem()

```
public HListElement getCurrentItem()
```

Retrieve the current active item, if one has been chosen. The current item is the `HListElement` which would be selected or deselected should the user action the `HListGroup`. If there is no current item or there is no content set this method shall return `null`

Returns:

the current item, or `null` if no such item exists.

getDefaultLook()

```
public static HListGroupLook getDefaultLook()
```

Returns the currently set default `HLook` for `HListGroup` components.

Returns:

The `HLook` that is used by default when creating a new `HListGroup` component.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

`getGainFocusSound()` in interface `HNavigable`

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then `null` shall be returned.

getIconSize()

```
public java.awt.Dimension getIconSize()
```

Retrieve the icon size for this `HListGroup`. This size is the desired size of the area into which the `HListGroupLook` should render any image content of the `HListElement`.

Returns:

the icon size. If no size has been set then this method shall return `new Dimension(DEFAULT_ICON_WIDTH, DEFAULT_ICON_HEIGHT)`.

getIndex(HListElement)

```
public int getIndex(HListElement item)
```

Retrieve the index position of an item in the content list.

Parameters:

`item` - the item to retrieve the index for.

Returns:

the index of the given `HListElement`, or `ITEM_NOT_FOUND` if no such element exists.

getItem(int)

```
public HListElement getItem(int index)
```

Retrieve an item from the content list by index.

Parameters:

`index` - the index of the item to retrieve. If this parameter is negative a `java.lang.IllegalArgumentException` shall be thrown.

Returns:

the `HListElement` at the given index, or `null` if no such element exists.

getLabelSize()

```
public java.awt.Dimension getLabelSize()
```

Retrieve the label size for this `HListGroup`. This size is the desired size of the area into which the `HListGroupLook` should render any textual content of the `HListElement`.

Returns:

the label size. If no size has been set then this method shall return `new Dimension(DEFAULT_LABEL_WIDTH, DEFAULT_LABEL_HEIGHT)`.

getListContent()

```
public HListElement[] getListContent()
```

Retrieve the list content for this `HListGroup`.

Returns:

the list content or `null` if no content has been set.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

`getLoseFocusSound()` in interface `HNavigable`

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then `null` shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

`getMove(int)` in interface `HNavigable`

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns `null`.

getMultiSelection()

```
public boolean getMultiSelection()
```

Return the multiple selection mode currently active for this `HListGroup`. Multiple selection mode means that there may be more than one `HListElement` selected at a time.

Returns:

`true` if multiple selections are permitted, `false` otherwise.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

`getNavigationKeys()` in interface `HNavigationInputPreferred`

Returns:

an array of key codes, or `null` if no navigation targets are set on this component.

getNumItems()

```
public int getNumItems()
```

Retrieve the number of items in the content list.

Returns:

the number of items in the content list, or 0 if no content has been set.

getNumSelected()

```
public int getNumSelected()
```

Return the number of items which would be in the selection, if the `getSelection()` method were called at this time.

Returns:

the number of selected items.

getOrientation()

```
public int getOrientation()
```

Retrieve the orientation of the `HListGroup`. The orientation controls how an associated `HLook` lays out the component and affects the visual behavior of the `HAdjustmentEvent` and `HItemEvent` events. For example, the system might use this information to select appropriate key mappings for these events.

Specified By:

`getOrientation()` in interface `HOrientable`

Returns:

one of `ORIENT_LEFT_TO_RIGHT`, `ORIENT_RIGHT_TO_LEFT`, `ORIENT_TOP_TO_BOTTOM`, or `ORIENT_BOTTOM_TO_TOP`.

getScrollPosition()

```
public int getScrollPosition()
```

Retrieve the scroll position of the `HListGroup`. The scroll position determines the first `HListElement` to be drawn when the `HListGroupLook` lays out the list.

Returns:

the current scroll position.

getSelection()

```
public HListElement[] getSelection()
```

Get the selection from this `HListGroup`. The selection is defined as that set of `HListElement` which the user has caused to be selected by actioning the `HListGroup`.

Returns:

the selection, or `null` if no items are selected. Only items which are currently part of the content for this `HListGroup` may be selected.

getSelectionIndices()

```
public int[] getSelectionIndices()
```

Get the list of selection indices from this `HListGroup`. The selection is defined as that set of `HListElement` indices which the user has caused to be selected by actioning the `HListGroup`.

Returns:

the index selection, or `null` if no items are selected. Only items which are currently part of the content for this `HListGroup` may be selected.

getSelectionMode()

```
public boolean getSelectionMode()
```

Get the selection mode for this `HListGroup`. If the returned value is `true` the component is in selection mode, and the selection may be changed.

The component is switched into and out of selection mode on receiving `ITEM_START_CHANGE` and `ITEM_END_CHANGE` events.

Specified By:

`getSelectionMode()` in interface `HSelectionInputPreferred`

Returns:

`true` if this component is in selection mode, `false` otherwise.

getSelectionSound()

```
public HSound getSelectionSound()
```

Get the sound to be played when the selection changes.

Specified By:

`getSelectionSound()` in interface `HItemValue`

Returns:

The sound played when the selection changes

isItemSelected(int)

```
public boolean isItemSelected(int index)
```

Retrieve the selection state of a particular `HListElement`.

Note that if multiple selections are not permitted only one `HListElement` may be selected at a time.

Parameters:

`index` - the index of the `HListElement` to query. A `java.lang.IllegalArgumentException` shall be thrown if this index is not valid for the `HListGroup`.

Returns:

`true` if the given `HListElement` is selected, `false` otherwise.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

`isSelected()` in interface `HNavigable`

Returns:

`true` if the component has focus, otherwise returns `false`.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HListGroup`.

Specified By:

`processHFocusEvent(HFocusEvent)` in interface `HNavigationInputPreferred`

Parameters:

`evt` - the `HFocusEvent` to process.

processHItemEvent(HItemEvent)

```
public void processHItemEvent(HItemEvent evt)
```

Process an `HItemEvent` sent to this `HListGroup`.

Specified By:

`processHItemEvent(HItemEvent)` in interface `HSelectionInputPreferred`

Parameters:

`evt` - the `HItemEvent` to process.

removeAllItems()

```
public void removeAllItems()
```

Remove all the content. The selection is also destroyed and calls to `getSelection()` shall return `null` until new content and selections are created.

See Also:

`getSelection()`

removeItem(int)

```
public HListElement removeItem(int index)
```

Remove the `HListElement` at the specified index. The item is also removed from the selection, if any is set. If this was the last item in the selection the entire selection is destroyed and calls to `getSelection()` shall return `null` until new content and selections are created.

If the act of removing an item causes the current active item index to change, an `HAdjustmentEvent` shall be sent.

If the act of removing an item causes the selection to change, an `HItemEvent` shall be sent.

Parameters:

`index` - the index of the item to remove.

Returns:

the `HListElement` that has been removed or `null` if the index is not valid. No exception is thrown if `index` is not valid.

See Also:

`getSelection()`

removeItemListener(HItemListener)

```
public void removeItemListener(HItemListener l)
```

Removes the specified `HItemListener` so that it no longer receives `HItemEvent` from this object. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Specified By:

`removeItemListener(HItemListener)` in interface `HItemValue`

Parameters:

`l` - the `HItemListener` to be removed from notification.

setCurrentItem(int)

```
public boolean setCurrentItem(int index)
```

Set the current active item. The current item is the `HListElement` which would be selected or deselected should the user action the `HListGroup`.

Parameters:

`index` - the index of the new current item.

Returns:

`true` if the current item was changed, `false` if `index` was not a valid index for this `HListGroup` or the current item was not changed because it is already selected. No exception is thrown if `index` is not valid.

setDefaultLook(HListGroupLook)

```
public static void setDefaultLook(HListGroupLook look)
```

Sets the default `HLook` for further `HListGroup` Components.

Parameters:

`look` - The `HLook` that will be used by default when creating a new `HListGroup` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
                             HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

```
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) in
interface HNavigable
```

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` KeyEvent. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` KeyEvent. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` KeyEvent. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` KeyEvent. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

```
setGainFocusSound(HSound) in interface HNavigable
```

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setIconSize(Dimension)

```
public void setIconSize(java.awt.Dimension size)
```


Set the icon size for this `HListGroup`. This size is the desired size of the area into which the `HListGroupLook` should render any image content of the `HListElement`.

Parameters:

`size` - the icon size. If this parameter is `new Dimension(DEFAULT_ICON_SIZE, DEFAULT_ICON_SIZE)` or `null` the `HListGroup` shall revert to using an implementation-specific icon size.

setItemSelected(int, boolean)

```
public void setItemSelected(int index, boolean sel)
```

Set the selection state of a particular `HListElement`.

If a successful call to this method causes the selection to change an `HItemEvent` shall be sent to any registered listeners.

Parameters:

`index` - the index of the `HListElement` to alter. A `java.lang.IllegalArgumentException` shall be thrown if this index is not valid for the `HListGroup`.

`sel` - `true` to select the given `HListElement`, `false` otherwise.

setLabelSize(Dimension)

```
public void setLabelSize(java.awt.Dimension size)
```

Set the label size for this `HListGroup`. This size is the desired size of the area into which the `HListGroupLook` should render any textual content of the `HListElement`.

Parameters:

`size` - the label size. If this parameter is `new Dimension(DEFAULT_LABEL_WIDTH, DEFAULT_LABEL_HEIGHT)` or `null` the `HListGroup` shall revert to using an implementation-specific label size.

setListContent(HListElement[])

```
public void setListContent(HListElement[] elements)
```

Set the list content for this `HListGroup`. Any existing selection is discarded (which may cause an `HItemEvent` to be generated.)

Parameters:

`elements` - the list content. If this parameter is `null` any existing content is removed.

setLook(HLook)

```
public void setLook(HLook hlook)
```

Sets the `HLook` for this component.

Overrides:

`setLook(HLook)` in class `HVisible`

Parameters:

`hlook` - The `HLook` that is to be used for this component. Note that this parameter may be `null`, in which case the component will not draw itself until a look is set.

Throws:

`HInvalidLookAndFeelException` - If the `Look` is not an `HListGroupLook`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRCcapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

setMultiSelection(boolean)

```
public void setMultiSelection(boolean multi)
```

Set the multiple selection mode for this `HListGroup`. Multiple selection mode means that there may be more than one `HListElement` selected at a time.

Note that if the `HListGroup` is switched out of multiple selection mode and more than one item is selected, the selection shall change so that the first of the items is selected and the others are deselected. This will cause an `HItemEvent` to be sent to any registered listeners.

Parameters:

`true` - if multiple selections are to be permitted, `false` otherwise.

setOrientation(int)

```
public void setOrientation(int orient)
```

Set the orientation of the `HListGroup`. The orientation controls how the associated `HLook` lays out the component.

Specified By:

`setOrientation(int)` in interface `HOrientable`

Parameters:

`orient` - one of `ORIENT_LEFT_TO_RIGHT`, `ORIENT_RIGHT_TO_LEFT`, `ORIENT_TOP_TO_BOTTOM`, or `ORIENT_BOTTOM_TO_TOP`.

setScrollPosition(int)

```
public void setScrollPosition(int scroll)
```

Set the scroll position of the `HListGroup`. The scroll position determines the first `HListElement` to be drawn when the `HListGroupLook` lays out the list. An `IllegalArgumentException` shall be thrown if `scroll` is not a valid scroll position.

It is an implementation option for `HListGroupLook` to draw elements before this first one, in order to fill the available space.

Returns:

the current scroll position, or 0 if no content is set.

setSelectionMode(boolean)

```
public void setSelectionMode(boolean adjust)
```

Set the selection mode for this `HListGroup`.

This method is provided for the convenience of component implementors. Interoperable applications shall not call this method. It cannot be made protected because interfaces cannot have protected methods.

Specified By:

`setSelectionMode(boolean)` in interface `HSelectionInputPreferred`

Parameters:

`edit` - true to switch this component into selection mode, false otherwise.

See Also:

`getSelectionMode()`

setSelectionSound(HSound)

```
public void setSelectionSound(HSound sound)
```

Associate a sound to be played when the selection is modified. The sound is played irrespective of whether an `HItemEvent` is sent to one or more listeners.

Specified By:

`setSelectionSound(HSound)` in interface `HItemValue`

Parameters:

`sound` - the sound to be played, when the selection is modified. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

org.havi.ui HListGroupLook

Syntax

```
public class HListGroupLook implements HAdjustableLook
```

```
java.lang.Object
|
+--org.havi.ui.HListGroupLook
```

All Implemented Interfaces:

```
java.lang.Cloneable, HAdjustableLook, HLook
```

Description

The `HListGroupLook` class is used by the `HListGroup` component to display both the `HListGroup` itself (potentially including a scrollbar component) and graphical or textual list content held on the `HListGroup`. This look will be provided by the platform and the exact way in which it is rendered will be platform dependent.

The `HListGroupLook` class draws the `HListGroup` and any look-specific borders around the component, and then renders the content set on the `HListGroup`. It uses the `getListContent()` method to determine the content to render. The content of the `HListGroup` does not depend on the interaction state. Borders are not drawn around the content.

`HListGroupLook` should use the following properties of `HListGroup` to lay out and render the `HListElement` content:

Item	Method	Purpose
Orientation	<code>getOrientation()</code>	direction to lay out elements
Content	<code>getListContent()</code>	elements to display
Scroll position	<code>getScrollPosition()</code>	first element to draw
Selection	<code>isItemSelected(int)</code>	mark an element as selected
Current item	<code>getCurrentItem()</code>	highlight an element

`HListGroupLook` should draw a scrollbar as necessary when there are more `HListElement` than can be displayed. It is an implementation option to leave border space between each element. The insets used for the element borders can be retrieved using `getElementInsets()`

Implementations of `HListGroupLook` should use the appropriate methods on `HListGroup` to determine which scaling and alignment modes to use when rendering content. See the class description for `HLook` for more details.

`HListGroupLook` may support scalable graphical content. As a minimum, all implementations must support the `RESIZE_NONE` scaling mode for graphical content, and all alignment modes for text content. However, Note that `HListGroupLook` behaves slightly differently from other HAVi `HLook` classes, as follows.

- Where supported, scaling applies to the icon (graphical content) of each `HListElement`, based on the area

allocated to that `HListElement` rather than the entire area of the `HListGroup`.

- Alignment mode applies to the content of the `HListElement` within the area allocated to that `HListElement` rather than the entire area of the `HListGroup`.

Note that the results of applying the `VALIGN_JUSTIFY` and `HALIGN_JUSTIFY` alignment modes to graphical content are defined to be identical to `VALIGN_CENTER` and `HALIGN_CENTER` modes respectively, as justification is meaningless in this context.

This is the default look that is used by `HListGroup`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Element insets	null	<code>getElementInsets()</code>	---

See Also:

`HListGroup`, `HListElement`, `HVisible`, `HLook`, `HDefaultTextLayoutManager`

Constructors

`HListGroupLook()`

```
public HListGroupLook()
```

Creates a `HListGroupLook` object. See the class description for details of constructor parameters and default values.

Methods

`getElementInsets()`

```
public java.awt.Insets getElementInsets()
```

Retrieve the element insets for this instance of `HListGroupLook`. The element insets control the amount of empty space left between the elements and the border of the `HListGroup` component.

Returns:

the element insets, or `null` if insets are not used by this implementation of `HListGroupLook`.

`getInsets(HVisible)`

```
public java.awt.Insets getInsets(HVisible visible)
```

Determines the insets of this `HLook` , which indicate the size of the border. This area is reserved for the `HLook` to use for drawing borders around the associated `HVisible` .

Specified By:

`getInsets(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

the insets of this `HLook` .

getMaximumSize(HVisible)

```
public java.awt.Dimension getMaximumSize(HVisible hvisible)
```

Gets the maximum size of the `HVisible` component when drawn with this `HLook` .

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) then the return value is the current size of the `HVisible` (as returned by `HVisible#getSize`).
2. If the `HLook` does not support scaling of content or no scaling is requested, and content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If there is no content set then a maximum size of [`Short.MAX_VALUE` , `Short.MAX_VALUE`] is returned as a `Dimension`.

Specified By:

`getMaximumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` maximum size.

See Also:

`getMaximumSize()`

getMinimumSize(HVisible)

```
public java.awt.Dimension getMinimumSize(HVisible hvisible)
```

Gets the minimum size of the `HVisible` component when drawn with this `HLook` .

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the size of the smallest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.

2. If the `HLook` does not support scaling of content or no scaling is requested, *and* content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If no content is available but a default preferred size has been set using `setDefaultSize(Dimension)` has been called to set then the return value is this value (as obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
4. If there is no content or default size set then the return value is an implementation-specific minimum size plus any additional dimensions that the `HLook` requires for border decoration etc.

Specified By:

`getMinimumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` minimum size.

See Also:

`getMinimumSize()`

getNumVisible(HVisible)

```
public int getNumVisible(HVisible visible)
```

Retrieve the number of visible elements for the specified component.

This method should determine the number of list elements that would be completely visible should the specified component be drawn using this look.

Parameters:

`visible` - the `HVisible` to obtain the number of visible elements for.

Returns:

the number of visible elements.

getPreferredSize(HVisible)

```
public java.awt.Dimension getPreferredSize(HVisible hvisible)
```

Gets the preferred size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If a default preferred size has been set for this `HVisible` (using `setDefaultSize(Dimension)`) then the return value is this size (obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If this `HLook` does not support scaling of content or no scaling is requested, and content is present then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If this `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the current size of the `HVisible` as returned by `getSize()`.
4. If there is no content and no default size set then the return value is the current size of the `HVisible` as

returned by `getSize()`).

Specified By:

`getPreferredSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating the preferred size of the `HVisible` when drawn with this `HLook`.

See Also:

`getPreferredSize()`, `setDefaultSize(Dimension)`

hitTest(HAdjustmentValue, Point)

```
public int hitTest(HAdjustmentValue component, java.awt.Point pt)
```

Returns a value which indicates the pointer click position in the on-screen representation of the adjustable component. Note that it is a valid implementation option to always return `ADJUST_NONE`.

Specified By:

`hitTest(HAdjustmentValue, Point)` in interface `HAdjustableLook`

Parameters:

`component` - the `HAdjustmentValue` component for which the hit position should be calculated.

`pt` - the pointer click point.

Returns:

one of `ADJUST_NONE`, `ADJUST_BUTTON_LESS`, `ADJUST_PAGE_LESS`, `ADJUST_THUMB`, `ADJUST_PAGE_MORE` or `ADJUST_BUTTON_MORE`.

isOpaque(HVisible)

```
public boolean isOpaque(HVisible visible)
```

Returns true if the entire painted area of the `HVisible` when using this look is fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`.

The default value is implementation specific and depends on the background painting mode of the given `HVisible`. The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque(HVisible)` in interface `HLook`

Parameters:

`visible` - the visible to test

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method of an `HVisible` using this look are fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`, otherwise false.

showLook(Graphics, HVisible, int)

```
public void showLook(java.awt.Graphics g, HVisible visible, int state)
```

The `showLook(Graphics, HVisible, int)` method is responsible for repainting the entire `HVisible` component, (including any content set on the component, and the component background), subject to the `clipRect` of the `Graphics` object passed to it.

The `showLook(Graphics, HVisible, int)` method should not modify the `clipRect` of the `Graphics` object that is passed to it.

For looks which draw content (e.g. `HTextLook`, `HGraphicLook` and `HAnimateLook`), if no content is associated with the component, the `showLook(Graphics, HVisible, int)` method paints the component with its current background `Color` according to the `setBackgroundMode(int)` method of `HVisible` and draws any (implementation-specific) borders. Note that by default the background mode is set so as to **not** paint a background. Furthermore on platforms which support transparent colors the background `Color` may be partially or completely transparent.

Any resources **explicitly** associated with an `HLook` should be loaded by the `HLook` during its creation, etc., or via its `setXXX()` methods. Note that the "standard" looks don't load content by default.

This method is called from the `paint(Graphics)` method of `HVisible` and must never be called from elsewhere. Components wishing to redraw themselves should call their `repaint` method in the usual way.

Specified By:

`showLook(Graphics, HVisible, int)` in interface `HLook`

Parameters:

`g` - the graphics context.

`visible` - the visible.

`state` - the state parameter indicates the state of the visible, allowing the look to render the appropriate content for that state. Note that some components (e.g. `HStaticRange`, `HRange`, `HRangeValue`) do not use state-based content).

widgetChanged(HVisible, HChangeData[])

```
public void widgetChanged(HVisible visible, HChangeData[] changes)
```

Called by the `HVisible` whenever its content, state, or any other data changes. See the class description of `HVisible` for more information about the `changes` parameter.

The implementation of this method should work out which graphical areas of the `HVisible` have changed and make any relevant calls to trigger the repainting of those areas.

A minimum implementation of this method could simply call

```
visible.repaint()
```

Specified By:

`widgetChanged(HVisible, HChangeData[])` in interface `HLook`

Parameters:

`visible` - the `HVisible` which has changed

`changes` - an array containing hint data and associated hint objects. If this argument is `null` a full repaint will be triggered.

org.havi.ui

HLook

Syntax

```
public interface HLook extends java.lang.Cloneable
```

All Known Subinterfaces:

`HAdjustableLook`

All Superinterfaces:

`java.lang.Cloneable`

All Known Implementing Classes:

`HAnimateLook`, `HGraphicLook`, `HTextLook`, `HSinglelineEntryLook`

Description

The `HLook` interface defines the "look" of a component and may be regarded as a mechanism to allow a "pluggable" paint method to be attached to the component. Instead of having to subclass the entire component to change its look, it is possible to simply implement an `HLook` that will render the component "look" and then associate this `HLook` implementation with the component.

Borders

An implementation of `HLook` will also include code to draw implementation-specific borders. The application or component can query the reserved space for an `HLook` with the `getInsets(HVisible)` method.

Since the border area is included in the overall size of the component, the border effectively constrains the area available for rendering content to the rectangle which has an upper-left corner location of `(insets.left, insets.top)`, and has a size of width - `(insets.left + insets.right)` by height - `(insets.top + insets.bottom)`.

Invocation Mechanism

The `showLook(Graphics, HVisible, int)` method of the `HLook` interface will be called by the `havi.ui` framework in response to the paint method of the `HVisible` being called by the AWT lightweight component framework. Applications should simply invoke the component repaint method as in normal AWT, rather than calling the `showLook(Graphics, HVisible, int)` method directly.

The conditions under which the `showLook(Graphics, HVisible, int)` method shall be invoked include the following:

- If the class implements one of the following interfaces, the `showLook(Graphics, HVisible, int)` method shall be invoked when the trigger events specified in the table below are processed:

Interface	Trigger Events
<code>HNavigable</code>	<code>HFocusEvent</code>
<code>HActionable</code>	<code>HFocusEvent</code> , <code>HActionEvent</code>
<code>HSwitchable</code>	<code>HFocusEvent</code> , <code>HActionEvent</code>

HAdjustmentValue HFocusEvent, HAdjustmentEvent

HItemValue HFocusEvent, HItemEvent

HTextView HFocusEvent, HTextEvent

- If the implementing class is an `HVisible`, then the `showLook(Graphics, HVisible, int)` method shall be invoked when content is set on that `HVisible`.
- Content Rendering

Some looks make use of content stored on an associated `HVisible`. These looks are:

- `HAnimateLook` - for animated graphical content
- `HGraphicLook` - for static graphical content
- `HTextLook` - for static textual content
- `HSinglelineEntryLook` - for single line text entry content
- `HMultilineEntryLook` - for multiline text entry content
- `HListGroupLook` - for list element content

Some of these looks may support the scaling and alignment of their content as an implementation option. The scaling and alignment modes supported are specified in the class description of `HVisible`. The table below details which features the content-based platform looks should support:

HLook	Scaling	Alignment
<code>HAnimateLook</code>	Optional	Mandatory
<code>HGraphicLook</code>	Optional	Mandatory
<code>HListGroupLook</code>	Optional	Mandatory
<code>HTextLook</code>	Not used	Mandatory
<code>HSinglelineEntryLook</code>	Not used	Not used
<code>HMultilineEntryLook</code>	Not used	Not used

Where scaling support is optional all implementations must as a minimum support the `RESIZE_NONE` scaling mode. Platforms are *not* required to support scaling of textual content by default.

Looks should use the `getHorizontalAlignment()` and `getVerticalAlignment()` methods to retrieve the current alignment modes, and the `getResizeMode()` method to determine the active scaling mode, where supported. However, note that HAVi platform looks which render text content using the `HDefaultTextLayoutManager` class shall delegate the alignment of text content to the layout manager.

Rendering Hints

`HLook` provides a method, `widgetChanged(HVisible, HChangeData[])` which can be called by an `HVisible` with one or more hints to inform the look that something has changed. This method provides information to the look about what has changed, which allows smarter repainting than having the `HVisible` simply call its `repaint` method. The hint constants are defined on `HVisible`. See the class definition for `HVisible` for more information.

Private Data

Implementations of `HLook` may store private data on each instance of an `HVisible` to optimize the drawing of that component. However, this is an implementation option. Furthermore such data may be invalidated by another part of the system, for example if `setLook(HLook)` is called on `HVisible`. Therefore if this mechanism is used by implementations of `HLook` those implementations *must* be capable of regenerating such data on the fly, according to the current state of the `HVisible`.

Platform Looks

The HAVi UI provides a number of classes implementing the `HLook` interface. Applications wishing to provide their own `HLook` may directly implement this interface or may subclass those provided by the platform.

Default Behavior

Unless already specified in a particular `HLook`, implementations of `HLook` should use:

- the foreground color of each associated `HVisible` (using the `java.awt.Component` method `getForeground`) to determine the `Color` to render both the content and border (as necessary)
- the background color of each associated `HVisible` (using the `java.awt.Component` method `getBackground`) to determine the `Color` used to render a rectangular area to fill the component and erase any previous content, as specified by the current background drawing mode for that component - see `setBackgroundMode(int)` on `HVisible`.
- the current alignment mode of each associated `HVisible` (using `getHorizontalAlignment()` and `getVerticalAlignment()`) to determine how to align content.
- the current scaling mode of each associated `HVisible` (using `getResizeMode()`) to determine how to scale content.

See Also:

`setLook(HLook)`, `setLookData(Object, Object)`, `paint(Graphics)`, `setBackgroundMode(int)`, `setHorizontalAlignment(int)`, `setVerticalAlignment(int)`, `setResizeMode(int)`, `HTextLook`, `HGraphicLook`, `HAnimateLook`, `HRangeLook`, `HSinglelineEntryLook`, `HMultilineEntryLook`

Methods

`getInsets(HVisible)`

```
public java.awt.Insets getInsets(HVisible visible)
```

Determines the insets of this `HLook`, which indicate the size of the border. This area is reserved for the `HLook` to use for drawing borders around the associated `HVisible`.

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

the insets of this `HLook`.

`getMaximumSize(HVisible)`

```
public java.awt.Dimension getMaximumSize(HVisible hvisible)
```

Gets the maximum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) then the return value is the current size of the `HVisible` (as returned by `HVisible#getSize()`).
2. If the `HLook` does not support scaling of content or no scaling is requested, and content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If there is no content set then a maximum size of `[Short.MAX_VALUE, Short.MAX_VALUE]` is returned as a `Dimension`.

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` maximum size.

See Also:

`getMaximumSize()`

getMinimumSize(HVisible)

```
public java.awt.Dimension getMinimumSize(HVisible hvisible)
```

Gets the minimum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the size of the smallest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If the `HLook` does not support scaling of content or no scaling is requested, *and* content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If no content is available but a default preferred size has been set using `setDefaultSize(Dimension)` has been called to set then the return value is this value (as obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
4. If there is no content or default size set then the return value is an implementation-specific minimum size plus any additional dimensions that the `HLook` requires for border decoration etc.

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` minimum size.

See Also:

`getMinimumSize()`

getPreferredSize(HVisible)

```
public java.awt.Dimension getPreferredSize(HVisible hvisible)
```

Gets the preferred size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If a default preferred size has been set for this `HVisible` (using `setDefaultSize(Dimension)`) then the return value is this size (obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If this `HLook` does not support scaling of content or no scaling is requested, and content is present then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If this `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the current size of the `HVisible` as returned by `getSize()`.
4. If there is no content and no default size set then the return value is the current size of the `HVisible` as returned by `getSize()`.

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating the preferred size of the `HVisible` when drawn with this `HLook`.

See Also:

`getPreferredSize()`, `setDefaultSize(Dimension)`

isOpaque(HVisible)

```
public boolean isOpaque(HVisible visible)
```

Returns true if the entire painted area of the `HVisible` when using this look is fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`.

The default value is implementation specific and depends on the background painting mode of the given `HVisible`. The consequences of an invalid overridden value are implementation specific.

Parameters:

`visible` - the visible to test

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method of an `HVisible` using this look are fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`, otherwise false.

showLook(Graphics, HVisible, int)

```
public void showLook(java.awt.Graphics g, HVisible visible, int state)
```

The `showLook(Graphics, HVisible, int)` method is responsible for repainting the entire `HVisible` component, (including any content set on the component, and the component background), subject to the `clipRect` of the `Graphics` object passed to it.

The `showLook(Graphics, HVisible, int)` method should not modify the `clipRect` of the `Graphics` object that is passed to it.

For looks which draw content (e.g. `HTextLook`, `HGraphicLook` and `HAnimateLook`), if no content is associated with the component, the `showLook(Graphics, HVisible, int)` method paints the component with its current background `Color` according to the `setBackgroundMode(int)` method of `HVisible` and draws any (implementation-specific) borders. Note that by default the background mode is set so as to **not** paint a background. Furthermore on platforms which support transparent colors the background `Color` may be partially or completely transparent.

Any resources **explicitly** associated with an `HLook` should be loaded by the `HLook` during its creation, etc., or via its `setXXX()` methods. Note that the "standard" looks don't load content by default.

This method is called from the `paint(Graphics)` method of `HVisible` and must never be called from elsewhere. Components wishing to redraw themselves should call their `repaint` method in the usual way.

Parameters:

`g` - the graphics context.

`visible` - the visible.

`state` - the state parameter indicates the state of the visible, allowing the look to render the appropriate content for that state. Note that some components (e.g. `HStaticRange`, `HRange`, `HRangeValue`) do not use state-based content).

widgetChanged(HVisible, HChangeData[])

```
public void widgetChanged(HVisible visible, HChangeData[] changes)
```

Called by the `HVisible` whenever its content, state, or any other data changes. See the class description of `HVisible` for more information about the `changes` parameter.

The implementation of this method should work out which graphical areas of the `HVisible` have changed and make any relevant calls to trigger the repainting of those areas.

A minimum implementation of this method could simply call

```
visible.repaint()
```

Parameters:

`visible` - the `HVisible` which has changed

`changes` - an array containing hint data and associated hint objects. If this argument is `null` a full repaint will be triggered.

org.havi.ui

HMatte

Syntax

```
public interface HMatte
```

All Known Implementing Classes:

```
HImageMatte, HFlatMatte, HFlatEffectMatte, HImageEffectMatte
```

Description

`HMatte` is the base interface for all matte classes.

Where pixels in a component already have an alpha value (e.g. from an image), the alpha value from the component and the alpha value from the `HMatte` are multiplied together to obtain the actual alpha value to be used for that pixel.

The final displayed value of the component and its `HMatte` is obviously subject to the capabilities of the underlying hardware platform.

org.havi.ui HMatteException

Syntax

```
public class HMatteException extends HUIException
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--HUIException
            |
            +--org.havi.ui.HMatteException
```

All Implemented Interfaces:

java.io.Serializable

Description

An `HMatteException` is an exception that is thrown when a Component is unable to support the desired `HMatte` effect. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
message	Message explaining why the exception was thrown	null	-	java.lang.Throwable#getMessage

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

[HMatteLayer](#)

Constructors

HMatteException()

```
public HMatteException()
```

Creates an `HMatteException` object. See the class description for details of constructor parameters and default values.

HMatteException(String)

```
public HMatteException(java.lang.String message)
```

Creates an HMatteException object with a specified reason string.

Parameters:

message - the reason why the exception was raised

org.havi.ui HMatteLayer

Syntax

```
public interface HMatteLayer
```

All Known Implementing Classes:

`HComponent`, `HContainer`

Description

This `HMatteLayer` interface enables the presentation of components, together with an associated `HMatte`, for matte compositing.

See Also:

`HMatte`

Methods

getMatte()

```
public HMatte getMatte()
```

Get any `HMatte` currently associated with this component.

Returns:

the `HMatte` currently associated with this component or null if there is no associated matte.

setMatte(HMatte)

```
public void setMatte(HMatte m)
```

Applies an `HMatte` to this component, for matte compositing. Any existing animated matte must be stopped before this method is called or an `HMatteException` will be thrown.

Parameters:

`m` - The `HMatte` to be applied to this component -- note that only one matte may be associated with the component, thus any previous matte will be replaced. If `m` is null, then any matte associated with the component is removed and further calls to `getMatte()` shall return null. The component shall behave as if it had a fully opaque `HFlatMatte` associated with it (i.e an `HFlatMatte` with the default value of 1.0.)

Throws:

`HMatteException` - if the `HMatte` cannot be associated with the component. This can occur:

- if the specific matte type is not supported
- if the platform does not support any matte type
- if the component is associated with an already running `HFlatEffectMatte` or `HImageEffectMatte`. The exception is thrown even if `m` is null.

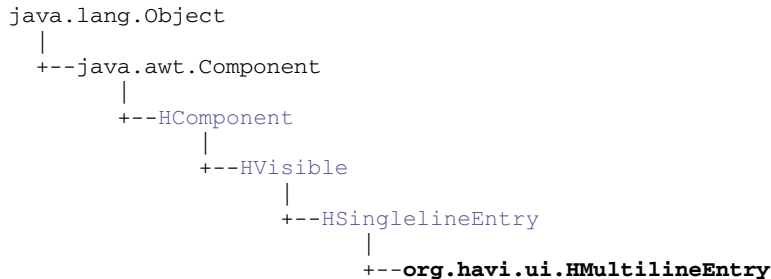
See Also:

`HMatte`

org.havi.ui HMultilineEntry

Syntax

```
public class HMultilineEntry extends HSinglelineEntry
```



All Implemented Interfaces:

[HKeyboardInputPreferred](#), [HMatteLayer](#), [HNavigable](#), [HNavigationInputPreferred](#), [HState](#), [HTextValue](#), [java.awt.image.ImageObserver](#), [java.awt.MenuContainer](#), [java.io.Serializable](#), [TestOpacity](#)

Description

The `HMultilineEntry` is a user interface component used to receive multiple lines of alphanumeric entry from the user. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
height	height of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
text	The text within this <code>HMultilineEntry</code> , to be used as the displayed and editable content for all states.	null	<code>setTextContent(String, int)</code>	<code>getTextContent(int)</code>

max-Chars	The maximum number of characters (per line) allowed in this <code>HMultilineEntry</code> .	16 characters	<code>setMaxCharsPerLine(int)</code>	<code>getMaxCharsPerLine()</code>
font	The font to be used for this component.	---	<code>java.awt.Component#setFont.</code>	<code>java.awt.Component#getFont.</code>
color	The color to be used for this component.	---	<code>java.awt.Component#setForeground.</code>	<code>java.awt.Component#getForeground.</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
Caret position	At the end of the current text string	<code>setCaretCharPosition(int)</code>	<code>getCaretCharPosition()</code>
Input type	<code>INPUT_ANY</code>	<code>setType(int)</code>	<code>getType()</code>
Customized input range	As for <code>INPUT_ALPHANUMERIC</code>	<code>setValidInput(char[])</code>	<code>getValidInput()</code>
Password protection (the echo character)	Entry is "clear", i.e. not password protected.	<code>setEchoChar(char)</code>	<code>getEchoChar()</code> and <code>echoCharIsSet()</code>
The default "look" for this class.	A platform specific <code>HMultilineEntryLook</code>	<code>setDefaultLook(HMultilineEntryLook)</code>	<code>getDefaultLook()</code>

The "look" for this object.	The <code>HMultilineEntryLook</code> returned from <code>HMultilineEntry.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The gain focus sound.	<code>null</code>	<code>setGainFocusSound(HSound)</code>	<code>getGainFocusSound()</code>
The lose focus sound.	<code>null</code>	<code>setLoseFocusSound(HSound)</code>	<code>getLoseFocusSound()</code>

Constructors

HMultilineEntry()

```
public HMultilineEntry()
```

Creates an `HMultilineEntry` object. See the class description for details of constructor parameters and default values.

HMultilineEntry(int)

```
public HMultilineEntry(int maxChars)
```

Creates an `HMultilineEntry` object. See the class description for details of constructor parameters and default values.

HMultilineEntry(int, int, int, int, int)

```
public HMultilineEntry(int x, int y, int width, int height, int maxChars)
```

Creates an `HMultilineEntry` object. See the class description for details of constructor parameters and default values.

HMultilineEntry(String, int, Font, Color)

```
public HMultilineEntry(java.lang.String text, int maxChars, java.awt.Font font,
    java.awt.Color color)
```

Creates an `HMultilineEntry` object. See the class description for details of constructor parameters and default values.

HMultilineEntry(String, int, int, int, int, int, Font, Color)

```
public HMultilineEntry(java.lang.String text, int x, int y, int width, int height,
    int maxChars, java.awt.Font font, java.awt.Color color)
```

Creates an `HMultilineEntry` object. See the class description for details of constructor parameters and default values.

Methods

caretNextLine()

```
public void caretNextLine()
```

Move the caret to the same column position on the next line. If the caret would be past the end of the text on the line the new caret position will be at the end of the line.

caretPreviousLine()

```
public void caretPreviousLine()
```

Move the caret to the same column position on the previous line. If the caret would be past the end of the text on the line the new caret position will be at the end of the line.

getDefaultLook()

```
public static HSinglelineEntryLook getDefaultLook()
```

Returns the currently set default look for `HMultilineEntry` components.

Returns:

The `HMultilineEntryLook` that is used by default when creating a new `HMultilineEntry` component, cast to an `HSinglelineEntryLook`.

setDefaultLook(HMultilineEntryLook)

```
public static void setDefaultLook(HMultilineEntryLook look)
```

Sets the default look for further `HMultilineEntry` Components.

Parameters:

`look` - The look that will be used by default when creating a new `HMultilineEntry` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setLook(HLook)

```
public void setLook(HLook hlook)
```

Sets the `HLook` for this component.

Overrides:

`setLook(HLook)` in class `HSinglelineEntry`

Parameters:

`hlook` - The `HLook` that is to be used for this component.

Throws:

`HInvalidLookException` - If the Look is not an `HMultilineEntryLook`.

org.havi.ui HMultilineEntryLook

Syntax

```
public class HMultilineEntryLook extends HSinglelineEntryLook
```

```
java.lang.Object
|
+--HSinglelineEntryLook
|
+--org.havi.ui.HMultilineEntryLook
```

All Implemented Interfaces:

java.lang.Cloneable, HLook

Description

The `HMultilineEntryLook` class is used by the `HMultilineEntry` component to display the entering of text. This look will be provided by the platform and the exact way in which it is rendered will be platform dependent.

The `HMultilineEntryLook` class draws the content set on an `HMultilineEntry`. It uses the `getTextContent(int)` method to determine the content to render. The interaction state of the `HMultilineEntry` is ignored.

This is the default look that is used by `HMultilineEntry` and its subclasses. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

`HMultilineEntry`

Constructors

HMultilineEntryLook()

```
public HMultilineEntryLook()
```

Creates a `HMultilineEntryLook` object. See the class description for details of constructor parameters and default values.

Methods

getCaretCharPositionForLine(HVisible, int)

```
public int getCaretCharPositionForLine(HVisible visible, int line)
```

Returns the character position of the caret within the content string if it were to be moved vertically to the given 'line'. A line is identified by its first character as obtained from the `getSoftLineBreakPositions()` method. If an invalid line is specified an `IllegalArgumentException` is thrown. If it cannot be moved the nearest position should be returned.

Parameters:

`visible` - a multiline text entry component.

Note that if this component is not actually using this `HLook` to display itself the return value of this method will probably be wrong. Application authors should take care to only call this method with components which are using this instance of the `HMultilineEntryLook`.

`line` - the line number for which the caret position is requested

Returns:

the caret position (as defined in `getCaretCharPosition()`) to move the caret to if it were moved to this line.

See Also:

`getCaretCharPosition()`, `getSoftLineBreakPositions(HVisible)`

getCaretPositionNextLine(HVisible)

```
public int getCaretPositionNextLine(HVisible visible)
```

Returns the character position of the caret within the content string if it were to be moved down one line.

Parameters:

`visible` - a multiline text entry component.

Note that if this component is not actually using this `HLook` to display itself the return value of this method will probably be wrong. Application authors should take care to only call this method with components which are using this instance of the `HMultilineEntryLook`.

Returns:

the caret position (as defined in `getCaretCharPosition()`) to move the caret to if it were moved down one line, or the nearest position if this is not possible.

getCaretPositionPreviousLine(HVisible)

```
public int getCaretPositionPreviousLine(HVisible visible)
```

Returns the character position of the caret within the content string if it were to be moved up one line.

Parameters:

`visible` - a multiline text entry component.

Note that if this component is not actually using this `HLook` to display itself the return value of this method will probably be wrong. Application authors should take care to only call this method with components which are using this instance of the `HMultilineEntryLook`.

Returns:

the caret position (as defined in `getCaretCharPosition()`) to move the caret to if it were moved up one line, or the nearest position if this is not possible.

getInsets(HVisible)

```
public java.awt.Insets getInsets(HVisible visible)
```

Determines the insets of this `HLook` , which indicate the size of the border. This area is reserved for the `HLook` to use for drawing borders around the associated `HVisible` .

Overrides:

`getInsets(HVisible)` in class `HSinglelineEntryLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

the insets of this `HLook` .

getMaximumSize(HVisible)

```
public java.awt.Dimension getMaximumSize(HVisible hvisible)
```

Gets the maximum size of the `HVisible` component when drawn with this `HLook` .

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) then the return value is the current size of the `HVisible` (as returned by `HVisible#getSize`).
2. If the `HLook` does not support scaling of content or no scaling is requested, and content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If there is no content set then a maximum size of `[Short.MAX_VALUE, Short.MAX_VALUE]` is returned as a `Dimension`.

Overrides:

`getMaximumSize(HVisible)` in class `HSinglelineEntryLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` maximum size.

See Also:

`getMaximumSize()`

getMinimumSize(HVisible)

```
public java.awt.Dimension getMinimumSize(HVisible hvisible)
```

Gets the minimum size of the `HVisible` component when drawn with this `HLook` .

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the size of the smallest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If the `HLook` does not support scaling of content or no scaling is requested, *and* content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If no content is available but a default preferred size has been set using `setDefaultSize(Dimension)` has been called to set then the return value is this value (as obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
4. If there is no content or default size set then the return value is an implementation-specific minimum size plus any additional dimensions that the `HLook` requires for border decoration etc.

Overrides:

`getMinimumSize(HVisible)` in class `HSinglelineEntryLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` minimum size.

See Also:

`getMinimumSize()`

getPreferredSize(HVisible)

```
public java.awt.Dimension getPreferredSize(HVisible hvisible)
```

Gets the preferred size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If a default preferred size has been set for this `HVisible` (using `setDefaultSize(Dimension)`) then the return value is this size (obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If this `HLook` does not support scaling of content or no scaling is requested, and content is present then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If this `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the current size of the `HVisible` as returned by `getSize()`.
4. If there is no content and no default size set then the return value is the current size of the `HVisible` as returned by `getSize()`.

Overrides:

`getPreferredSize(HVisible)` in class `HSinglelineEntryLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating the preferred size of the `HVisible` when drawn with this `HLook`.

See Also:

```
getPreferredSize(), setDefaultSize(Dimension)
```

getSoftLineBreakPositions(HVisible)

```
public int[] getSoftLineBreakPositions(HVisible visible)
```

Returns the positions within the content string of all those characters that start on a new 'line' (including those following \n), in order from the first line to the last, including the line starting at 0.

Parameters:

`visible` - a multiline text entry component.

Note that if this component is not actually using this `HLook` to display itself the return value of this method will probably be wrong. Application authors should take care to only call this method with components which are using this instance of the `HMultilineEntryLook`.

Returns:

the positions of 'soft line breaks' introduced by the `HLook`.

getVisibleSoftLineBreakPositions(HVisible)

```
public int[] getVisibleSoftLineBreakPositions(HVisible visible)
```

Returns the starting positions of lines currently shown within the `HVisible`. Lines are identified by the positions of those characters that start on a new 'line' (including those following \n), in order, from the first visible line to the last. This method can be used to calculate the number of visible lines currently shown in the look as well as the line shown at the top of the visible window.

Parameters:

`visible` - a multiline text entry component.

Returns:

the starting positions of the lines currently shown within the `HVisible`.

isOpaque(HVisible)

```
public boolean isOpaque(HVisible visible)
```

Returns true if the entire painted area of the `HVisible` when using this look is fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`.

The default value is implementation specific and depends on the background painting mode of the given `HVisible`. The consequences of an invalid overridden value are implementation specific.

Overrides:

`isOpaque(HVisible)` in class `HSinglelineEntryLook`

Parameters:

`visible` - the visible to test

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method of an `HVisible` using this look are fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`, otherwise false.

showLook(Graphics, HVisible, int)

```
public void showLook(java.awt.Graphics g, HVisible visible, int state)
```

The `showLook(Graphics, HVisible, int)` method is responsible for repainting the entire `HVisible` component, (including any content set on the component, and the component background), subject to the `clipRect` of the `Graphics` object passed to it.

The `showLook(Graphics, HVisible, int)` method should not modify the `clipRect` of the `Graphics` object that is passed to it.

For looks which draw content (e.g. `HTextLook`, `HGraphicLook` and `HAnimateLook`), if no content is associated with the component, the `showLook(Graphics, HVisible, int)` method paints the component with its current background `Color` according to the `setBackgroundMode(int)` method of `HVisible` and draws any (implementation-specific) borders. Note that by default the background mode is set so as to **not** paint a background. Furthermore on platforms which support transparent colors the background `Color` may be partially or completely transparent.

Any resources **explicitly** associated with an `HLook` should be loaded by the `HLook` during its creation, etc., or via its `setXXX()` methods. Note that the "standard" looks don't load content by default.

This method is called from the `paint(Graphics)` method of `HVisible` and must never be called from elsewhere. Components wishing to redraw themselves should call their repaint method in the usual way.

Overrides:

`showLook(Graphics, HVisible, int)` in class `HSinglelineEntryLook`

Parameters:

`g` - the graphics context.

`visible` - the visible.

`state` - the state parameter indicates the state of the visible, allowing the look to render the appropriate content for that state. Note that some components (e.g. `HStaticRange`, `HRange`, `HRangeValue`) do not use state-based content).

widgetChanged(HVisible, HChangeData[])

```
public void widgetChanged(HVisible visible, HChangeData[] changes)
```

Called by the `HVisible` whenever its content, state, or any other data changes. See the class description of `HVisible` for more information about the `changes` parameter.

The implementation of this method should work out which graphical areas of the `HVisible` have changed and make any relevant calls to trigger the repainting of those areas.

A minimum implementation of this method could simply call

```
visible.repaint()
```

Overrides:

`widgetChanged(HVisible, HChangeData[])` in class `HSinglelineEntryLook`

Parameters:

`visible` - the `HVisible` which has changed

`changes` - an array containing hint data and associated hint objects. If this argument is `null` a full repaint will be triggered.

org.havi.ui

HNavigable

Syntax

```
public interface HNavigable extends HNavigationInputPreferred
```

All Known Subinterfaces:

```
HActionable, HAdjustmentValue, HItemValue, HSwitchable, HTextValue
```

All Superinterfaces:

```
HNavigationInputPreferred
```

All Known Implementing Classes:

```
HIcon, HRange, HText, HAnimation
```

Description

This interface is implemented by all HAVi UI components that can be navigated to by the user (i.e. components which can gain focus).

Event Behavior

Subclasses of `HComponent` which implement `HNavigable` must respond to `HFocusEvent` events.

Applications should assume that classes which implement `HNavigable` can only generate events of the type `HFocusEvent` in response to other types of input event.

An application may add one or more `HFocusListener` listeners to the component. The `focusGained` and `focusLost` methods of the `HFocusListener` are invoked whenever the `HNavigable` gains or loses focus.

An `HNavigable` has an arbitrary focus traversal table associated with it (see `setMove(int, HNavigable)` and `getMove(int)`). This mechanism allows the four-way focus behavior of a set of components to be set (see `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)`, `setMove(int, HNavigable)` and `getMove(int)`).

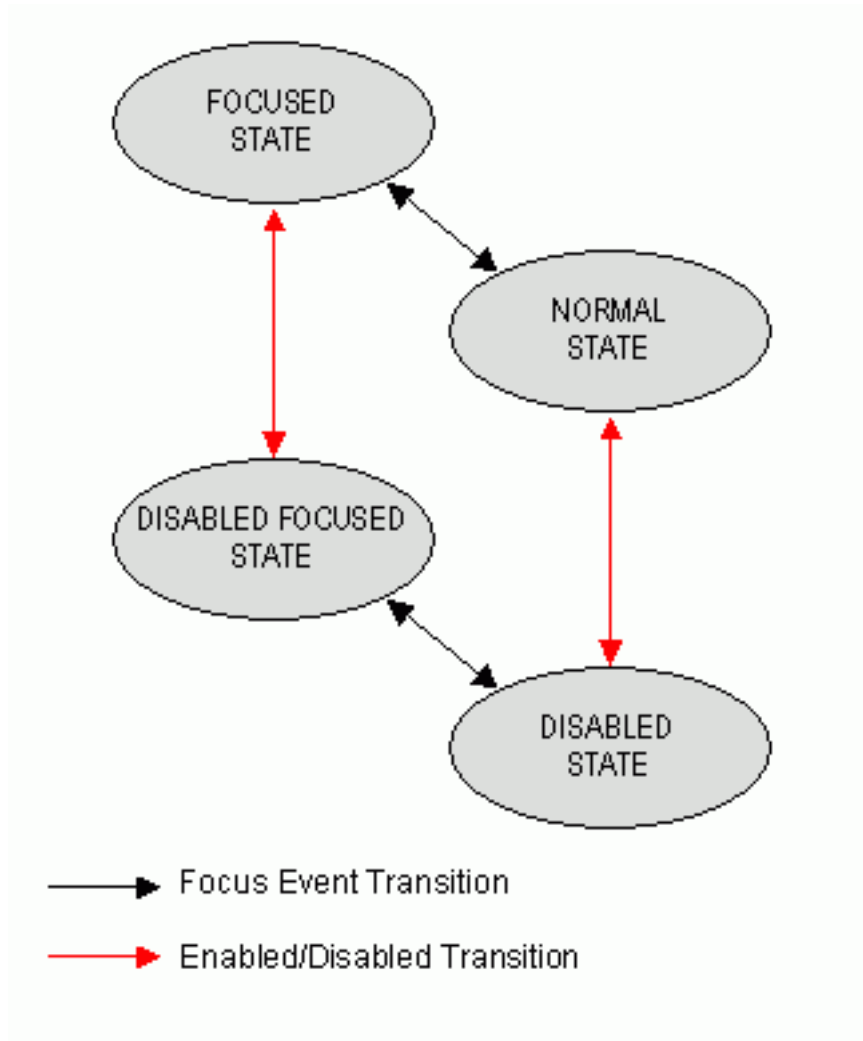
HAVi focus events are discussed in detail in the `HNavigationInputPreferred` interface description.

Interaction States

The following interaction states are valid for this `HNavigable` component:

- `NORMAL_STATE`
- `FOCUSED_STATE`
- `DISABLED_STATE`
- `DISABLED_FOCUSED_STATE`

The state machine diagram below shows the valid state transitions for an `HNavigable` component.



Platform Classes

The following HAVi platform classes implement or inherit the `HNavigable` interface. These classes shall all generate `HFocusEvent` events in addition to any other events specified in the respective class descriptions.

- `HAnimation`
- `HIcon`
- `HText`
- `HRange`
- `HGraphicButton`
- `HTextButton`
- `HToggleButton`
- `HListGroup`
- `HSinglelineEntry`
- `HMultilineEntry`
- `HRangeValue`

See Also:

`HNavigationInputPreferred`, `HFocusEvent`, `HFocusListener`

Methods

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns null.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Returns:

`true` if the component has focus, otherwise returns `false`.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
                             HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` `KeyEvent`. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` `KeyEvent`. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` `KeyEvent`. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` `KeyEvent`. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

org.havi.ui

HNavigationInputPreferred

Syntax

```
public interface HNavigationInputPreferred
```

All Known Subinterfaces:

```
HActionable, HAdjustmentValue, HItemValue, HNavigable, HSwitchable, HTextValue
```

Description

A component which implements `HNavigationInputPreferred` indicates that this component expects to receive `HFocusEvent` events. The focus event system in HAVi is designed to be compatible with standard AWT focus mechanisms while supporting key event-based focus traversal for HAVi UI components.

All interoperable implementations of the `HNavigationInputPreferred` interface must extend `HComponent`.

Components which implement `HNavigationInputPreferred` to handle `HFocusEvent` events can optionally manage focus traversal based on keyboard input events, in addition to the normal semantics of the `FOCUS_GAINED` and `FOCUS_LOST` event types. The focus traversal mechanism specified by the HAVi UI `HNavigable` interface is one such system.

In the case where such an implementation requires specific keys to manage focus traversal the `getNavigationKeys()` method is provided to allow the HAVi platform to query the set of keys for which a navigation target has been set. When such a component has the input focus, platforms without a physical means of generating the desired keystrokes shall provide another means for navigation e.g. by offering an on-screen "virtual" keyboard. Applications can query the system about the support of specific keyCodes through the `isSupported(int)` method.

The keyCodes for navigation keystrokes generated on the `HNavigationInputPreferred` will be passed to the `HNavigationInputPreferred` as an `HFocusEvent` transferId through the `processHFocusEvent(HFocusEvent)` method. No `HKeyEvent` will be generated on the `HNavigationInputPreferred` as a result of these keystrokes.

Note that the `java.awt.Component` method `isFocusTraversable` should always return true for a `java.awt.Component` implementing this interface.

Methods

`getNavigationKeys()`

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Returns:

an array of key codes, or `null` if no navigation targets are set on this component.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HNavigationInputPreferred`.

Parameters:

`evt` - the `HFocusEvent` to process.

org.havi.ui

HNoInputPreferred

Syntax

```
public interface HNoInputPreferred
```

All Known Implementing Classes:

```
HStaticIcon, HStaticRange, HStaticText, HStaticAnimation
```

Description

A component which implements `HNoInputPreferred` indicates that the user cannot navigate to this component.

All interoperable implementations of the `HNoInputPreferred` interface must extend `HComponent` .

In some cases a component which implements this interface will be extended, and that component will implement another "XxxInputPreferred" interface. In all cases, these other interfaces take precedence.

org.havi.ui

HOrientable

Syntax

```
public interface HOrientable
```

All Known Subinterfaces:

```
HAdjustmentInputPreferred, HAdjustmentValue, HItemValue,  
HSelectionInputPreferred
```

All Known Implementing Classes:

```
HStaticRange
```

Description

The `HOrientable` interface provides support for components which have an orientation.

All interoperable implementations of the `HOrientable` interface must extend `HComponent`.

Fields

ORIENT_BOTTOM_TO_TOP

```
public static final int ORIENT_BOTTOM_TO_TOP
```

A constant which specifies that the `HOrientable` should be rendered with a vertical orientation, with the minimum value on the bottom, and the maximum value on the top.

ORIENT_LEFT_TO_RIGHT

```
public static final int ORIENT_LEFT_TO_RIGHT
```

A constant which specifies that the `HOrientable` should be rendered with a horizontal orientation, with the minimum value on the left side, and the maximum value on the right side.

ORIENT_RIGHT_TO_LEFT

```
public static final int ORIENT_RIGHT_TO_LEFT
```

A constant which specifies that the `HOrientable` should be rendered with a horizontal orientation, with the minimum value on the right side, and the maximum value on the left side.

ORIENT_TOP_TO_BOTTOM

```
public static final int ORIENT_TOP_TO_BOTTOM
```

A constant which specifies that the `HOrientable` should be rendered with a vertical orientation, with the minimum value on the top, and the maximum of the range on the bottom.

Methods

getOrientation()

```
public int getOrientation()
```

Retrieve the orientation of the `HOrientable`. The orientation controls how an associated `HLook` lays out the component and affects the visual behavior of the `HAdjustmentEvent` and `HItemEvent` events. For example, the system might use this information to select appropriate key mappings for these events.

Returns:

one of `ORIENT_LEFT_TO_RIGHT`, `ORIENT_RIGHT_TO_LEFT`, `ORIENT_TOP_TO_BOTTOM`, or `ORIENT_BOTTOM_TO_TOP`.

setOrientation(int)

```
public void setOrientation(int orient)
```

Set the orientation of the `HOrientable`. The orientation controls how the associated `HLook` lays out the component.

Parameters:

`orient` - one of `ORIENT_LEFT_TO_RIGHT`, `ORIENT_RIGHT_TO_LEFT`, `ORIENT_TOP_TO_BOTTOM`, or `ORIENT_BOTTOM_TO_TOP`.

org.havi.ui HPermissionDeniedException

Syntax

```
public class HPermissionDeniedException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
|
+--java.lang.Exception
|
+--org.havi.ui.HPermissionDeniedException
```

All Implemented Interfaces:

java.io.Serializable

Description

Thrown when an application attempts to control a device or feature it does not have the right to do at the time of making the call. The precise conditions of this are defined in more detail in the places where this exception is thrown. It could be when the application does not have some underlying resource reserved.

This exception is not related in any way to the Java security model or to `java.lang.SecurityException`. Methods where an application could be denied the right to control a device or feature by security policy also must throw a `java.lang.SecurityException`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
message	Message explaining why the exception was thrown	null	-	java.lang.Throwable#getMessage

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HPermissionDeniedException()

```
public HPermissionDeniedException()
```

Creates an `HPermissionDeniedException` object. See the class description for details of constructor parameters and default values.

HPermissionDeniedException(String)

```
public HPermissionDeniedException(java.lang.String message)
```

Creates an HPermissionDeniedException object with a specified reason string.

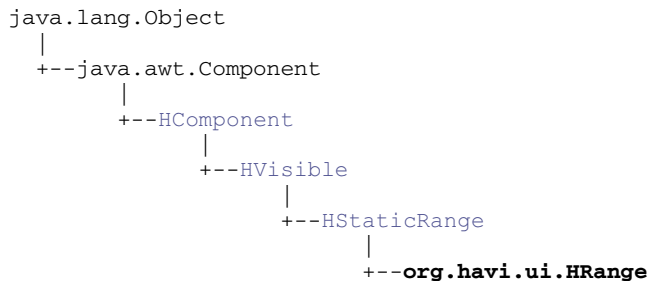
Parameters:

message - the reason why the exception was raised

org.havi.ui HRange

Syntax

```
public class HRange extends HStaticRange implements HNavigable
```



Direct Known Subclasses:

[HRangeValue](#)

All Implemented Interfaces:

[HMatteLayer](#), [HNavigable](#), [HNavigationInputPreferred](#), [HNoInputPreferred](#), [HOrientable](#), [HState](#), [java.awt.image.ImageObserver](#), [java.awt.MenuContainer](#), [java.io.Serializable](#), [TestOpacity](#)

Description

The [HRange](#) is a user interface component used to display a value within a fixed range (as [org.havi.ui.HStaticRange](#) [HStaticRange](#)) which also enables a user to navigate to it, i.e. it can have the input focus. By default it uses the [HRangeLook](#) to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds

orientation	The "orientation" of the range object.	ORIENT_LEFT_T O_RIGHT	setOrientation(int)	getOrientation()
minimum	The minimum value that can be returned by this range object.	0	setRange(int, int)	getMinValue()
maximum	The maximum value that can be returned by this range object.	100	setRange(int, int)	getMaxValue()
value	The current value returned by this range object.	0	setValue(int)	getValue()

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
The default "look" for this class.	A platform specific <code>HRangeLook</code>	<code>setDefaultLook(HRangeLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HRangeLook</code> returned from <code>HRange.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>

The offsets for the "thumb" of this range control	min = 0, max = 0	setThumbOffsets(int, int)	getThumbMinOffset() / getThumbMaxOffset()
The behavior of this range object with respect to its "thumb" values	SLIDER_BEHAVIOR	setBehavior(int)	getBehavior()
The gain focus sound.	null	setGainFocusSound(HSound)	getGainFocusSound()
The lose focus sound.	null	setLoseFocusSound(HSound)	getLoseFocusSound()

See Also:

[HStaticRange](#), [HNavigable](#)

Constructors

HRange()

```
public HRange()
```

Creates an [HRange](#) object. See the class description for details of constructor parameters and default values.

HRange(int, int, int, int)

```
public HRange(int orientation, int minimum, int maximum, int value)
```

Creates an [HRange](#) object. See the class description for details of constructor parameters and default values.

HRange(int, int, int, int, int, int, int, int)

```
public HRange(int orientation, int minimum, int maximum, int value, int x, int y,
              int width, int height)
```

Creates an [HRange](#) object. See the class description for details of constructor parameters and default values.

Methods

getDefaultLook()

```
public static HRangeLook getDefaultLook()
```

Returns the currently set default [HLook](#) for [HRange](#) components.

Returns:

The `HLook` that is used by default when creating a new `HRange` component.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

```
getGainFocusSound() in interface HNavigable
```

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

```
getLoseFocusSound() in interface HNavigable
```

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

```
getMove(int) in interface HNavigable
```

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns null.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

```
getNavigationKeys() in interface HNavigationInputPreferred
```

Returns:

an array of key codes, or null if no navigation targets are set on this component.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

`isSelected()` in interface `HNavigable`

Returns:

`true` if the component has focus, otherwise returns `false`.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HRange`.

Specified By:

`processHFocusEvent(HFocusEvent)` in interface `HNavigationInputPreferred`

Parameters:

`evt` - the `HFocusEvent` to process.

setDefaultLook(HRangeLook)

```
public static void setDefaultLook(HRangeLook look)
```

Sets the default `HLook` for further `HRange` Components.

Parameters:

`look` - The `HLook` that will be used by default when creating a new `HRange` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
    HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in interface `HNavigable`

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` KeyEvent. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` KeyEvent. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` KeyEvent. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` `KeyEvent`. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setGainFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

org.havi.ui

HRangeLook

Syntax

public class HRangeLook implements HAdjustableLook

```
java.lang.Object
|
+--org.havi.ui.HRangeLook
```

All Implemented Interfaces:

java.lang.Cloneable, HAdjustableLook, HLook

Description

The `HRangeLook` class is used to display a slider or scrollbar type range control on screen. It is used by specific `HVisible` components which implement the `HAdjustmentValue` interface to present a graphical representation of the value to the user. This look will be provided by the platform and the exact way in which it is rendered will be platform dependant.

This look does NOT use content set on the `HVisible`.

This is the default look that is used by `HStaticRange` and its subclasses. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

[HRange](#)

Constructors

HRangeLook()

```
public HRangeLook()
```

Creates an `HRangeLook` object. See the class description for details of constructor parameters and default values.

Methods

getInsets(HVisible)

```
public java.awt.Insets getInsets(HVisible visible)
```

Determines the insets of this `HLook` , which indicate the size of the border. This area is reserved for the `HLook` to use for drawing borders around the associated `HVisible` .

Specified By:

`getInsets(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

the insets of this `HLook` .

getMaximumSize(HVisible)

```
public java.awt.Dimension getMaximumSize(HVisible hvisible)
```

Gets the maximum size of the `HVisible` component when drawn with this `HLook` .

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) then the return value is the current size of the `HVisible` (as returned by `HVisible#getSize`).
2. If the `HLook` does not support scaling of content or no scaling is requested, and content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If there is no content set then a maximum size of [`Short.MAX_VALUE` , `Short.MAX_VALUE`] is returned as a `Dimension`.

Specified By:

`getMaximumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` maximum size.

See Also:

`getMaximumSize()`

getMinimumSize(HVisible)

```
public java.awt.Dimension getMinimumSize(HVisible hvisible)
```

Gets the minimum size of the `HVisible` component when drawn with this `HLook` .

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this

algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the size of the smallest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If the `HLook` does not support scaling of content or no scaling is requested, *and* content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If no content is available but a default preferred size has been set using `setDefaultSize(Dimension)` has been called to set then the return value is this value (as obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
4. If there is no content or default size set then the return value is an implementation-specific minimum size plus any additional dimensions that the `HLook` requires for border decoration etc.

Specified By:

`getMinimumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` minimum size.

See Also:

`getMinimumSize()`

getPreferredSize(HVisible)

```
public java.awt.Dimension getPreferredSize(HVisible hvisible)
```

Gets the preferred size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If a default preferred size has been set for this `HVisible` (using `setDefaultSize(Dimension)`) then the return value is this size (obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If this `HLook` does not support scaling of content or no scaling is requested, and content is present then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If this `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the current size of the `HVisible` as returned by `getSize()`.
4. If there is no content and no default size set then the return value is the current size of the `HVisible` as returned by `getSize()`.

Specified By:

`getPreferredSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating the preferred size of the `HVisible` when drawn with this `HLook`.

See Also:

`getPreferredSize()`, `setDefaultSize(Dimension)`

hitTest(HAdjustmentValue, Point)

```
public int hitTest(HAdjustmentValue component, java.awt.Point pt)
```

Returns a value which indicates the pointer click position in the on-screen representation of the adjustable component. Note that it is a valid implementation option to always return `ADJUST_NONE`.

Specified By:

`hitTest(HAdjustmentValue, Point)` in interface `HAdjustableLook`

Parameters:

`component` - the `HAdjustmentValue` component for which the hit position should be calculated.

`pt` - the pointer click point.

Returns:

one of `ADJUST_NONE`, `ADJUST_BUTTON_LESS`, `ADJUST_PAGE_LESS`, `ADJUST_THUMB`, `ADJUST_PAGE_MORE` or `ADJUST_BUTTON_MORE`.

isOpaque(HVisible)

```
public boolean isOpaque(HVisible visible)
```

Returns true if the entire painted area of the `HVisible` when using this look is fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`.

The default value is implementation specific and depends on the background painting mode of the given `HVisible`. The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque(HVisible)` in interface `HLook`

Parameters:

`visible` - the visible to test

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method of an `HVisible` using this look are fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`, otherwise false.

showLook(Graphics, HVisible, int)

```
public void showLook(java.awt.Graphics g, HVisible visible, int state)
```

The `showLook(Graphics, HVisible, int)` method is responsible for repainting the entire `HVisible` component, (including any content set on the component, and the component background), subject to the `clipRect` of the `Graphics` object passed to it.

The `showLook(Graphics, HVisible, int)` method should not modify the `clipRect` of the `Graphics` object that is passed to it.

For looks which draw content (e.g. `HTextLook`, `HGraphicLook` and `HAnimateLook`), if no content is associated with the component, the `showLook(Graphics, HVisible, int)` method paints the component with its current background `Color` according to the `setBackgroundMode(int)` method of `HVisible` and draws any (implementation-specific) borders. Note that by default the background mode is set so as to **not** paint a background. Furthermore on platforms which support transparent colors the background `Color` may be partially or completely transparent.

Any resources **explicitly** associated with an `HLook` should be loaded by the `HLook` during its creation, etc., or via its `setXXX()` methods. Note that the "standard" looks don't load content by default.

This method is called from the `paint(Graphics)` method of `HVisible` and must never be called from elsewhere. Components wishing to redraw themselves should call their `repaint` method in the usual way.

Specified By:

`showLook(Graphics, HVisible, int)` in interface `HLook`

Parameters:

`g` - the graphics context.

`visible` - the visible.

`state` - the state parameter indicates the state of the visible, allowing the look to render the appropriate content for that state. Note that some components (e.g. `HStaticRange`, `HRange`, `HRangeValue`) do not use state-based content).

widgetChanged(HVisible, HChangeData[])

```
public void widgetChanged(HVisible visible, HChangeData[] changes)
```

Called by the `HVisible` whenever its content, state, or any other data changes. See the class description of `HVisible` for more information about the `changes` parameter.

The implementation of this method should work out which graphical areas of the `HVisible` have changed and make any relevant calls to trigger the repainting of those areas.

A minimum implementation of this method could simply call

```
visible.repaint()
```

Specified By:

`widgetChanged(HVisible, HChangeData[])` in interface `HLook`

Parameters:

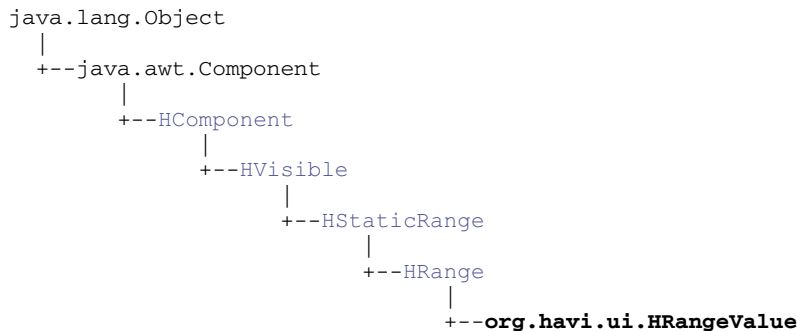
`visible` - the `HVisible` which has changed

`changes` - an array containing hint data and associated hint objects. If this argument is `null` a full repaint will be triggered.

org.havi.ui HRangeValue

Syntax

public class HRangeValue extends HRange implements HAdjustmentValue, HAdjustmentInputPreferred



All Implemented Interfaces:

HAdjustmentInputPreferred, HAdjustmentValue, HMatteLayer, HNavigable, HNavigationInputPreferred, HNoInputPreferred, HOrientable, HState, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

The `HRangeValue` is a user interface component used to display a value within a fixed range (as `org.havi.ui.HStaticRange` `HStaticRange`}) which enables a user to navigate to and alter the value of it, i.e. it can have the input focus and it can be adjusted. By default it uses the `HRangeLook` to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
orientation	The "orientation" of the range object.	ORIENT_LEFT_T O_RIGHT	setOrientation(int)	getOrientation()

minimum	The minimum value that can be returned by this range object.	0	<code>setRange(int, int)</code>	<code>getMinValue()</code>
maximum	The maximum value that can be returned by this range object.	100	<code>setRange(int, int)</code>	<code>getMaxValue()</code>
value	The current value returned by this range object.	0	<code>setValue(int)</code>	<code>getValue()</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
The default "look" for this class.	A platform specific <code>HRangeLook</code>	<code>setDefaultLook(HRangeLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HRangeLook</code> returned from <code>HRangeValue.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The offsets for the "thumb" of this range control	min = 0, max = 0	<code>setThumbOffsets(int, int)</code>	<code>getThumbMinOffset()</code> / <code>getThumbMaxOffset()</code>
The behavior of this range object with respect to its "thumb" values	<code>SLIDER_BEHAVIOR</code>	<code>setBehavior(int)</code>	<code>getBehavior()</code>

The block increment for this object.	1 unit	<code>setBlockIncrement(int)</code>	<code>getBlockIncrement()</code>
The gain focus sound.	null	<code>setGainFocusSound(HSound)</code>	<code>getGainFocusSound()</code>
The lose focus sound.	null	<code>setLoseFocusSound(HSound)</code>	<code>getLoseFocusSound()</code>

See Also:

`HStaticRange`, `HRange`, `HNavigable`, `HAdjustmentValue`

Constructors

HRangeValue()

```
public HRangeValue()
```

Creates an `HRangeValue` object. See the class description for details of constructor parameters and default values.

HRangeValue(int, int, int, int)

```
public HRangeValue(int orientation, int minimum, int maximum, int value)
```

Creates an `HRangeValue` object. See the class description for details of constructor parameters and default values.

HRangeValue(int, int, int, int, int, int, int, int)

```
public HRangeValue(int orientation, int minimum, int maximum, int value, int x, int y,
                  int width, int height)
```

Creates an `HRangeValue` object. See the class description for details of constructor parameters and default values.

Methods

addAdjustmentListener(HAdjustmentListener)

```
public void addAdjustmentListener(HAdjustmentListener l)
```

Adds the specified `HAdjustmentListener` to receive `HAdjustmentEvent` sent from this object. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Specified By:

`addAdjustmentListener(HAdjustmentListener)` in interface `HAdjustmentValue`

Parameters:

`l` - the `HAdjustmentListener` to be notified.

getAdjustmentSound()

```
public HSound getAdjustmentSound()
```

Get the sound to be played when the value changes.

Specified By:

```
getAdjustmentSound() in interface HAdjustmentValue
```

Returns:

The sound played when the value changes

getAdjustMode()

```
public boolean getAdjustMode()
```

Get the adjustment mode for this `HRangeValue` . If the returned value is `true` the component is in adjustment mode, and its value may be changed on receipt of `ADJUST_LESS` and `ADJUST_MORE` events.

The component is switched into and out of adjustment mode on receiving `ADJUST_START_CHANGE` and `ADJUST_END_CHANGE` events.

Specified By:

```
getAdjustMode() in interface HAdjustmentInputPreferred
```

Returns:

`true` if this component is in adjustment mode, `false` otherwise.

getBlockIncrement()

```
public int getBlockIncrement()
```

Get the block increment for this `HRangeValue` .

Specified By:

```
getBlockIncrement() in interface HAdjustmentValue
```

Returns:

the block increment value for this `HRangeValue` .

getDefaultLook()

```
public static HRangeLook getDefaultLook()
```

Returns the currently set default look for `HRangeValue` components.

Returns:

The look that is used by default when creating a new `HRangeValue` component.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

```
getGainFocusSound() in interface HNavigable
```

Overrides:

```
getGainFocusSound() in class HRange
```

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

```
getLoseFocusSound() in interface HNavigable
```

Overrides:

```
getLoseFocusSound() in class HRange
```

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

```
getMove(int) in interface HNavigable
```

Overrides:

```
getMove(int) in class HRange
```

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns `null`.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

```
getNavigationKeys() in interface HNavigationInputPreferred
```

Overrides:

```
getNavigationKeys() in class HRange
```

Returns:

an array of key codes, or `null` if no navigation targets are set on this component.

getUnitIncrement()

```
public int getUnitIncrement()
```

Get the unit increment for this `HRangeValue`.

Specified By:

```
getUnitIncrement() in interface HAdjustmentValue
```

Returns:

the increment value for this `HRangeValue`.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

```
isSelected() in interface HNavigable
```

Overrides:

```
isSelected() in class HRange
```

Returns:

true if the component has focus, otherwise returns false.

processHAdjustmentEvent(HAdjustmentEvent)

```
public void processHAdjustmentEvent(HAdjustmentEvent evt)
```

Process an `HAdjustmentEvent` sent to this `HRangeValue`.

Specified By:

```
processHAdjustmentEvent(HAdjustmentEvent) in interface  
HAdjustmentInputPreferred
```

Parameters:

evt - the `HAdjustmentEvent` to process.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HRangeValue`.

Specified By:

```
processHFocusEvent(HFocusEvent) in interface HNavigationInputPreferred
```

Overrides:

```
processHFocusEvent(HFocusEvent) in class HRange
```

Parameters:

evt - the `HFocusEvent` to process.

removeAdjustmentListener(HAdjustmentListener)

```
public void removeAdjustmentListener(HAdjustmentListener l)
```

Removes the specified `HAdjustmentListener` so that it no longer receives `HAdjustmentEvent` from this object. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Specified By:

```
removeAdjustmentListener(HAdjustmentListener) in interface HAdjustmentValue
```

Parameters:

l - the `HAdjustmentListener` to be removed from notification.

setAdjustmentSound(HSound)

```
public void setAdjustmentSound(HSound sound)
```

Associate a sound to be played when the value is modified. The sound is played irrespective of whether an `HAdjustmentEvent` is sent to one or more listeners.

Specified By:

`setAdjustmentSound(HSound)` in interface `HAdjustmentValue`

Parameters:

`sound` - the sound to be played, when the value is modified. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setAdjustMode(boolean)

```
public void setAdjustMode(boolean adjust)
```

Set the adjustment mode for this `HRangeValue`.

This method is provided for the convenience of component implementors. Interoperable applications shall not call this method. It cannot be made protected because interfaces cannot have protected methods.

Specified By:

`setAdjustMode(boolean)` in interface `HAdjustmentInputPreferred`

Parameters:

`edit` - true to switch this component into adjustment mode, false otherwise.

See Also:

`getAdjustMode()`

setBlockIncrement(int)

```
public void setBlockIncrement(int increment)
```

Set the block increment for this `HRangeValue`.

Specified By:

`setBlockIncrement(int)` in interface `HAdjustmentValue`

Parameters:

`increment` - the amount by which the value of the `HRangeValue` should change when an `ADJUST_PAGE_LESS` or `ADJUST_PAGE_MORE` event is received. Values of `increment` less than one shall be treated as a value of one.

setDefaultLook(HRangeLook)

```
public static void setDefaultLook(HRangeLook look)
```

Sets the default `HLook` for further `HRangeValue` Components.

Parameters:

`look` - The `HLook` that will be used by default when creating a new `HRangeValue` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
    HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application

programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in interface `HNavigable`

Overrides:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in class `HRange`

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` `KeyEvent`. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` `KeyEvent`. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` `KeyEvent`. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` `KeyEvent`. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setGainFocusSound(HSound)` in interface `HNavigable`

Overrides:

`setGainFocusSound(HSound)` in class `HRange`

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an

object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Overrides:

`setLoseFocusSound(HSound)` in class `HRange`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Overrides:

`setMove(int, HNavigable)` in class `HRange`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

setUnitIncrement(int)

```
public void setUnitIncrement(int increment)
```

Set the unit increment for this `HRangeValue`.

Specified By:

`setUnitIncrement(int)` in interface `HAdjustmentValue`

Parameters:

`increment` - the amount by which the value of the `HRangeValue` should change when an `ADJUST_LESS` or `ADJUST_MORE` event is received. Values of `increment` less than one shall be treated as a value of one.

org.havi.ui HScene

Syntax

```
public class HScene extends java.awt.Container implements HComponentOrdering
```

```
java.lang.Object
|
+--java.awt.Component
|
+--java.awt.Container
|
+--org.havi.ui.HScene
```

All Implemented Interfaces:

`HComponentOrdering`, `java.awt.image.ImageObserver`, `java.awt.MenuContainer`,
`java.io.Serializable`

Description

An `HScene` is a container representing the displayable area on-screen within which the application can display itself and thus interact with the user.

`HScene` may be regarded as a simple connection to the window management policy within the device, acting as a "screen resource reservation mechanism" denoting the area within which an application may present components.

Rendering Behavior

By default, `HScene` does not paint itself on-screen, only its added "child" components and hence its only immediate graphical effect is to "clip" its child components. However, it is possible to request that the entire `HScene` be painted in the current background color before any drawing takes place, and/or that a background image be drawn before the children are rendered.

Class Behavior

For all interoperable applications, the `HScene` is considered the top-level component of the application. No parent component to an `HScene` should be accessible to applications. Interoperable applications should not use the `getParent` method in `HScene`, since results are implementation dependent and valid implementations may generate a run-time error.

Although `HScene` is a subclass of `java.awt.Container`, implementations are allowed to insert extra classes in the inheritance tree between `HScene` and `Container`. It is allowed that this may result in `HScene` inheriting additional methods beyond those specified here. This allows platforms with only one native `java.awt.Frame` to use `HScene` as specified, whereas platforms with support for multiple `java.awt.Frame` or `java.awt.Window` classes can use an `HScene` class derived from the appropriate class.

`HScene` follow the design pattern of the `java.awt.Window` class. They are not a scarce resource on the platform. On platforms which only support one `HScene` being visible at one time the current `HScene` both loses the input focus and is hidden (e.g. iconified) when another application successfully requests the input focus. Two `java.awt.event.WindowEvent` events, with ids `WINDOW_DEACTIVATED` and `WINDOW_ICONIFIED`, shall be generated and sent to the `HScene` which has lost the focus and the `isShowing` method for that `HScene` shall return false.

In terms of delegation, the `HScene` shall behave like a `Window` with a native peer implementation, in that it will not appear to delegate any functionality to any parent object. Components which do not specify default characteristics inherit default values transitively from their parent objects. Therefore, the

implementation of `HScene` must have valid defaults defined for all characteristics, e.g. `Font`, `foreground Color`, `background Color`, `ColorModel`, `Cursor` and `Locale`.

Additional Z-order support

`HScene` extends the `java.awt.Container` class by providing additional Z-ordering capabilities, which are required since components in the HAVi user-interface are explicitly allowed to overlap each other. The Z-ordering capabilities are defined by the `HComponentOrdering` interface.

Note that these Z-ordering capabilities (`addBefore`, `addAfter`, `pop`, `popInFrontOf`, `popToFront`, `push`, `pushBehind` and `pushToBack`) must be implemented by (implicitly) reordering the child Components within the `HScene`, so that the standard AWT convention that the Z-order is defined as the order in which Components are added to a given Container is maintained. See the description for `HComponentOrdering` for more details.

Shortcut Keys

It is an implementation option for HAVi systems to implement shortcut keys by forwarding `java.awt.KeyEvent` events to the parent `HScene` of an application. Under these circumstances it is the responsibility of the application designer to ensure that the relevant `java.awt.KeyEvent` events used for "shortcut keys" are not consumed by any custom components.

Implementations of the standard HAVi UI components which process `java.awt.event.KeyEvent` events shall not consume any `KeyEvent`, thus allowing their use as a shortcut key on implementation which rely on `KeyEvents` being available in this way.

Event Handling

The mechanism by which input events are passed to the `HScene` and its component hierarchy is not specified.

Note that whether the `HScene` is visible or not (as determined by the `isVisible()` method) does not guarantee that it has the input focus and is receiving events.

When the application initially gains the input focus, this is indicated by the system sending a `java.awt.event.WindowEvent` of type `WINDOW_ACTIVATED` to the `HScene`. The `HScene` should request that a child component gain the focus, if one is available. However, the mechanism by which this occurs is intentionally not specified here.

When the entire application loses the user's focus, the system shall notify the `HScene` that it is no longer receiving events by sending a `java.awt.event.WindowEvent` of type `WINDOW_DEACTIVATED` to the `HScene`.

If the entire application has its location, or extent modified, then these events should be signaled via a `java.awt.event.WindowEvent` with an id of `ComponentEvent.COMPONENT_MOVED` being sent to the `HScene` object.

Acquiring and Displaying HScenes

There is no public constructor for `HScene`, it is constructed by an `HSceneFactory`. Only one `HScene` per `HGraphicsDevice` can be acquired at any one time for each application.

The application may request that it be made visible by calling the `show()` method. This method should ensure that the `HScene` is completely visible to the user, e.g. by expanding an icon, or changing the stacking order between competing overlapping applications.

Making the `HScene` visible shall not automatically cause it to receive or even request input focus. Input focus can be requested by the application by calling the `requestFocus` method at any time.

The `requestFocus` method should first ensure that the `HScene` is visible, and call the `show()` method if this is not the case. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Visibility of the <code>HScene</code>	false	<code>setVisible</code>	<code>isVisible</code>
Activity of associated shortcuts	Shortcuts are active	<code>enableShortcuts (boolean)</code>	<code>isEnabledShortcuts ()</code>
Associated layout manager	null	<code>java.awt.Container#setLayout</code>	<code>java.awt.Container#getLayout</code>
Background image mode	<code>IMAGE_NONE</code>	<code>setRenderMode (int)</code>	<code>getRenderMode ()</code>

Fields

BACKGROUND_FILL

```
public static final int BACKGROUND_FILL
```

A constant for use with the `setBackgroundMode (int)` method which indicates that the `HScene` should fill its bounding rectangle with its current background color before painting any background image and children.

IMAGE_CENTER

```
public static final int IMAGE_CENTER
```

A constant for use with `setRenderMode (int)` which specifies that any background image rendered in this `HScene` should be centered in the extents of the `HScene`. No tiling or scaling of the image shall be performed.

IMAGE_NONE

```
public static final int IMAGE_NONE
```

A constant for use with `setRenderMode (int)` which specifies that a background image should not be rendered in this `HScene`.

IMAGE_STRETCH

```
public static final int IMAGE_STRETCH
```

A constant for use with `setRenderMode (int)` which specifies that any background image rendered in this `HScene` should be stretched to fill the extents of the `HScene`.

IMAGE_TILE

```
public static final int IMAGE_TILE
```

A constant for use with `setRenderMode(int)` which specifies that any background image rendered in this `HScene` should be tiled starting from the top left origin of the `HScene`. No scaling of the image shall be performed.

NO_BACKGROUND_FILL

```
public static final int NO_BACKGROUND_FILL
```

A constant for use with the `setBackgroundMode(int)` method which indicates that the `HScene` should not fill its bounding rectangle with any color before painting any background image and children.

Constructors

HScene()

```
protected HScene()
```

It is not intended that applications should directly construct `HScene` objects. `HScene` objects should be constructed via the `HSceneFactory` classes factory methods.

Creates an `HScene` object. See the class description for details of constructor parameters and default values.

See Also:

`HSceneFactory`

Methods

addAfter(Component, Component)

```
public java.awt.Component addAfter(java.awt.Component component, java.awt.Component front)
```

Adds a `java.awt.Component` to this `HScene` directly behind a previously added `java.awt.Component`.

If `component` has already been added to this container, then `addAfter` moves `component` behind `front`. If `front` and `component` are the same component which was already added to this container, `addAfter` does not change the ordering of the components and returns `component`.

This method affects the Z-order of the `java.awt.Component` children within the `HScene`, and may also implicitly change the numeric ordering of those children.

Specified By:

`addAfter(Component, Component)` in interface `HComponentOrdering`

Parameters:

`component` - is the `java.awt.Component` to be added to the `HScene`

`front` - is the `java.awt.Component`, which `component` will be placed behind, i.e. `front` will be directly in front of the added `java.awt.Component`

Returns:

If the `java.awt.Component` is successfully added, then it will be returned from this call. If the `java.awt.Component` is not successfully added, e.g. `front` is not a `java.awt.Component` currently added to the `HScene`, then `null` will be returned.

This method must be implemented in a thread safe manner.

addBefore(Component, Component)

```
public java.awt.Component addBefore(java.awt.Component component,
                                   java.awt.Component behind)
```

Adds a `java.awt.Component` to this `HScene` directly in front of a previously added `java.awt.Component`.

If `component` has already been added to this container, then `addBefore` moves `component` in front of `behind`. If `behind` and `component` are the same component which was already added to this container, `addBefore` does not change the ordering of the components and returns `component`.

This method affects the Z-order of the `java.awt.Component` children within the `HScene`, and may also implicitly change the numeric ordering of those children.

Specified By:

`addBefore(Component, Component)` in interface `HComponentOrdering`

Parameters:

`component` - is the `java.awt.Component` to be added to the `HScene`

`behind` - is the `java.awt.Component`, which `component` will be placed in front of, i.e. `behind` will be directly behind the added `java.awt.Component`

Returns:

If the `java.awt.Component` is successfully added, then it will be returned from this call. If the `java.awt.Component` is not successfully added, e.g. `behind` is not a `java.awt.Component` currently added to the `HScene`, then `null` will be returned.

This method must be implemented in a thread safe manner.

addShortcut(int, HActionable)

```
public boolean addShortcut(int keyCode, HActionable comp)
```

Adds a shortcut key to action the specified `HActionable`. Generating the defined `java.awt.KeyEvent` or `HRcEvent` keycode causes the specified component to become actioned --- potentially any `keyCode` may have a shortcut associated with it. The shortcut will only be added if the `HActionable` component is a child component in the container hierarchy of which the `HScene` is the root container. If this is not the case this method shall return false.

Note that a maximum of one `HActionable` may be associated with a given `keyCode`. An `HActionable` can have at most one associated shortcut keycode. Calling `addShortcut(int, HActionable)` repeatedly with the same `HActionable` will result in the previous short cut being removed. A short cut can be set on an invisible `HActionable` and therefore it is possible to provide short-cuts that have no user representation.

If the relevant `keyCode` is received by the `HScene`, then the `HActionable` will be actioned by the `HScene` sending it an `ACTION_PERFORMED`.

Parameters:

`keyCode` - the keycode that represents the short cut. If keycode is `java.awt.event.KeyEvent#VK_UNDEFINED`, then the shortcut will not be added, any existing shortcut for this component will not be changed and this method shall return false.

`comp` - The actionable component that will be actioned.

Returns:

true if the shortcut was added, false otherwise.

addWindowListener(WindowListener)

```
public void addWindowListener(java.awt.event.WindowListener wl)
```

Add a listener to receive any `java.awt.event.WindowEvents` sent from this `HScene`. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Parameters:

`wl` - The `java.awt.event.WindowListener` to be notified of any `java.awt.event.WindowEvents`.

dispose()

```
public void dispose()
```

Disposes of this window. This method must be called at application exit to release the resources that are used for the `HScene`. Calling this method will be equivalent to calling `dispose(HScene)`. Calling this method on an `HScene` that was already disposed will have no effect or result in an unspecified exception being thrown. This is intentionally implementation-dependent.

enableShortcuts(boolean)

```
public void enableShortcuts(boolean enable)
```

Enables or disables all short cuts that are currently set on the Scene. To enable or disable a single shortcut use `addShortcut(int, HActionable)` or `removeShortcut(int)`.

Note `enableShortcuts(boolean)` does not remove existing added `HScene` shortcuts - they are merely disabled and may be subsequently re-enabled with `enableShortcuts(boolean)`.

Parameters:

`enable` - a value of true indicates all shortcuts are to be enabled, and a value of false indicates all shortcuts are to be disabled.

getAllShortcutKeycodes()

```
public int[] getAllShortcutKeycodes()
```

Returns all keycodes added in the `HScene` as shortcuts.

Returns:

all keycodes added in the `HScene` as shortcuts, there are no ordering guarantees.

getBackgroundImage()

```
public java.awt.Image getBackgroundImage()
```

Retrieve any image used as a background for this `HScene`.

Returns:

an image used as a background, or `null` if no image is set. Note that depending on the current render mode any image set may not actually be rendered.

See Also:

`setRenderMode(int)`

getBackgroundMode()

```
public int getBackgroundMode()
```

Get the background mode of this `HScene`. The return value specifies whether the paint method should draw the background (i.e. a rectangle filling the bounds of the `HScene`).

Returns:

one of `NO_BACKGROUND_FILL` or `BACKGROUND_FILL`.

getFocusOwner()

```
public java.awt.Component getFocusOwner()
```

Returns the child component of this `HScene` which has focus if and only if this `HScene` is active.

Returns:

the component with focus, or null if no children have focus assigned to them.

getPixelCoordinatesHScreenRectangle(Rectangle)

```
public HScreenRectangle getPixelCoordinatesHScreenRectangle(java.awt.Rectangle r)
```

Returns an `HScreenRectangle` which corresponds to the graphics (AWT) pixel area specified by the parameter in this `HScene`. (i.e. within the `HScene`'s coordinate space).

Parameters:

`r` - the AWT pixel area within this `HScene` (i.e. within the `HScene`'s coordinate space), specified as an `java.awt.Rectangle`.

Returns:

an `HScreenRectangle` which corresponds to the graphics (AWT) pixel area specified by the parameter in this `HScene` (i.e. within the `HScene`'s coordinate space).

getRenderMode()

```
public int getRenderMode()
```

Get the rendering mode of any background image associated with this `HScene`.

Returns:

the rendering mode, one of `IMAGE_NONE`, `IMAGE_STRETCH`, `IMAGE_CENTER` or `IMAGE_TILE`.

getSceneTemplate()

```
public HSceneTemplate getSceneTemplate()
```

Return an `HSceneTemplate` describing this `HScene`. This template can be queried in order to obtain the size & position of the `HScene` in screen coordinates and the display device used for the `HScene`, etc.

Returns:

an `HSceneTemplate` describing of the `HScene`.

getShortcutComponent(int)

```
public HActionable getShortcutComponent(int keyCode)
```

Retrieve the `HActionable` associated with the specified shortcut key.

Parameters:

`keyCode` - the shortcut key code to be queried for an associated `HActionable` .

Returns:

the `HActionable` associated with the specified key if `keyCode` is a valid shortcut key for this `HScene` , null otherwise.

getShortcutKeyCode(HActionable)

```
public int getShortcutKeyCode(HActionable comp)
```

Returns the keycode associated with the specified `HActionable` component.

Parameters:

`comp` - the `HActionable` to return the keycode that it is associated with.

Returns:

the keycode associated with the specified `HActionable` component, if it is currently a valid shortcut "target", otherwise return `java.awt.event.KeyEvent#VK_UNDEFINED`.

isDoubleBuffered()

```
public boolean isDoubleBuffered()
```

Returns `true` if all the drawing done during the update and paint methods for this specific `HScene` object is automatically double buffered.

Overrides:

`java.awt.Component.isDoubleBuffered()` in class `java.awt.Component`

Returns:

`true` if all the drawing done during the update and paint methods for this specific `HScene` object is automatically double buffered, or `false` if drawing is not double buffered. The default value for the double buffering setting is platform-specific.

isEnabledShortcuts()

```
public boolean isEnabledShortcuts()
```

Returns the status of all short cuts that are currently set on the `HScene`.

Returns:

`true` if shortcuts are enabled, `false` otherwise.

See Also:

`enableShortcuts(boolean)`

isOpaque()

```
public boolean isOpaque()
```

Returns `true` if the entire `HScene` area, as given by the `java.awt.Component#getBounds` method, is fully opaque, i.e. its paint method (or surrogate methods) guarantee that all pixels are painted in an opaque `Color`.

By default, the return value depends on the value of the current background mode, as set by the `setBackgroundMode(int)` method. The return value should be overridden by subclasses that can guarantee full opacity. The consequences of an invalid overridden value are implementation specific.

Returns:

`true` if all the pixels within the area given by the `java.awt.Component#getBounds` method are fully opaque, i.e. its paint method (or surrogate methods) guarantee that all pixels are painted in an opaque `Color`, otherwise `false`.

isVisible()

```
public boolean isVisible()
```

Determines if the `HScene` (or more properly its added child components) is Visible. Initially an `HScene` is invisible.

Overrides:

`java.awt.Component.isVisible()` in class `java.awt.Component`

Returns:

`true` if the `HScene` is visible; `false` otherwise.

paint(Graphics)

```
public void paint(java.awt.Graphics g)
```

`HScene` objects override the paint method (defined in `java.awt.Component`) to paint the added "child" components on top of an optional background color or image. The paint behavior is as follows:

1. If the current background mode is `BACKGROUND_FILL`, the entire `HScene` is first filled using the current background color.
2. If a background image has been set using the `setBackgroundImage(Image)` method, and the current image rendering mode as set using `setRenderMode(int)` is not `IMAGE_NONE`, the specified image is painted. Scaling and tiling are performed according to the render mode set.
3. Finally any children of the `HScene` are rendered in z-order.

Overrides:

`java.awt.Container.paint(java.awt.Graphics)` in class `java.awt.Container`

Parameters:

`g` - the graphics context to use for painting.

pop(Component)

```
public boolean pop(java.awt.Component component)
```

Moves the specified `java.awt.Component` one component nearer in the Z-order, i.e. swapping it with the `java.awt.Component` that was directly in front of it.

If `component` is already at the front of the Z-order, the order is unchanged and `pop` returns `true`.

Specified By:

`pop(Component)` in interface `HComponentOrdering`

Parameters:

`component` - The `java.awt.Component` to be moved.

Returns:

returns `true` on success, `false` on failure, for example if the `java.awt.Component` has yet to be added to the `HScene`.

popInFrontOf(Component, Component)

```
public boolean popInFrontOf(java.awt.Component move, java.awt.Component behind)
```

Puts the specified `java.awt.Component` in front of another `java.awt.Component` in the Z-order of this `HScene` .

If `move` and `behind` are the same component which has been added to the container `popInFront` does not change the Z-order and returns `true`.

Specified By:

`popInFrontOf(Component, Component)` in interface `HComponentOrdering`

Parameters:

`move` - The `java.awt.Component` to be moved directly in front of the "behind" Component in the Z-order of this `HScene` .

`behind` - The `java.awt.Component` which the "move" Component should be placed directly in front of.

Returns:

returns `true` on success, `false` on failure, for example when either `java.awt.Component` has yet to be added to the `HScene` . If this method fails, the Z-order is unchanged.

popToFront(Component)

```
public boolean popToFront(java.awt.Component component)
```

Brings the specified `java.awt.Component` to the "front" of the Z-order in this `HScene` .

If component is already at the front of the Z-order, the order is unchanged and `popToFront` returns `true`.

Specified By:

`popToFront(Component)` in interface `HComponentOrdering`

Parameters:

`component` - The `java.awt.Component` to bring to the "front" of the Z-order of this `HScene` .

Returns:

returns `true` on success, `false` on failure, for example when the `java.awt.Component` has yet to be added to the `HScene` . If this method fails, the Z-order is unchanged.

processWindowEvent(WindowEvent)

```
protected void processWindowEvent(java.awt.event.WindowEvent we)
```

Process a `java.awt.event.WindowEvent` for this `HScene` .

Parameters:

`we` - the `java.awt.event.WindowEvent` to be processed.

push(Component)

```
public boolean push(java.awt.Component component)
```

Moves the specified `java.awt.Component` one component further away in the Z-order, i.e. swapping it with the `java.awt.Component` that was directly behind it.

If component is already at the back of the Z-order, the order is unchanged and `push` returns `true`.

Specified By:

`push(Component)` in interface `HComponentOrdering`

Parameters:

`component` - The `java.awt.Component` to be moved.

Returns:

returns `true` on success, `false` on failure, for example if the `java.awt.Component` has yet to be added to the `HScene`.

pushBehind(Component, Component)

```
public boolean pushBehind(java.awt.Component move, java.awt.Component front)
```

Puts the specified `java.awt.Component` behind another `java.awt.Component` in the Z-order of this `HScene`.

If `move` and `front` are the same component which has been added to the container `pushBehind` does not change the Z-order and returns `true`.

Specified By:

`pushBehind(Component, Component)` in interface `HComponentOrdering`

Parameters:

`move` - The `java.awt.Component` to be moved directly behind the "front" Component in the Z-order of this `HScene`.

`front` - The `java.awt.Component` which the "move" Component should be placed directly behind.

Returns:

returns `true` on success, `false` on failure, for example when either `java.awt.Component` has yet to be added to the `HScene`.

pushToBack(Component)

```
public boolean pushToBack(java.awt.Component component)
```

Place the specified `java.awt.Component` at the "back" of the Z-order in this `HScene`.

If `component` is already at the back the Z-order is unchanged and `pushToBack` returns `true`.

Specified By:

`pushToBack(Component)` in interface `HComponentOrdering`

Parameters:

`component` - The `java.awt.Component` to place at the "back" of the Z-order of this `HScene`.

Returns:

returns `true` on success, `false` on failure, for example when the `java.awt.Component` has yet to be added to the `HScene`. If the component was not added to the container `pushToBack` does not change the Z-order.

removeShortcut(int)

```
public void removeShortcut(int keyCode)
```

Removes the specified short-cut key. if the specified short-cut key is not registered, the method has no effect

Parameters:

`keyCode` - The keycode that represents the short cut

removeWindowListener(WindowListener)

```
public void removeWindowListener(java.awt.event.WindowListener wl)
```

Remove a listener so that it no longer receives any `java.awt.event.WindowEvents`. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Parameters:

`wl` - The `java.awt.event.WindowListener` to be removed from notification of any `java.awt.event.WindowEvents`.

setBackgroundImage(Image)

```
public void setBackgroundImage(java.awt.Image image)
```

Set an image which shall be painted in the background of the `HScene`, after the background has been drawn according to the current mode set with `setBackgroundMode(int)`, but before any children are drawn. The image is rendered according to the current render mode set with `setRenderMode(int)`.

Note that the use of a background image in this way may affect the return value of the `isOpaque()` method, depending on the image and the current rendering mode.

Parameters:

`image` - the image to be used as a background. If this parameter is `null` any current image is removed. Note that depending on the current render mode any image set may not actually be rendered.

See Also:

`setRenderMode(int)`

setBackgroundMode(int)

```
public void setBackgroundMode(int mode)
```

Set the background mode of this `HScene`. The value specifies whether the paint method should draw the background (i.e. a rectangle filling the bounds of the `HScene`).

Note that the background mode will affect the return value of the `isOpaque()` method, depending on the value of the `mode` parameter. A fill mode of `BACKGROUND_FILL` implies that `isOpaque()` must return `true`.

Parameters:

`mode` - one of `NO_BACKGROUND_FILL` or `BACKGROUND_FILL`. If `mode` is not a valid value, an `IllegalArgumentException` will be thrown.

setRenderMode(int)

```
public boolean setRenderMode(int mode)
```

Set the rendering mode of any background image associated with this `HScene`.

Note that the minimum requirement is to support only the `IMAGE_NONE` mode. Support of the other modes is platform and implementation specific.

Parameters:

`mode` - the rendering mode, one of `IMAGE_NONE`, `IMAGE_STRETCH`, `IMAGE_CENTER` or `IMAGE_TILE`.

Returns:

`true` if the mode was set successfully, `false` if the mode is not supported by the platform.

setVisible(boolean)

```
public void setVisible(boolean visible)
```

Shows or hides this `HScene` depending on the value of the input parameter `visible`. An `HScene` is initially not visible, a call to `setVisible` should be used to make it visible. Unlike the `show()` method This method does *not* cause the `HScene` to request the input focus.

Overrides:

`java.awt.Component.setVisible(boolean)` in class `java.awt.Component`

Parameters:

`visible` - If true, makes this `HScene` visible; otherwise, hides this `HScene` .

See Also:

`show()`

show()

```
public void show()
```

Shows this `HScene` , and brings it to the front.

If this `HScene` is not yet visible, `show` makes it visible. If this `HScene` is already visible, then this method brings it to the front.

Overrides:

`java.awt.Component.show()` in class `java.awt.Component`

See Also:

`setVisible(boolean)`

org.havi.ui HSceneFactory

Syntax

```
public class HSceneFactory
{
    java.lang.Object
    |
    +--org.havi.ui.HSceneFactory
}
```

Description

The `HSceneFactory` class provides a generic mechanism for an application to request `HScene` resources from a (conceptual) window management system. The `HSceneFactory` is the single entry to potentially multiple `HGraphicsDevice` centric window management policies.

The `HSceneFactory` class provides an opaque interface between any application (or window) management scheme and the Java application, itself.

Note that only one `HScene` per `HGraphicsDevice` can be acquired at any one time for each application.

`HScene` follow the design pattern of the `java.awt.Window` class. They are not a scarce resource on the platform. On platforms which only support one `HScene` being visible at one time the current `HScene` both loses the input focus and is hidden (e.g. iconified) when another application successfully requests the input focus. Two `java.awt.event.WindowEvent` events, with ids `WINDOW_DEACTIVATED` and `WINDOW_ICONIFIED`, shall be generated and sent to the `HScene` which has lost the focus and the `isShowing` method for that `HScene` shall return false.

The constraints on the sizing and positioning of the `HScene` returned by the methods are dependent on the platform-specific `HScene` support. The three scenarios are defined below:

Platforms Supporting a Full Multi-Window System

Platforms where windows may obscure each other shall allow applications to create `HScene` objects which are fully within the area of the supporting `HGraphicsDevice` without any restriction on size or location. Whether successful creation of `HScenes` which are wholly or partially outside the area of the `HGraphicsDevice` is supported is implementation dependent.

Platforms Supporting a Single Window System

Platforms supporting a simple "full-screen" view on a single application at any one time are required to allow applications to create `HScenes` which cover the full area of the supporting `HGraphicsDevice`. `HScenes` matching this description shall be returned as the default `HScene` for the supporting `HGraphicsDevice`. It is implementation dependent whether requests to create `HScene` objects which cover less than the full area of the supporting `HGraphicsDevice` succeed and if they succeed, what the consequences are of their being displayed.

Platforms Supporting a Restricted Multi-Window System

Platforms supporting a "paned" system where each application occupies an area on-screen that is always visible make fewer guarantees to applications. When an `HScene` is created on such a system, the platform shall return an `HScene` which, if visible at that time, would cover as much as possible of the requested area of the supporting `HGraphicsDevice` considering all other visible `HScenes` at that time. `HScenes` which are not visible at this time shall not be considered when fixing the location & size of the new `HScene`. `HScenes` which are visible at this time shall not be effected by the creation of the new `HScene`.

When `setVisible(boolean)` is called on such an `HScene`, the platform shall attempt to make the `HScene` visible using its currently set position and size. If this would conflict with `HScenes` which are already visible (e.g. because of changes between when the `HScene` was created and when

`setVisible` was called) then the call to `setVisible` shall fail silently. Applications are responsible for testing for failure using the `isVisible()` method. The HScenes of already visible applications shall not be impacted by this method call.

The above text specifies the relationship between an `HScene` and its supporting `HGraphicsDevice`. This specification intentionally does not define minimum requirements for `HGraphicsDevices` or for their relationship with other `HScreenDevices` of any type.

Calling `resizeScene(HScene, HSceneTemplate)` for an `HScene` shall apply the same policies as described above for newly created HScenes when deciding whether the resizing operation requested is possible. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Methods

`dispose(HScene)`

```
public void dispose(HScene scene)
```

This method allows an application to dispose of its `HScene`, indicating that the application has no further need for user interaction (i.e. its resources may be released to the system, for future garbage collection. After `dispose()` has been called the application may then acquire another `HScene`.

After calling this method, further method calls on the `HScene` will have no effect or result in an unspecified exception being thrown. This is intentionally implementation-dependent.

Parameters:

`scene` - the `HScene` to be disposed of.

See Also:

`HScene`

`getBestScene(HSceneTemplate)`

```
public HScene getBestScene(HSceneTemplate hst)
```

Returns an `HScene` that best corresponds to the input `HSceneTemplate`, or null if such an `HScene` cannot be generated.

Note that conflict may occur between properties in the `HSceneTemplate` and the `HGraphicsConfigTemplate` corresponding to the currently active `HGraphicsConfiguration`. In the event of conflict between properties which are PREFERRED or UNNECESSARY, the properties concerned shall be ignored and the default will prevail. In the event of conflict between properties which are REQUIRED, this method shall fail and return null.

Parameters:

`hst` - the `HSceneTemplate` to match against

Returns:

the `HScene` that matches the properties as specified in the `HSceneTemplate` , or null if they cannot be satisfied, or if no further `HScene` are available for this application.

getBestSceneTemplate(HSceneTemplate)

```
public HSceneTemplate getBestSceneTemplate(HSceneTemplate hst)
```

Returns an `HSceneTemplate` that is closest to to the input `HSceneTemplate` and corresponds to an `HScene` which could be successfully created on this platform at the time that this method is called.

Note that since some platforms may support more than one concurrent application there is no guarantee that the values returned by this method would actually match those of a subsequently requested `HScene` , using the same template.

Note that conflict may occur between properties in the `HSceneTemplate` and the `HGraphicsConfigTemplate` corresponding to the currently active `HGraphicsConfiguration` . In the event of conflict between properties which are PREFERRED or UNNECESSARY, the properties concerned shall be ignored and the default will prevail. In the event of conflict between properties which are REQUIRED, this method shall fail and return null.

Parameters:

`hst` - The `HSceneTemplate` properties that the `HScene` should satisfy.

Returns:

an `HSceneTemplate` that best corresponds to the input `HSceneTemplate` .

getDefaultHScene()

```
public HScene getDefaultHScene()
```

Create the default `HScene` for the default `HScreen` for this application. This shall be identical to calling

```
org.havi.ui.HScene.getDefaultHScene(org.havi.ui.HScreen.getDefaultHScreen())
```

Returns:

the default `HScene` for the default `HScreen` . If the application has already obtained an `HScene` for the default `HScreen` , then that `HScene` is returned.

getDefaultHScene(HScreen)

```
public HScene getDefaultHScene(HScreen screen)
```

Create the default `HScene` for this `HScreen` . This shall use the `HGraphicsConfiguration` returned by calling

```
screen.getDefaultHGraphicsDevice().getDefaultConfiguration()
```

Parameters:

`screen` - the screen for which the `HScene` should be returned.

Returns:

the default `HScene` for this `HScreen` . If the application has already obtained an `HScene` for this `HScreen` , then that `HScene` is returned.

getFullScreenScene(HGraphicsDevice)

```
public HScene getFullScreenScene(HGraphicsDevice device)
```

Create a full-screen `HScene` on the specified `HGraphicsDevice` or null if such an `HScene` cannot be generated.

Parameters:

`device` - the graphics device with which to create the `HScene`. This is obtained through a `HGraphicsConfigTemplate` / `HGraphicsConfiguration` sequence as described in the document for these classes.

Returns:

a created full-screen `HScene` or null if this is not possible.

getInstance()

```
public static HSceneFactory getInstance()
```

Returns an `HSceneFactory` object to an application.

Returns:

an `HSceneFactory` object to an application. Note that repeated invocations of this method should return the same object (reference).

resizeScene(HScene, HSceneTemplate)

```
public HSceneTemplate resizeScene(HScene hs, HSceneTemplate hst)
```

Resizes an `HScene` so that it best corresponds to the input `HSceneTemplate`, or remains unchanged if it cannot be so resized.

Parameters:

`hs` - the `HScene` to be resized.

`hst` - the `HSceneTemplate` which denotes the new size / location. Only size location options in the `HSceneTemplate` will be considered.

Returns:

an `HSceneTemplate` that indicates the `HScene` properties after (possible) resizing.

Throws:

`java.lang.IllegalStateException` - if the `HScene` had previously been disposed.

org.havi.ui

HSceneTemplate

Syntax

```
public class HSceneTemplate
    java.lang.Object
    |
    +--org.havi.ui.HSceneTemplate
```

Description

The `HSceneTemplate` class is used to obtain an `HScene` subject to a variety of constraints.

The following constraints are supported:

Preference	Object
<code>GRAPHICS_CONFIGURATION</code>	<code>HGraphicsConfiguration</code>
<code>SCENE_PIXEL_LOCATION</code>	<code>java.awt.Point</code>
<code>SCENE_PIXEL_DIMENSION</code>	<code>java.awt.Dimension</code>
<code>SCENE_SCREEN_LOCATION</code>	<code>HScreenPoint</code>
<code>SCENE_SCREEN_DIMENSION</code>	<code>HScreenDimension</code>

Note that as defined here users must set both a location and a dimension preference to request a given rectangle area. Instances of `HSceneTemplate` returned by the system will always be fully specified. Therefore, if an application only sets a preference on `SCENE_SCREEN_LOCATION` the system will fill in `SCENE_SCREEN_DIMENSION`, `SCENE_PIXEL_LOCATION` and `SCENE_PIXEL_DIMENSION` with default values based on the appropriate `HGraphicsConfiguration` and its associated `HGraphicsDevice`.

In the event of a conflict between `REQUIRED` preferences specified in pixel coordinates (`SCENE_PIXEL_LOCATION`, `SCENE_PIXEL_DIMENSION`) and normalized screen coordinates (`SCENE_SCREEN_LOCATION`, `SCENE_SCREEN_DIMENSION`) the system shall ignore the pixel coordinates and use only the screen coordinate preferences. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

`HSceneFactory`

Fields

GRAPHICS_CONFIGURATION

```
public static final int GRAPHICS_CONFIGURATION
```

A value for use in the preference field of the `setPreference(int, Object, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the `HSceneTemplate` that indicates that the `HScene` be created with a specified `HGraphicsConfiguration` (corresponding to a particular `HGraphicsDevice`).

By default the `HSceneTemplate` creates `HScene` on the default `HScreen` default `HGraphicsDevice` with its current `HGraphicsConfiguration`.

LARGEST_PIXEL_DIMENSION

```
public static final java.awt.Dimension LARGEST_PIXEL_DIMENSION
```

A `Dimension` object for use in the object field of the `setPreference(int, Object, int)` and `getPreferenceObject(int)` methods in the `HSceneTemplate` that indicates that the `SCENE_PIXEL_DIMENSION` feature should be set to its largest possible dimension.

PREFERRED

```
public static final int PREFERRED
```

A value for use in the priority field of the `setPreference(int, Object, int)` and `getPreferencePriority(int)` methods in the `HSceneTemplate` that indicates that this feature is preferred over a selection that does not include this feature, although both selections can be considered valid.

REQUIRED

```
public static final int REQUIRED
```

A value for use in the priority field of the `setPreference(int, Object, int)` and `getPreferencePriority(int)` methods in the `HSceneTemplate` that indicates that this feature is required in the `HScene`. If this feature is not available, do not create an `HScene` object.

SCENE_PIXEL_DIMENSION

```
public static final int SCENE_PIXEL_DIMENSION
```

A value for use in the preference field of the `setPreference(int, Object, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the `HSceneTemplate` that indicates that the `HScene` be created with preferred dimensions in pixels as given by a `Dimension` object. If the `Dimension` object is `LARGEST_DIMENSION` then the returned `HScene` should have the largest possible dimensions.

SCENE_PIXEL_LOCATION

```
public static final int SCENE_PIXEL_LOCATION
```

A value for use in the preference field of the `setPreference(int, Object, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the `HSceneTemplate` that indicates that the `HScene` be created with a preferred location in pixels as given by a `Point` object. The graphics pixels shall correspond to the pixel setting for the `HGraphicsDevice` settings as indicated by the `HGraphicsConfiguration` as specified in the `HSceneTemplate` (or its default value).

SCENE_SCREEN_DIMENSION

```
public static final int SCENE_SCREEN_DIMENSION
```

A value for use in the preference field of the `setPreference(int, Object, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the `HSceneTemplate` that indicates that the `HScene` be created with preferred dimensions in normalized screen coordinates as given by an `HScreenDimension` object.

SCENE_SCREEN_LOCATION

```
public static final int SCENE_SCREEN_LOCATION
```

A value for use in the preference field of the `setPreference(int, Object, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the `HSceneTemplate` that indicates that the `HScene` be created with a preferred location in normalized screen coordinates, as given by an `HScreenPoint` object.

UNNECESSARY

```
public static final int UNNECESSARY
```

A value for use in the priority field of the `setPreference(int, Object, int)` and `getPreferencePriority(int)` methods in the `HSceneTemplate` that indicates that this feature is unnecessary in the `HScene`. A selection without this feature is preferred over a selection that includes this feature since it is not used.

Constructors

HSceneTemplate()

```
public HSceneTemplate()
```

Creates a new `HSceneTemplate` object. See the class description for details of constructor parameters and default values.

Methods

getPreferenceObject(int)

```
public java.lang.Object getPreferenceObject(int preference)
```

Return the preference object for the specified preference.

Parameters:

`preference` - the preference to be indicated.

Returns:

the preference object for the specified preference. Valid values shall be of the following types, or null if no preference object was set:

- An `HGraphicsConfiguration` object which is returned for the `GRAPHICS_CONFIGURATION` preference.
- A `java.awt.Point` object which is returned for the `SCENE_PIXEL_LOCATION` preference.
- A `java.awt.Dimension` object which is returned for the `SCENE_PIXEL_DIMENSION` preference.
- An `HScreenPoint` object which is returned for the `SCENE_SCREEN_LOCATION` preference.
- An `HScreenDimension` object which is returned for the `SCENE_SCREEN_DIMENSION` preference.

getPreferencePriority(int)

```
public int getPreferencePriority(int preference)
```

Return the priority for the specified preference.

Parameters:

`preference` - the preference to be indicated. Valid values are: `GRAPHICS_CONFIGURATION` , `SCENE_PIXEL_LOCATION` , `SCENE_PIXEL_DIMENSION` , `SCENE_SCREEN_LOCATION` and `SCENE_SCREEN_DIMENSION` .

Returns:

the priority for the specified preference.

setPreference(int, Object, int)

```
public void setPreference(int preference, java.lang.Object object, int priority)
```

Set the indicated preference (and associated value object) to have the specified priority. If the preference has been previously set, then the previous object and priority shall be overwritten.

By default, the preferences should have an `UNNECESSARY` priority.

Parameters:

`preference` - the preference to be indicated. Valid values are: `GRAPHICS_CONFIGURATION` , `SCENE_PIXEL_LOCATION` , `SCENE_PIXEL_DIMENSION` , `SCENE_SCREEN_LOCATION` and `SCENE_SCREEN_DIMENSION` .

An `IllegalArgumentException` shall be thrown if the preference is not a valid value as listed above.

`object` - the Object associated with the given preference.

An `IllegalArgumentException` shall be thrown if the object is not valid for the preference as specified in the class description.

`priority` - the priority of the preference. Valid values are: `REQUIRED` , `PREFERRED` and `UNNECESSARY` .

If `priority` is not a valid priority as defined here a `java.lang.IllegalArgumentException` will be thrown.

org.havi.ui

HScreen

Syntax

```
public class HScreen
```

```
java.lang.Object
|
+--org.havi.ui.HScreen
```

Description

This class describes the final output composition of a device. It ties together all the (MPEG) video decoders, all the graphics sub-systems and backgrounds which are all combined together before finally being displayed. A platform with two independent displays would support two instances of this class. Where a device outputs audio closely bound with video, that audio output can also be represented through this class.

Since an HScreen represents a single video output signal from a device, all the devices which contribute to that signal must have certain properties in common. It is not possible to select conflicting configurations for different devices on the same HScreen - for example having a video device whose logical output has a 4:3 picture aspect ratio and a graphics device whose logical output has a 16:9 picture aspect ratio. This specification intentionally does not define configurations, or which configurations would be conflicting, since these are essentially region or market dependent. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Methods

getBestConfiguration(HBackgroundConfigTemplate[])

```
public HBackgroundConfiguration getBestConfiguration(HBackgroundConfigTemplate[] hbcta)
```

Returns an `HBackgroundConfiguration` from an `HBackgroundDevice` which is present on this `HScreen` that best matches at least one of the specified `HBackgroundConfigTemplate`, or null if this is not possible.

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`
3. satisfy as many as possible of the preferences whose priority was `PREFERRED`.
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT`.

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

`hvca` - the array of `HBackgroundConfiguration` objects to choose from, represented as an array of `HBackgroundConfiguration` objects.

Returns:

an `HBackgroundConfiguration` object that is the best matching configuration possible, or null if no `HBackgroundConfiguration` passes the criteria.

getBestConfiguration(HGraphicsConfigTemplate[])

```
public HGraphicsConfiguration getBestConfiguration(HGraphicsConfigTemplate[] hgcta)
```

Returns an `HGraphicsConfiguration` from an `HGraphicsDevice` which is present on this `HScreen` that best matches at least one of the specified `HGraphicsConfigTemplate`. If this is not possible this method will attempt to construct an `HEmulatedGraphicsConfiguration` where the emulated configuration best matches one of the specified `HGraphicsConfigTemplate`. If this is not possible, null is returned.

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`
3. satisfy as many as possible of the preferences whose priority was `PREFERRED`.
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT`.

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

`hgcta` - - the array of `HGraphicsConfigTemplate` objects to choose from.

Returns:

an `HGraphicsConfiguration` object that is the best matching configuration possible, or null if no `HGraphicsConfiguration` or `HEmulatedGraphicsConfiguration` object passes the criteria.

getBestConfiguration(HVideoConfigTemplate[])

```
public HVideoConfiguration getBestConfiguration(HVideoConfigTemplate[] hvcta)
```

Returns an `HVideoConfiguration` from an `HVideoDevice` which is present on this `HScreen` that best matches at least one of the specified `HVideoConfigTemplate`. If this is not possible, null is returned.

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`
3. satisfy as many as possible of the preferences whose priority was `PREFERRED`.
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT`.

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

`hvcta` - - the array of `HVideoConfigTemplate` objects to choose from.

Returns:

an `HVideoConfiguration` object that is the best matching configuration possible, or null if no `HVideoConfiguration` object passes the criteria.

getCoherentScreenConfigurations(HScreenConfigTemplate[])

```
public HScreenConfiguration[] getCoherentScreenConfigurations(HScreenConfigTemplate[]
    hscta)
```

Return a coherent set of `HScreenConfiguration` matching a set of templates. One `HScreenConfiguration` will be returned for each `HScreenConfigTemplate` provided as input. The class of the returned objects will correspond to the class of the templates provided as input - where an `HGraphicsConfigTemplate` is provided as input, an `HGraphicsConfiguration` shall be returned. Where an `HVideoConfigTemplate` is provided as input, an `HVideoConfiguration` shall be returned. If more than one template of the same type is provided then the configurations returned must be on different devices but presented on the same screen. If more templates of one type are provided than there are devices of that type in the system, this function will return null.

Coherent means that all the required properties are respected in all of the templates provided and that a configuration can be returned for each template provided.

Conflicts between templates are resolved as discussed in the description of `HScreenConfigTemplate`.

Parameters:

`hscta` - an array of objects describing desired / required configurations. If a zero-length array is passed this function will throw a `java.lang.IllegalArgumentException`.

Returns:

an array of non-null objects describing a coherent set of screen device configurations or null if no such coherent set is possible.

getDefaultHBackgroundDevice()

```
public HBackgroundDevice getDefaultHBackgroundDevice()
```

Return the default background device for this screen.

Returns:

the default background device for this screen or null if none exist.

getDefaultHGraphicsDevice()

```
public HGraphicsDevice getDefaultHGraphicsDevice()
```

Return the default graphics device for this screen. Note that the `HGraphicsDevice` is the default device for rendering graphics, but it may not be capable of displaying video / mixing it with graphics concurrently.

Returns:

the default graphics device for this screen or null if none exist.

getDefaultHScreen()

```
public static HScreen getDefaultHScreen()
```

Returns the default `HScreen` for this application. For systems where an application is associated with audio or video which is started before the application starts, this method will return the `HScreen` where that associated audio / video is being output.

Returns:

the default `HScreen` for this application.

getDefaultHVideoDevice()

```
public HVideoDevice getDefaultHVideoDevice()
```

Return the default video device for this screen. Note that the `HVideoDevice` is the default device for rendering video, but it may not be capable of displaying graphics / mixing it with graphics concurrently.

Returns:

an `HVideoDevice` object or null if none exist.

getHBackgroundDevices()

```
public HBackgroundDevice[] getHBackgroundDevices()
```

Returns a list of background devices for this screen.

Returns:

an array of `HBackgroundDevice` or null if none exist.

getHGraphicsDevices()

```
public HGraphicsDevice[] getHGraphicsDevices()
```

Returns a list of graphics devices for this screen.

Returns:

an array of `HGraphicsDevice` or null if none exist.

getHScreens()

```
public static HScreen[] getHScreens()
```

Returns all `HScreen` in this system.

Returns:

an array of `HScreen` representing all `HScreen` in this system.

getHVideoDevices()

```
public HVideoDevice[] getHVideoDevices()
```

Returns a list of video device for this screen. For systems where an application is associated with video started before the application starts, the first entry in the array returned will be the video device where that video is being output.

Returns:

an array of `HVideoDevice` objects or null if none exist.

setCoherentScreenConfigurations(HScreenConfiguration[])

```
public boolean setCoherentScreenConfigurations(HScreenConfiguration[] hsca)
```

Modify the settings for a set of `HScreenDevice`, based on their `HScreenConfiguration` supplied. Settings should be modified atomically (where possible) or should not be modified if the `HScreenConfiguration` can be determined to be conflicting a priori, i.e. are not "coherent", or would cause an exception to be thrown.

Parameters:

`hsca` - the array of configurations that should be applied atomically (where possible). If the length of this array is zero a `java.lang.IllegalArgumentException` will be thrown.

Returns:

A boolean indicating whether all `HScreenConfiguration` could be applied successfully. If all of the `HScreenConfiguration` could not be applied successfully, the configuration after this method may not match the configuration of the devices prior to this method being called --- applications should take steps to determine whether a partial change of settings has been made on each device.

Throws:

`java.lang.SecurityException` - if the application does not have sufficient rights to set the `HScreenConfiguration` for any of the devices.

`HPermissionDeniedException` - if the application does not currently have the right to set the configuration for any of the devices.

`HConfigurationException` - if the specified `HScreenConfiguration` array is not valid for any of the devices.

org.havi.ui HScreenConfigTemplate

Syntax

```
public abstract class HScreenConfigTemplate
    java.lang.Object
    |
    +--org.havi.ui.HScreenConfigTemplate
```

Direct Known Subclasses:

[HBackgroundConfigTemplate](#), [HGraphicsConfigTemplate](#), [HVideoConfigTemplate](#)

Description

This class describes a configuration of a screen device in terms of various properties and their importance to the application. It is used to request a valid instance of a configuration conforming to the description provided. Sub-classes of this define additional constants which may be used for additional properties. Those classes can be sub-classed in turn to add further properties by systems using the HAVi UI.

In the event of conflicting preferences between `HScreenConfigTemplates` (for example where a configuration is requested which conflicts with an existing configuration) the following rules shall be applied in all cases.

- Where all the conflicting preferences have priority `PREFERRED`, `PREFERRED_NOT` or `DONT_CARE`, the conflicting preferences shall be discarded from the template.
- Where all the conflicting preferences have priority `REQUIRED` or `REQUIRED_NOT`, the method concerned shall fail.
- In situations other than the above, all preferences with priority `PREFERRED`, `PREFERRED_NOT` or `DONT_CARE` shall be discarded. If there is still a conflict after this, the method concerned shall fail.

The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

[HBackgroundConfigTemplate](#), [HGraphicsConfigTemplate](#), [HVideoConfigTemplate](#)

Fields

DONT_CARE

```
public static final int DONT_CARE
```

A value for use in the priority field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the presence or absence of this feature in the `HScreenConfiguration` does not matter. Preferences with this priority play no part in the selection procedure.

FLICKER_FILTERING

```
public static final int FLICKER_FILTERING
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the device configuration supports flicker filtering (if it supports an interlaced screen).

INTERLACED_DISPLAY

```
public static final int INTERLACED_DISPLAY
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the device configuration supports an interlaced display.

PIXEL_ASPECT_RATIO

```
public static final int PIXEL_ASPECT_RATIO
```

A value for use in the preference field of the `setPreference(int, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the device configuration supports the pixel aspect ratio, as specified in a Dimension object which indicates the (relative) x, y pixel aspect ratio.

Instances of `HScreenConfigTemplate` generated by the platform and returned to applications (e.g. from `getConfigTemplate()`) shall have this preference set to a platform specific value with the `REQUIRED` priority.

PIXEL_RESOLUTION

```
public static final int PIXEL_RESOLUTION
```

A value for use in the preference field of the `setPreference(int, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the device configuration supports the pixel resolution, as specified in a Dimension object which indicates the pixel resolution of (the area of) the graphics device (as specified using the `SCREEN_RECTANGLE` preference).

Instances of `HScreenConfigTemplate` generated by the platform and returned to applications (e.g. from `getConfigTemplate()`) shall have this preference set to a platform specific value with the `REQUIRED` priority.

PREFERRED

```
public static final int PREFERRED
```

A value for use in the priority field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that

this feature is desired in the `HScreenConfiguration`. A selection with this feature is preferred over a selection that does not include this feature, although both selections can be considered valid matches.

PREFERRED_NOT

```
public static final int PREFERRED_NOT
```

A value for use in the priority field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that this feature is desired not to be present in the `HScreenConfiguration`. A selection without this feature is preferred over a selection that does not include this feature, although both selections can be considered valid matches.

REQUIRED

```
public static final int REQUIRED
```

A value for use in the priority field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that this feature is required in the `HScreenConfiguration`. If this feature is not available, do not select the `HScreenConfiguration` object.

REQUIRED_NOT

```
public static final int REQUIRED_NOT
```

A value for use in the priority field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that this feature is required not to be present in the `HScreenConfiguration`. If this feature is available, do not select the `HScreenConfiguration` object.

SCREEN_RECTANGLE

```
public static final int SCREEN_RECTANGLE
```

A value for use in the preference field of the `setPreference(int, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the device configuration supports presentation on a particular on-screen area, as specified in an `HScreenRectangle` object

Use of this value with an `HScreenRectangle` object other than the identity rectangle `[0, 0 -> 1, 1]` implies scaling of the presentation to fit within the specified `HScreenRectangle`.

Platforms not supporting such scaling at all or choosing to expose such scaling through other APIs should only return `HScreenConfigTemplate` with the `HScreenRectangle [0, 0 -> 1, 1]` for the `SCREEN_RECTANGLE` preference.

Instances of `HScreenConfigTemplate` generated by the platform and returned to applications (e.g. from `getConfigTemplate()`) shall have this preference set to a platform specific value with the `REQUIRED` priority.

VIDEO_GRAPHICS_PIXEL_ALIGNED

```
public static final int VIDEO_GRAPHICS_PIXEL_ALIGNED
```

A value for use in the preference field of the `setPreference(int, int)`, `getPreferenceObject(int)` and `getPreferencePriority(int)` methods in the

`HScreenConfigTemplate` that indicates that the device configuration supports the display of video streams and graphics with aligned pixels of the same size. Alignment of the origins of the two pixel coordinate spaces is explicitly not required. Where a video device is moving the video relative to the screen in real time (e.g. implementing pan and scan), graphics configurations shall only support this feature where the implementation of the graphics device can track the position changes in the video device automatically.

If this preference is set and used to request an `HVideoConfiguration` then an `HGraphicsConfiguration` shall be used as the preference object. If it is set and used to request an `HGraphicsConfiguration` then an `HVideoConfiguration` shall be used as the preference object. Requesting an `HVideoConfiguration` which is `VIDEO_GRAPHICS_PIXEL_ALIGNED` with another `HVideoConfiguration` shall fail unless the system concerned supports two `HVideoDevice` objects which can support this exact feature.

This preference is used by the platform as a constraint in selecting configurations. Templates generated by the platform and then returned to applications (e.g. from a `getConfigTemplate` method) shall not have this preference filled in by the platform.

ZERO_BACKGROUND_IMPACT

```
public static final int ZERO_BACKGROUND_IMPACT
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the device configuration should have zero impact on already displayed backgrounds. If used with the `REQUIRED` priority, this means no changes shall be made. If used with the `PREFERRED` priority, this means changes may be made but should be minimized.

The `PREFERRED_NOT` and `REQUIRED_NOT` priorities may be ignored in the selection of an `HScreenConfiguration` for this preference type.

This preference is used by the platform as a constraint in selecting configurations. Templates generated by the platform and then returned to applications (e.g. from a `getConfigTemplate` method) shall not have this preference filled in by the platform.

ZERO_GRAPHICS_IMPACT

```
public static final int ZERO_GRAPHICS_IMPACT
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the device configuration should have zero impact on already running graphical applications. If used with the `REQUIRED` priority, this means no changes shall be made. If used with the `PREFERRED` priority, this means changes may be made but should be minimized.

The `PREFERRED_NOT` and `REQUIRED_NOT` priorities may be ignored in the selection of an `HScreenConfiguration` for this preference type.

This preference is used by the platform as a constraint in selecting configurations. Templates generated by the platform and then returned to applications (e.g. from a `getConfigTemplate` method) shall not have this preference filled in by the platform.

ZERO_VIDEO_IMPACT

```
public static final int ZERO_VIDEO_IMPACT
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HScreenConfigTemplate` that indicates that the device configuration should have zero impact on already running video streams. If used with the

`REQUIRED` priority, this means no changes shall be made. If used with the `PREFERRED` priority, this means changes may be made but should be minimized.

The `PREFERRED_NOT` and `REQUIRED_NOT` priorities may be ignored in the selection of an `HScreenConfiguration` for this preference type.

This preference is used by the platform as a constraint in selecting configurations. Templates generated by the platform and then returned to applications (e.g. from a `getConfigTemplate` method) shall not have this preference filled in by the platform.

Constructors

`HScreenConfigTemplate()`

```
public HScreenConfigTemplate()
```

Creates an `HScreenConfigTemplate` object. See the class description for details of constructor parameters and default values.

Methods

`getPreferenceObject(int)`

```
public java.lang.Object getPreferenceObject(int preference)
```

Return the preference object for the specified preference.

Instances of `HScreenConfigTemplate` which have not had this preference set shall return null for this object. Note that instances constructed by the platform and returned to applications are required to have all preferences (except where explicitly identified) set by the platform before it is returned.

Parameters:

`preference` - the preference to be indicated. Valid values for an `HScreenConfigTemplate` are: `VIDEO_GRAPHICS_PIXEL_ALIGNED`, `PIXEL_ASPECT_RATIO`, `PIXEL_RESOLUTION` and `SCREEN_RECTANGLE`.

Subclasses may add further valid values. A `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HScreenConfigTemplate`, or if `preference` does not have an associated value object.

Returns:

the preference object for the specified preference.

`getPreferencePriority(int)`

```
public int getPreferencePriority(int preference)
```

Return the priority for the specified preference.

By default the preferences in a template returned from the system will have an `DONT_CARE` priority unless specified otherwise. Any configuration always satisfies these attributes.

Parameters:

`preference` - the preference to be indicated. Valid values for an `HScreenConfigTemplate` are: `ZERO_BACKGROUND_IMPACT`, `ZERO_GRAPHICS_IMPACT`, `ZERO_VIDEO_IMPACT`,

INTERLACED_DISPLAY , FLICKER_FILTERING , VIDEO_GRAPHICS_PIXEL_ALIGNED ,
PIXEL_ASPECT_RATIO , PIXEL_RESOLUTION and SCREEN_RECTANGLE .

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HScreenConfigTemplate`

Returns:

the priority for the specified preference.

setPreference(int, int)

```
public void setPreference(int preference, int priority)
```

Set the indicated preference to have the specified priority. If the preference has been previously set, then the previous priority for the preference shall be overwritten.

Attributes that are not filled in in a template (through `setPreference(int, int)`), shall have the priority `DONT_CARE` . Any configuration always satisfies these attributes.

Parameters:

`preference` - the preference to be indicated. Valid values for an `HScreenConfigTemplate` are: `ZERO_GRAPHICS_IMPACT` , `ZERO_BACKGROUND_IMPACT` , `ZERO_VIDEO_IMPACT` , `INTERLACED_DISPLAY` and `FLICKER_FILTERING` .

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HScreenConfigTemplate`

`priority` - the priority of the preference. Valid values are: `REQUIRED` , `PREFERRED` , `DONT_CARE` , `PREFERRED_NOT` and `REQUIRED_NOT` .

If `priority` is not a valid priority as defined here a `java.lang.IllegalArgumentException` will be thrown.

setPreference(int, Object, int)

```
public void setPreference(int preference, java.lang.Object object, int priority)
```

Set the indicated preference (and associated value object) to have the specified priority. If the preference has been previously set, then the previous object and priority shall be overwritten.

Attributes that are not filled in in a template (through `setPreference(int, int)`), shall have the priority `DONT_CARE` . Any configuration always satisfies these attributes.

An application which wishes to remove a preference from an existing template (e.g. one generated by the platform) may call this method with null for the object parameter.

Parameters:

`preference` - the preference to be indicated. Valid values for an `HScreenConfigTemplate` are: `VIDEO_GRAPHICS_PIXEL_ALIGNED` , `PIXEL_ASPECT_RATIO` , `PIXEL_RESOLUTION` and `SCREEN_RECTANGLE` .

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HScreenConfigTemplate`

`object` - the Object associated with the given preference, or null.

`priority` - the priority of the preference. Valid values include: `REQUIRED` , `PREFERRED` , `DONT_CARE` , `PREFERRED_NOT` and `REQUIRED_NOT` .

If `priority` is not a valid priority as defined here a `java.lang.IllegalArgumentException` will be thrown.

org.havi.ui HScreenConfiguration

Syntax

```
public abstract class HScreenConfiguration
    java.lang.Object
    |
    +--org.havi.ui.HScreenConfiguration
```

Direct Known Subclasses:

[HBackgroundConfiguration](#), [HGraphicsConfiguration](#), [HVideoConfiguration](#)

Description

The [HScreenConfiguration](#) class describes the characteristics (settings) of an [HScreenDevice](#). There can be many [HScreenConfiguration](#) objects associated with a single [HScreenDevice](#).

See Also:

[HScreenDevice](#)

Methods

convertTo(HScreenConfiguration, Point)

```
public java.awt.Point convertTo(HScreenConfiguration destination, java.awt.Point source)
```

Convert a pixel position from one coordinate system to another without including any rounding errors from passing through normalized coordinates. This returns null if this transformation isn't possible for various reasons. These reasons are:

- at least one of the two [HScreenConfiguration](#) isn't pixel based or doesn't yet have a fixed location on the HScreen.
- a non-linear transformation is in use between the two.
- the information needed to calculate this isn't available.
- the transformation is changing with time (e.g. due to pan & scan).

The source position is interpreted in the coordinate system of the [HScreenConfiguration](#) object on which this method is called.

Parameters:

`destination` - the destination [HScreenConfiguration](#) .
`source` - the pixel position in this [HScreenConfiguration](#) .

Returns:

the position of the specified pixel position measured in the destination coordinate system, or null if this isn't possible.

getFlickerFilter()

```
public boolean getFlickerFilter()
```

Return whether this configuration includes filtering to reduce interlace flicker.

Returns:

true if filtering is included, false otherwise.

getInterlaced()

```
public boolean getInterlaced()
```

Return whether this configuration is interlaced

Returns:

true if this configuration is interlaced, false otherwise.

getOffset(HScreenConfiguration)

```
public java.awt.Dimension getOffset(HScreenConfiguration hsc)
```

Returns the offset between the origin of the pixel coordinate space of the specified `HScreenConfiguration`, and the origin of the current pixel coordinate space of this `HScreenConfiguration`. The offset is returned in the pixel coordinate space of this `HScreenConfiguration`.

Parameters:

`hsc` - the `HScreenConfiguration` to which the offset between pixel origins should be recovered.

Returns:

the offset between the pixel coordinate space of the specified `HScreenConfiguration` and the current pixel coordinate space of this `HScreenConfiguration`. A null object will be returned if there is insufficient information to recover the pixel offset.

getPixelAspectRatio()

```
public java.awt.Dimension getPixelAspectRatio()
```

Return the pixel aspect ratio of this configuration. Some examples are {16:15}, {64:45}, {1:1}.

Returns:

the aspect ratio of the pixels in this configuration.

getPixelResolution()

```
public java.awt.Dimension getPixelResolution()
```

Return the resolution of this configuration in pixels. The pixel coordinate system used is that of the device concerned.

Returns:

the resolution of this configuration in pixels.

getScreenArea()

```
public HScreenRectangle getScreenArea()
```

Return the position and size of this configuration on the screen in screen coordinates.

Returns:

the area on the screen of this configuration in screen coordinates.

org.havi.ui

HScreenDevice

Syntax

```
public class HScreenDevice implements org.davic.resources.ResourceProxy,
    org.davic.resources.ResourceServer
```

```
java.lang.Object
|
+--org.havi.ui.HScreenDevice
```

Direct Known Subclasses:

[HBackgroundDevice](#), [HGraphicsDevice](#), [HVideoDevice](#)

All Implemented Interfaces:

[org.davic.resources.ResourceProxy](#), [org.davic.resources.ResourceServer](#)

Description

An instance of the [HScreen](#) class represents a single independent video output signal from a device. Devices with multiple independent video output signals should support multiple instances of this class. A video output signal is created by adding together the contributions from the devices represented by a number of objects inheriting from the [HScreenDevice](#) class. These can be [HGraphicsDevice](#) objects, [HVideoDevice](#) objects and [HBackgroundDevice](#) objects. A given [HScreen](#) may support any number of any of these objects as far as the API is concerned however some form of profiling may restrict this. In reality right now, one instance of each is all that may reasonably be expected to be present.

Each [HScreenDevice](#) can have multiple settings ([HScreenConfiguration](#)) but only one "setting" ([HScreenConfiguration](#)) can be active at any point in time. The current configuration can be determined on the [HScreenDevice](#) subclasses using their specific `getCurrentConfiguration` methods. The current configuration can be modified on the [HScreenDevice](#) subclasses using their specific `setCurrentConfiguration` methods (assuming sufficient rights, etc.).

Applications may select the best of these configurations for them by creating an instance of [HScreenConfigTemplate](#) and populating that with a number preferences each with a priority. The implementation then matches this template against the range of possible configurations and attempts to find one which matches the template provided. Priorities [REQUIRED](#) and [REQUIRED_NOT](#) must be respected. If they cannot be respected then the method call shall fail and not return any configuration. Priorities [PREFERRED](#) and [PREFERRED_NOT](#) should be respected as much as possible. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

Methods

addResourceStatusEventListener(ResourceStatusListener)

```
public void addResourceStatusEventListener(org.davic.resources.ResourceStatusListener
    listener)
```

Register a listener for events about changes in the state of the ownership of this device. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Specified By:

org.davic.resources.ResourceServer.addResourceStatusEventListener(org.davic.resources.ResourceStatusListener) in interface org.davic.resources.ResourceServer

Parameters:

listener - the object to be informed of state changes

See Also:

HScreenDeviceReleasedEvent, HScreenDeviceReservedEvent

addScreenConfigurationListener(HScreenConfigurationListener)

```
public void addScreenConfigurationListener(HScreenConfigurationListener hscl)
```

Add an `HScreenConfigurationListener` to this device, which is notified whenever the device's configuration is modified. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Parameters:

hscl - the `HScreenConfigurationListener` to be added to this device.

addScreenConfigurationListener(HScreenConfigurationListener, HScreenConfigTemplate)

```
public void addScreenConfigurationListener(HScreenConfigurationListener hscl,
    HScreenConfigTemplate hsct)
```

Add an `HScreenConfigurationListener` to this device, which is notified when the device's configuration is further modified so that it is no longer compatible with the specified `HScreenConfigTemplate`. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Note that if the device configuration does not match the specified template, then the listener should be added and a `HScreenConfigurationEvent` immediately generated for the specified `HScreenConfigurationListener`.

Parameters:

hscl - the `HScreenConfigurationListener` to be added to this device.

hsct - the `HScreenConfigTemplate` which is to be used to determine compatibility with the device configuration.

getClient()

```
public org.davic.resources.ResourceClient getClient()
```

Return the last `ResourceClient` passed to the last successful call to the `reserveDevice(ResourceClient)` method of this instance of `HScreenDevice`, or null if this method has not been called on this instance.

Specified By:

org.davic.resources.ResourceProxy.getClient() in interface org.davic.resources.ResourceProxy

Returns:

a representation of the intended owner of the resource or null if none has been set.

getIDstring()

```
public java.lang.String getIDstring()
```

Returns the identification string associated with this [HScreenDevice](#) .

Returns:

an identification string

getScreenAspectRatio()

```
public java.awt.Dimension getScreenAspectRatio()
```

Return the aspect ratio of the screen as far as is known. i.e. 4:3, 16:9, etc.

This [Dimension](#) may be used to determine the pixel aspect ratio for given [HScreenConfiguration](#) .

Returns:

a [Dimension](#) object specifying the aspect ratio of the screen

releaseDevice()

```
public void releaseDevice()
```

Release the right to control of this device. If this application doesn't have this right then this method has no effect. It is not specified whether any device configuration set by this application will be removed from display immediately or whether it will remain on display until a subsequent application obtains the device and sets its own configuration. Applications wishing to ensure a configuration they have installed is removed must actively remove it before calling this method.

removeResourceStatusEventListener(ResourceStatusListener)

```
public void removeResourceStatusEventListener(org.davic.resources.ResourceStatusListener listener)
```

Remove a listener for events about changes in the state of the ownership of this device. This method has no effect if the listener specified is not registered.

Specified By:

org.davic.resources.ResourceServer.removeResourceStatusEventListener(org.davic.resources.ResourceStatusListener) in interface org.davic.resources.ResourceServer

Parameters:

listener - the object which is no longer interested

See Also:

[HScreenDeviceReleasedEvent](#), [HScreenDeviceReservedEvent](#)

removeScreenConfigurationListener(HScreenConfigurationListener)

```
public void removeScreenConfigurationListener(HScreenConfigurationListener hsc1)
```

Remove an [HScreenConfigurationListener](#) from this device. if the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Parameters:

`hscl` - the `HScreenConfigurationListener` to be removed from this device.

reserveDevice(ResourceClient)

```
public boolean reserveDevice(org.davic.resources.ResourceClient client)
```

Requests the right to call any method which may otherwise throw an `HPermissionDeniedException`. If this method returns true this exception will never be thrown until this right is revoked as notified by methods on `ResourceClient`. The policy by which the platform decides whether or not to grant this right is not defined in this specification.

Note that the word "right" in this context has nothing to do with security. See the description of `HPermissionDeniedException`.

Once the right to control this device has been granted and not removed in the intervening period further calls to this method shall have no effect and return true.

Parameters:

`client` - a representation of the intended owner of the resource

Returns:

true if the right is granted, otherwise false

org.havi.ui

HScreenDimension

Syntax

```
public class HScreenDimension
    java.lang.Object
    |
    +--org.havi.ui.HScreenDimension
```

Description

`HScreenDimension` denotes a screen dimension expressed as a relative value of the screen dimensions. Note that since these are relative dimensions they are effectively independent of any particular screen's physical dimensions, or aspect ratio.

Note that the extents of the dimension must be positive (including zero), but are otherwise unconstrained - and hence may denote areas greater in size than the entire screen.

Hence,

- (1.0, 1.0) denotes the size of the entire screen.
- (0.5, 0.5) denotes a quarter of the screen.

Note that in practice, particularly in the case of television, the precise dimension may vary slightly due to effects of overscan, etc.

Note that systems using `HScreenDimension` directly should consider the effects of rounding errors, etc. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
width	The horizontal extent of the dimension	no default constructor exists	<code>set-Size(float, float)</code>	---
height	The vertical extent of the dimension	no default constructor exists	<code>set-Size(float, float)</code>	---

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

`HScreenPoint`

Fields

height

```
public float height
```

width

```
public float width
```

Constructors

HScreenDimension(float, float)

```
public HScreenDimension(float width, float height)
```

Creates an `HScreenDimension` object. See the class description for details of constructor parameters and default values.

Methods

setSize(float, float)

```
public void setSize(float width, float height)
```

Set the extents of the `HScreenDimension`.

Parameters:

`width` - the horizontal extent of the `HScreenDimension`

`height` - the vertical extent of the `HScreenDimension`

org.havi.ui HScreenPoint

Syntax

```
public class HScreenPoint
{
    java.lang.Object
    |
    +--org.havi.ui.HScreenPoint
}
```

Description

`HScreenPoint` denotes a screen location expressed as a relative value of the screen dimensions. Note that since these are relative dimensions they are effectively independent of any particular screen's physical dimensions, or aspect ratio.

The x coordinate is in terms of the ratio of the particular horizontal screen location to the entire screen width.

The y coordinate is in terms of the ratio of the particular vertical screen location to the entire screen width.

All measurements should be taken from the top, left corner of the screen, measuring positive dimensions down and to the right.

Note that x and y coordinates are not constrained - they may be negative, or have values greater than one - and hence, may denote locations that are not "on- screen".

Hence,

- (0.0, 0.0) denotes the top, left hand corner of the screen.
- (1.0, 0.0) denotes the top, right hand corner of the screen.
- (0.5, 0.5) denotes the center (middle) of the screen.
- (0.0, 1.0) denotes the bottom, left hand corner of the screen.
- (1.0, 1.0) denotes the bottom, right hand corner of the screen.

Note that in practice, particularly in the case of television, the precise location may vary slightly due to effects of overscan, etc. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	The horizontal position of the point	no default constructor exists	<code>setLocation(float, float)</code>	---
y	The vertical position of the point	no default constructor exists	<code>setLocation(float, float)</code>	---

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

[HScreenRectangle](#)

Fields

x

```
public float x
```

y

```
public float y
```

Constructors

HScreenPoint(float, float)

```
public HScreenPoint(float x, float y)
```

Creates an [HScreenPoint](#) object. See the class description for details of constructor parameters and default values.

Methods

setLocation(float, float)

```
public void setLocation(float x, float y)
```

Set the location of the [HScreenPoint](#).

Parameters:

x - the horizontal position of the point

y - the vertical position of the point

org.havi.ui HScreenRectangle

Syntax

```
public class HScreenRectangle
{
    java.lang.Object
    |
    +--org.havi.ui.HScreenRectangle
}
```

Description

`HScreenRectangle` denotes a screen area expressed as a relative value of the screen dimensions. Note that since these are relative dimensions they are effectively independent of any particular screen's physical dimensions, or aspect ratio.

Note that the x and y offset coordinates of the top, left corner of the area are not constrained - they may be negative, or have values greater than one - and hence, may denote an offset location that is not "on-screen". The width and height of the area should be positive (including zero), but are otherwise unconstrained - and hence may denote areas greater in size than the entire screen.

Hence,

- (0.0, 0.0, 1.0, 1.0) denotes the whole of the screen.
- (0.0, 0.0, 0.5, 0.5) denotes the top, left hand quarter of the screen.
- (0.5, 0.0, 0.5, 0.5) denotes the top, right hand quarter of the screen.
- (0.25, 0.25, 0.5, 0.5) denotes a centered quarter-screen area of the screen.
- (0.0, 0.5, 0.5, 0.5) denotes the bottom, left hand quarter of the screen.
- (0.5, 0.5, 0.5, 0.5) denotes the bottom, right hand quarter of the screen.

Note that in practice, particularly in the case of television, the precise location may vary slightly due to effects of overscan, etc.

Note that systems using `HScreenRectangle` directly should consider the effects of rounding errors, etc. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	The horizontal position of the top left corner	no default constructor exists	<code>setLocation(float, float)</code>	---
y	The vertical position of the top left corner	no default constructor exists	<code>setLocation(float, float)</code>	---
width	The width of the rectangle	no default constructor exists	<code>setSize(float, float)</code>	---
height	The height of the rectangle	no default constructor exists	<code>setSize(float, float)</code>	---

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

[HScreenPoint](#)

Fields

height

```
public float height
```

width

```
public float width
```

x

```
public float x
```

y

```
public float y
```

Constructors

HScreenRectangle(float, float, float, float)

```
public HScreenRectangle(float x, float y, float width, float height)
```

Creates an [HScreenRectangle](#) object. See the class description for details of constructor parameters and default values.

Methods

setLocation(float, float)

```
public void setLocation(float x, float y)
```

Set the location of the top left corner of the [HScreenRectangle](#).

Parameters:

x - the horizontal position of the top left corner

y - the vertical position of the top left corner

setSize(float, float)

```
public void setSize(float width, float height)
```

Set the size of the HScreenRectangle.

Parameters:

width - the width of the HScreenRectangle

height - the height of the HScreenRectangle

org.havi.ui HSelectionInputPreferred

Syntax

```
public interface HSelectionInputPreferred extends HOrientable
```

All Known Subinterfaces:

```
HItemValue
```

All Superinterfaces:

```
HOrientable
```

Description

A component which implements `HSelectionInputPreferred` indicates that this component expects to receive `HItemEvent` input events.

All interoperable implementations of the `HSelectionInputPreferred` interface must extend `HComponent`.

Note that the `java.awt.Component` method `isFocusTraversable` should always return true for a `java.awt.Component` implementing this interface.

Methods

getSelectionMode()

```
public boolean getSelectionMode()
```

Get the selection mode for this `HSelectionInputPreferred`. If the returned value is true the component is in selection mode, and the selection may be changed.

The component is switched into and out of selection mode on receiving `ITEM_START_CHANGE` and `ITEM_END_CHANGE` events.

Returns:

true if this component is in selection mode, false otherwise.

processHItemEvent(HItemEvent)

```
public void processHItemEvent(HItemEvent evt)
```

Process an `HItemEvent` sent to this `HSelectionInputPreferred`.

Parameters:

`evt` - the `HItemEvent` to process.

setSelectionMode(boolean)

```
public void setSelectionMode(boolean adjust)
```

Set the selection mode for this `HSelectionInputPreferred`.

This method is provided for the convenience of component implementors. Interoperable applications shall not call this method. It cannot be made protected because interfaces cannot have protected methods.

Parameters:

`edit` - true to switch this component into selection mode, false otherwise.

See Also:

`getSelectionMode()`

org.havi.ui HSinglelineEntry

Syntax

public class HSinglelineEntry extends HVisible implements HTextValue

```

java.lang.Object
|
+--java.awt.Component
|
+--HComponent
|
+--HVisible
|
+--org.havi.ui.HSinglelineEntry

```

Direct Known Subclasses:

HMultilineEntry

All Implemented Interfaces:

HKeyboardInputPreferred, HMatteLayer, HNavigable, HNavigationInputPreferred, HState, HTextValue, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

The `HSinglelineEntry` is a user interface component used to receive a single line of alphanumeric entry from the user and can also be used for password input.

Upon creation the `HSinglelineEntry` is set to a non-editable mode identical in functionality to an `HText`.

On keyboard-based systems, if the user navigates to the component using the keyboard then the component must first be switched into edit mode before it will accept any key presses (other than for navigation to another component). The mechanism by which the component is switched into and out of edit mode is via the `TEXT_START_CHANGE` and `TEXT_END_CHANGE` events, which may be triggered in response to a key stroke or other Java AWT event.

On entering its editable mode the component will send an `TEXT_START_CHANGE` event to all registered `HTextListener` listeners. The `HSinglelineEntry` will then respond to key events by inserting characters into the text string or positioning the insertion point (caret) (via further `HTextEvent` events).

For example, on platforms which do not provide a means of positioning the caret independently from navigating to components, the navigation keys will be interpreted as caret positioning keys in this mode.

While in the editing mode, the component will generate an `TEXT_CHANGE` event whenever the text content of the `HSinglelineEntry` changes (e.g. a character is inserted).

On receiving an `TEXT_END_CHANGE` event the component shall leave its editable mode and send an `TEXT_END_CHANGE` event to all registered `HTextListener` listeners. The user can then navigate out of the `HSinglelineEntry`.

On mouse-based systems, if the user selects the component by clicking a mouse button inside its bounds then the `HSinglelineEntry` will automatically switch into edit mode and generate a `TEXT_START_CHANGE` event. It will stay in edit mode so long as the mouse pointer remains within the bounds of the component. Once the mouse pointer leaves the bounds then it will switch back into non-editable mode and generate a `TEXT_END_CHANGE` event.

By default `HSinglelineEntry` uses the `HSinglelineEntryLook` to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
height	height of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
text	The text within this <code>HSinglelineEntry</code> , to be used as the displayed and editable content for all states.	null	<code>setTextContent(String, int)</code>	<code>getTextContent(int)</code>
max-Chars	The maximum number of characters (per line) allowed in this <code>HSinglelineEntry</code> .	16 characters	<code>setMaxCharsPerLine(int)</code>	<code>getMaxCharsPerLine()</code>
font	The font to be used for this component.	---	<code>java.awt.Component#setFont</code> .	<code>java.awt.Component#getFont</code> .
color	The color to be used for this component.	---	<code>java.awt.Component#setForeground</code> .	<code>java.awt.Component#getForeground</code> .

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>

The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
Caret position	At the end of the current text string	<code>setCaretCharPosition(int)</code>	<code>getCaretCharPosition()</code>
Input type	<code>INPUT_ANY</code>	<code>setType(int)</code>	<code>getType()</code>
Customized input range	As for <code>INPUT_ALPHANUMERIC</code>	<code>setValidInput(char[])</code>	<code>getValidInput()</code>
Password protection (the echo character)	Entry is "clear", i.e. not password protected.	<code>setEchoChar(char)</code>	<code>getEchoChar()</code> and <code>echoCharIsSet()</code>
The default "look" for this class.	A platform specific <code>HSinglelineEntryLook</code>	<code>setDefaultLook(HSinglelineEntryLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HSinglelineEntryLook</code> returned from <code>HSinglelineEntry.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The gain focus sound.	null	<code>setGainFocusSound(HSound)</code>	<code>getGainFocusSound()</code>
The lose focus sound.	null	<code>setLoseFocusSound(HSound)</code>	<code>getLoseFocusSound()</code>

Constructors

HSinglelineEntry()

```
public HSinglelineEntry()
```

Creates an `HSinglelineEntry` object. See the class description for details of constructor parameters and default values.

HSinglelineEntry(int)

```
public HSinglelineEntry(int maxChars)
```

Creates an `HSinglelineEntry` object. See the class description for details of constructor parameters and default values.

HSinglelineEntry(int, int, int, int, int)

```
public HSinglelineEntry(int x, int y, int width, int height, int maxChars)
```

Creates an `HSinglelineEntry` object. See the class description for details of constructor parameters and default values.

HSinglelineEntry(String, int, Font, Color)

```
public HSinglelineEntry(java.lang.String text, int maxChars, java.awt.Font font,
                        java.awt.Color color)
```

Creates an `HSinglelineEntry` object. See the class description for details of constructor parameters and default values.

HSinglelineEntry(String, int, int, int, int, int, Font, Color)

```
public HSinglelineEntry(java.lang.String text, int x, int y, int width, int height,
                        int maxChars, java.awt.Font font, java.awt.Color color)
```

Creates an `HSinglelineEntry` object. See the class description for details of constructor parameters and default values.

Methods

caretNextCharacter()

```
public void caretNextCharacter()
```

Move the caret to the next character. The caret position is constrained such that the insert point lies within the range as defined by the `getCaretCharPosition()` method.

caretPreviousCharacter()

```
public void caretPreviousCharacter()
```

Move the caret to the previous character. The caret position is constrained such that the insert point lies within the range as defined by the `getCaretCharPosition()` method.

deleteNextChar()

```
public boolean deleteNextChar()
```

Delete a character forward of the current caret position.

Returns:

true if a character was deleted, false otherwise.

deletePreviousChar()

```
public boolean deletePreviousChar()
```

Delete a character behind the current caret position.

Returns:

true if a character was deleted, false otherwise.

echoCharIsSet()

```
public boolean echoCharIsSet()
```

Determine if this component has an echo character set, i.e. if the echo character is non-zero.

Returns:

true if an echo character is set, false otherwise.

getCaretCharPosition()

```
public int getCaretCharPosition()
```

Gets the position of the text insertion caret for this the current line in this text component. The valid values of the caret position are from 0 to the length of the string retrieved using `getTextContent(int)`, where 0 implies insertion as the first character (i.e. at the start of the string) and `getTextContent(int)` implies that further characters are to be appended onto the end of the string. Hence, the valid caret positions for the string "abc" of length 3, are 0, 1, 2 and 3 --- with caret locations as shown below:

```
0 "a" 1 "b" 2 "c" 3
```

Returns:

the position of the text insertion caret.

getDefaultLook()

```
public static HSinglelineEntryLook getDefaultLook()
```

Returns the currently set default `HLook` for `HSinglelineEntry` components.

Returns:

The `HLook` that is used by default when creating a new `HSinglelineEntry` component.

getEchoChar()

```
public char getEchoChar()
```

Returns the character to be used for echoing.

Returns:

the character to be used for echoing or 0 (ASCII NUL) if no echo character is set.

getEditMode()

```
public boolean getEditMode()
```

Get the editing mode for this `HSinglelineEntry`. If the returned value is `true` the component is in edit mode, and its textual content may be changed through user interaction such as keyboard events.

The component is switched into and out of edit mode on receiving `TEXT_START_CHANGE` and `TEXT_END_CHANGE` events.

Specified By:

`getEditMode()` in interface `HKeyboardInputPreferred`

Returns:

`true` if this component is in edit mode, `false` otherwise.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

`getGainFocusSound()` in interface `HNavigable`

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

`getLoseFocusSound()` in interface `HNavigable`

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMaxCharsPerLine()

```
public int getMaxCharsPerLine()
```

Get maximum number of characters per (single) line. The behavior of the component when the last character on a line is typed is implementation dependent.

Returns:

the maximum number of characters per line.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

`getMove(int)` in interface `HNavigable`

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns `null`.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

```
getNavigationKeys() in interface HNavigationInputPreferred
```

Returns:

an array of key codes, or `null` if no navigation targets are set on this component.

getTextContent(int)

```
public java.lang.String getTextContent(int state)
```

Gets the text content used in this `HSinglelineEntry`.

Note that `HSinglelineEntry` components do not support separate pieces of textual content per state (as defined in `HState`) --- rather a single piece of content is defined for all its interaction states.

Overrides:

```
getTextContent(int) in class HVisible
```

Parameters:

`state` - The state of the component for which this content should be displayed. This parameter shall be ignored.

Returns:

the text content used in this `HSinglelineEntry`

See Also:

```
setTextContent(String, int)
```

getType()

```
public int getType()
```

Retrieve the desired input type for this component. This value should be set to indicate to the system which input keys are required by this component.

Specified By:

```
getType() in interface HKeyboardInputPreferred
```

Returns:

one of `INPUT_ALPHANUMERIC`, `INPUT_NUMERIC`, `INPUT_ALPHA`, or `INPUT_CUSTOMIZED`.

getValidInput()

```
public char[] getValidInput()
```

Retrieve the customized input character range. The return value of this method should reflect the range of input keys which the component wishes to see, should `getType()` return `INPUT_CUSTOMIZED`. This method may return `null` if and only if it can guarantee that customized input is *never* required.

If customized input can be used but no specific customized input is set, this method should return the same range as the `INPUT_ALPHANUMERIC` input type, i.e. that range of characters for which the `java.lang.Character.isLetterOrDigit` returns `true`.

Specified By:

```
getValidInput() in interface HKeyboardInputPreferred
```

Returns:

an array containing the characters which this component expects the platform to provide, or `null` to indicate that customized characters are not used.

insertChar(char)

```
public boolean insertChar(char c)
```

Insert a character at the current caret position, subject to the maximum number of input characters.

Parameters:

`c` - the character to insert

Returns:

true if the character was inserted, false otherwise.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

`isSelected()` in interface `HNavigable`

Returns:

true if the component has focus, otherwise returns false.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HSinglelineEntry`.

Specified By:

`processHFocusEvent(HFocusEvent)` in interface `HNavigationInputPreferred`

Parameters:

`evt` - the `HFocusEvent` to process.

processHKeyEvent(HKeyEvent)

```
public void processHKeyEvent(HKeyEvent evt)
```

Process an `HKeyEvent` sent to this `HSinglelineEntry`.

Specified By:

`processHKeyEvent(HKeyEvent)` in interface `HKeyboardInputPreferred`

Parameters:

`evt` - the `HKeyEvent` to process.

processHTextEvent(HTextEvent)

```
public void processHTextEvent(HTextEvent evt)
```

Process an `HTextEvent` sent to this `HSinglelineEntry`.

Specified By:

`processHTextEvent(HTextEvent)` in interface `HKeyboardInputPreferred`

Parameters:

`evt` - the `HTextEvent` to process.

setCaretCharPosition(int)

```
public int setCaretCharPosition(int position)
```

Sets the position of the text insertion caret for this text component. If position is not valid for the current content the caret is moved to the nearest position.

Parameters:

`position` - the new position of the text insertion caret.

Returns:

the new caret position.

setDefaultLook(HSinglelineEntryLook)

```
public static void setDefaultLook(HSinglelineEntryLook look)
```

Sets the default `HLook` for further `HSinglelineEntry` Components.

Parameters:

`look` - The `HLook` that will be used by default when creating a new `HSinglelineEntry` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setEchoChar(char)

```
public void setEchoChar(char c)
```

Sets the number of character to echo for this component.

Parameters:

`c` - the character used to echo any input, e.g. if `c == '*'` a password-style input will be displayed. If `c` is zero (ASCII NUL), then all characters will be echoed on-screen, this is the default behavior.

setEditMode(boolean)

```
public void setEditMode(boolean edit)
```

Set the editing mode for this `HSinglelineEntry`.

This method is provided for the convenience of component implementors. Interoperable applications shall not call this method. It cannot be made protected because interfaces cannot have protected methods.

Specified By:

`setEditMode(boolean)` in interface `HKeyboardInputPreferred`

Parameters:

`edit` - true to switch this component into edit mode, false otherwise.

See Also:

`getEditMode()`

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
    HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

```
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) in
interface HNavigable
```

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` `KeyEvent`. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` `KeyEvent`. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` `KeyEvent`. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` `KeyEvent`. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

```
setGainFocusSound(HSound) in interface HNavigable
```

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLook(HLook)

```
public void setLook(HLook hlook)
```

Sets the `HLook` for this component.

Overrides:

```
setLook(HLook) in class HVisible
```

Parameters:

`hlook` - The `HLook` that is to be used for this component. Note that this parameter may be null, in which case the component will not draw itself until a look is set.

Throws:

```
HInvalidLookException - If the Look is not an HSinglelineEntryLook .
```

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMaxCharsPerLine(int)

```
public void setMaxCharsPerLine(int maxCol)
```

Set maximum number of characters per (single) line.

Parameters:

`maxCol` - the maximum number of characters per line.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

setTextContent(String, int)

```
public void setTextContent(java.lang.String string, int state)
```

Sets the text content used in this `HSinglelineEntry`.

Note that `HSinglelineEntry` components do not support separate pieces of textual content per state (as defined in `HState`) --- rather a single piece of content is defined for all its interaction states.

Additionally, the `setTextContent(String, int)` method truncates the string according to the current `maxChars` setting.

Overrides:

`setTextContent(String, int)` in class `HVisible`

Parameters:

`string` - The content. If the content is null, then any currently assigned content shall be removed for the specified state.

`state` - The state of the component for which this content should be displayed. This parameter shall be ignored and considered to have the value `ALL_STATES`.

See Also:

`getTextContent(int)`

setType(int)

```
public void setType(int type)
```

Set the type of permitted keyboard entry.

Parameters:

`type` - one of `INPUT_ANY`, `INPUT_ALPHANUMERIC`, `INPUT_ALPHA`, `INPUT_NUMERIC` or `INPUT_CUSTOMIZED`

setValidInput(char[])

```
public void setValidInput(char[] inputChars)
```

Defines the set of the characters which are valid for customized keyboard input, i.e. when the input type is set to `INPUT_CUSTOMIZED`.

Parameters:

`inputChars` - an array of characters which comprises the valid input characters.

org.havi.ui HSinglelineEntryLook

Syntax

```
public class HSinglelineEntryLook implements HLook
```

```
java.lang.Object
|
+--org.havi.ui.HSinglelineEntryLook
```

Direct Known Subclasses:

```
HMultilineEntryLook
```

All Implemented Interfaces:

```
java.lang.Cloneable, HLook
```

Description

The `HSinglelineEntryLook` class is used by the `HSinglelineEntry` component to display the entering of text. This look will be provided by the platform and the exact way in which it is rendered will be platform dependant.

The `HSinglelineEntryLook` class draws the content set on an `HSinglelineEntry`. It uses the `getTextContent(int)` method to determine the content to render. The interaction state of the `HSinglelineEntry` is ignored.

This is the default look that is used by `HSinglelineEntry` and its subclasses. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

```
HSinglelineEntry
```

Constructors

HSinglelineEntryLook()

```
public HSinglelineEntryLook()
```

Creates a `HSinglelineEntryLook` object. See the class description for details of constructor parameters and default values.

Methods

`getInsets(HVisible)`

```
public java.awt.Insets getInsets(HVisible visible)
```

Determines the insets of this `HLook`, which indicate the size of the border. This area is reserved for the `HLook` to use for drawing borders around the associated `HVisible`.

Specified By:

`getInsets(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

the insets of this `HLook`.

`getMaximumSize(HVisible)`

```
public java.awt.Dimension getMaximumSize(HVisible hvisible)
```

Gets the maximum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) then the return value is the current size of the `HVisible` (as returned by `HVisible#getSize`).
2. If the `HLook` does not support scaling of content or no scaling is requested, and content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If there is no content set then a maximum size of `[Short.MAX_VALUE, Short.MAX_VALUE]` is returned as a `Dimension`.

Specified By:

`getMaximumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` maximum size.

See Also:

`getMaximumSize()`

`getMinimumSize(HVisible)`

```
public java.awt.Dimension getMinimumSize(HVisible hvisible)
```

Gets the minimum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the size of the smallest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If the `HLook` does not support scaling of content or no scaling is requested, *and* content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If no content is available but a default preferred size has been set using `setDefaultSize(Dimension)` has been called to set then the return value is this value (as obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
4. If there is no content or default size set then the return value is an implementation-specific minimum size plus any additional dimensions that the `HLook` requires for border decoration etc.

Specified By:

`getMinimumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` minimum size.

See Also:

`getMinimumSize()`

getPreferredSize(HVisible)

```
public java.awt.Dimension getPreferredSize(HVisible hvisible)
```

Gets the preferred size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If a default preferred size has been set for this `HVisible` (using `setDefaultSize(Dimension)`) then the return value is this size (obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If this `HLook` does not support scaling of content or no scaling is requested, and content is present then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If this `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the current size of the `HVisible` as returned by `getSize()`.
4. If there is no content and no default size set then the return value is the current size of the `HVisible` as returned by `getSize()`.

Specified By:

`getPreferredSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating the preferred size of the `HVisible` when drawn with this `HLook`.

See Also:

`getPreferredSize()`, `setDefaultSize(Dimension)`

isOpaque(HVisible)

```
public boolean isOpaque(HVisible visible)
```

Returns true if the entire painted area of the `HVisible` when using this look is fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`.

The default value is implementation specific and depends on the background painting mode of the given `HVisible`. The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque(HVisible)` in interface `HLook`

Parameters:

`visible` - the visible to test

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method of an `HVisible` using this look are fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`, otherwise false.

showLook(Graphics, HVisible, int)

```
public void showLook(java.awt.Graphics g, HVisible visible, int state)
```

The `showLook(Graphics, HVisible, int)` method is responsible for repainting the entire `HVisible` component, (including any content set on the component, and the component background), subject to the `clipRect` of the `Graphics` object passed to it.

The `showLook(Graphics, HVisible, int)` method should not modify the `clipRect` of the `Graphics` object that is passed to it.

For looks which draw content (e.g. `HTextLook`, `HGraphicLook` and `HAnimateLook`), if no content is associated with the component, the `showLook(Graphics, HVisible, int)` method paints the component with its current background `Color` according to the `setBackgroundMode(int)` method of `HVisible` and draws any (implementation-specific) borders. Note that by default the background mode is set so as to **not** paint a background. Furthermore on platforms which support transparent colors the background `Color` may be partially or completely transparent.

Any resources **explicitly** associated with an `HLook` should be loaded by the `HLook` during its creation, etc., or via its `setXXX()` methods. Note that the "standard" looks don't load content by default.

This method is called from the `paint(Graphics)` method of `HVisible` and must never be called from elsewhere. Components wishing to redraw themselves should call their repaint method in the usual way.

Specified By:

`showLook(Graphics, HVisible, int)` in interface `HLook`

Parameters:

`g` - the graphics context.

`visible` - the visible.

`state` - the state parameter indicates the state of the visible, allowing the look to render the appropriate content for that state. Note that some components (e.g. `HStaticRange`, `HRange`, `HRangeValue`) do not use state-based content).

widgetChanged(HVisible, HChangeData[])

```
public void widgetChanged(HVisible visible, HChangeData[] changes)
```

Called by the `HVisible` whenever its content, state, or any other data changes. See the class description of `HVisible` for more information about the `changes` parameter.

The implementation of this method should work out which graphical areas of the `HVisible` have changed and make any relevant calls to trigger the repainting of those areas.

A minimum implementation of this method could simply call

```
visible.repaint()
```

Specified By:

```
widgetChanged(HVisible, HChangeData[] ) in interface HLook
```

Parameters:

`visible` - the `HVisible` which has changed

`changes` - an array containing hint data and associated hint objects. If this argument is `null` a full repaint will be triggered.

org.havi.ui

HSound

Syntax

```
public class HSound
    java.lang.Object
    |
    +--org.havi.ui.HSound
```

Description

The `HSound` class is used to represent an audio clip. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

The starting position of any audio clip to be played.	At the beginning of the audio clip.	---	---
---	-------------------------------------	-----	-----

Constructors

HSound()

```
public HSound()
```

Creates an `HSound` object. See the class description for details of constructor parameters and default values.

Methods

dispose()

```
public void dispose()
```

If the `HSound` object is playing / looping then it will be stopped. The dispose method then discards all sample resources used by the `HSound` object. This mechanism resets the `HSound` object to the state before a `load()` method was invoked.

load(String)

```
public void load(java.lang.String location)
```

Loads data synchronously into an `HSound` object from an audio sample in the specified file. If the object already contains data, this method shall perform the following sequence:

- stop the sample if it is playing or looping.
- dispose of the old data and any associated resources, as if the `dispose()` method had been called.
- load the new data synchronously.

Parameters:

`location` - the name of a file containing audio data in a recognized file format.

Throws:

`java.io.IOException` - if the sample cannot be loaded due to an IO problem.

`java.lang.SecurityException` - if the caller does not have sufficient rights to access the specified audio sample.

load(URL)

```
public void load(java.net.URL contents)
```

Loads data synchronously into an `HSound` object from an audio sample indicated by a URL. If the object already contains data, this method shall perform the following sequence:

- stop the sample if it is playing or looping.
- dispose of the old data and any associated resources, as if the `dispose()` method had been called.
- load the new data synchronously.

Parameters:

`contents` - a URL referring to the data to load.

Throws:

`java.io.IOException` - if the audio sample cannot be loaded due to an IO problem.

`java.lang.SecurityException` - if the caller does not have sufficient rights to access the specified audio sample.

loop()

```
public void loop()
```

Starts the `HSound` class looping from the beginning of its associated audio data. If the sample data has not been completely loaded, this method has no effect.

When the audio data has been played in its entirety, then it should be played again from the beginning of its associated data, so as to cause a "seamless" continuous (infinite) audio playback - until the next stop, or play method is invoked. Note that the audio data is played back asynchronously, there is no mechanism for synchronization with other classes presenting sounds, images, or video.

This method may fail "silently" if (local) audio facilities are unavailable on the platform.

play()

```
public void play()
```

Starts the `HSound` class playing from the beginning of its associated audio data. If the sample data has not been completely loaded, this method has no effect.

When the audio data has been played in its entirety then no further audible output should be made until the next play or loop method is invoked. Note that the audio data is played back asynchronously. There is no mechanism for synchronization with other classes presenting sounds, images, or video.

This method may fail "silently" if (local) audio facilities are unavailable on the platform.

set(byte[])

```
public void set(byte[] data)
```

Constructs an `HSound` object from an array of bytes encoded in the same encoding format as when reading this type of audio sample data from a file. If the object already contains data, this method shall perform the following sequence:

- stop the sample if it is playing or looping.
- dispose of the old data and any associated resources, as if the `dispose()` method had been called.
- load the new data synchronously.

If the byte array does not contain a valid audio sample then this method shall throw a `java.lang.IllegalArgumentException`.

Parameters:

`data` - the data for the `HSound` object encoded in the specified format for audio sample files of this type.

stop()

```
public void stop()
```

Stops the `HSound` class playing its associated audio data.

Note that, if a play or loop method is invoked, after a stop, then presentation of the audio data will restart from the beginning of the audio data, rather than from the position where the audio data was stopped.

org.havi.ui

HState

Syntax

```
public interface HState
```

All Known Implementing Classes:

`HVisible`

Description

The `HState` interface encapsulates constants for component states which are used in the various `HVisible` `setContent` and `getContent` methods, to indicate which state the specified content is to be set.

There are two sets of constants defined in this interface. The first set are mutually exclusive state bits, which define properties of the component. The order of the states is important; each state has precedence over the one before it when considering the effect on the component. For example, the `DISABLED_STATE_BIT` property is considered the most significant property of a state. The state bits are shown in the table below.

Name	Interpretation
<code>FOCUSED_STATE_BIT</code>	component has focus
<code>ACTIONED_STATE_BIT</code>	component is actioned
<code>DISABLED_STATE_BIT</code>	component is disabled

The state bits combine to provide the actual interaction states which `HVisible` components may be in. Content for components is set on these states, not the state bits shown above. The interaction states are shown in the table below.

State	DISABLED_BIT	ACTIONED_BIT	FOCUSED_BIT
<code>NORMAL_STATE</code>	0	0	0
<code>FOCUSED_STATE</code>	0	0	1
<code>ACTIONED_STATE</code>	0	1	0
<code>ACTIONED_FOCUSED_STATE</code>	0	1	1
<code>DISABLED_STATE</code>	1	0	0
<code>DISABLED_FOCUSED_STATE</code>	1	0	1

<code>DISABLED_ACTIONED_STATE</code>	1	1	0
<code>DISABLED_ACTIONED_FOCUSED_STATE</code>	1	1	1

See Also:

`setTextContent(String, int)`, `getTextContent(int)`, `setGraphicContent(Image, int)`, `getGraphicContent(int)`, `setAnimateContent(Image[], int)`, `getAnimateContent(int)`, `setContent(Object, int)`, `getContent(int)`, `setInteractionState(int)`, `getInteractionState()`

Fields

ACTIONED_FOCUSED_STATE

```
public static final int ACTIONED_FOCUSED_STATE
```

This state indicates that the widget has been actioned, and has focus. `HSwitchable` components may stay in this state until they are actioned again. This state is applicable to all `HActionable` and `HSwitchable` components.

See Also:

`HActionable`, `HSwitchable`

ACTIONED_STATE

```
public static final int ACTIONED_STATE
```

This state indicates that the widget has been actioned, but does not have focus. `HSwitchable` components may stay in this state until they are actioned again. This state is applicable to all `HActionable` and `HSwitchable` components.

See Also:

`HActionable`, `HSwitchable`

ACTIONED_STATE_BIT

```
public static final int ACTIONED_STATE_BIT
```

This state bit indicates that the widget has been actioned. `HActionable` components only have this bit set for the duration of the calls to their registered `ActionListeners`, whereas `HSwitchable` components may remain with the `ACTIONED` bit set until further user input causes them to leave it. If state-based content is not used, the associated look should visually distinguish components with this bit set e.g. by drawing them as "pushed in".

ALL_STATES

```
public static final int ALL_STATES
```

Constant used to indicate all of the applicable states for a given component.

Note that the `ALL_STATES` constant should only be used in setting content
`setTextContent(String, int)` `setGraphicContent(Image, int)`
`setAnimateContent(Image[], int)` `setContent(Object, int)`

The ALL_STATES constant should not be used for retrieving content: `getTextContent(int)`
`getGraphicContent(int)` `getAnimateContent(int)` `getContent(int)`

DISABLED_ACTIONED_FOCUSED_STATE

```
public static final int DISABLED_ACTIONED_FOCUSED_STATE
```

This state indicates that the widget has been actioned and has input focus but is disabled. This state is applicable to all `HSwitchable` components.

See Also:

`HSwitchable`

DISABLED_ACTIONED_STATE

```
public static final int DISABLED_ACTIONED_STATE
```

This state indicates that the widget has been actioned but is disabled. This state is applicable to all `HSwitchable` components.

See Also:

`HSwitchable`

DISABLED_FOCUSED_STATE

```
public static final int DISABLED_FOCUSED_STATE
```

This state indicates that the widget has input focus but is disabled. This state is applicable to all `HNavigable` components.

See Also:

`HNavigable`

DISABLED_STATE

```
public static final int DISABLED_STATE
```

This state indicates that the widget is disabled. This state is applicable to all `HVisible` components.

See Also:

`HVisible`

DISABLED_STATE_BIT

```
public static final int DISABLED_STATE_BIT
```

This state bit indicates that the component is disabled. Regardless of other bits being set it shall not respond to user action, shortcut keys or mouse clicks. However the component is only disabled at the HAVi level. It may still receive AWT events directly, which interoperable components must ignore. If state-based content is not used the associated look should visually distinguish components with this bit set e.g. by graying them out.

FIRST_STATE

```
public static final int FIRST_STATE
```

Constant used to indicate the value of the first (builtin) component state.

FOCUSED_STATE

```
public static final int FOCUSED_STATE
```

This state indicates that the widget has input focus. This state is applicable to all `HNavigable` components.

See Also:

`HNavigable`

FOCUSED_STATE_BIT

```
public static final int FOCUSED_STATE_BIT
```

This state bit indicates that the widget has the input focus. This state is only valid for widgets implementing `HNavigable`. If state-based content is not used, the associated look should visually distinguish components with this bit set e.g. by highlighting them.

LAST_STATE

```
public static final int LAST_STATE
```

Constant used to indicate the value of the last (builtin) component state.

NORMAL_STATE

```
public static final int NORMAL_STATE
```

This constant (i.e. no state bits set) indicates that the widget is in its normal state. This state is applicable to all `HVisible` components.

See Also:

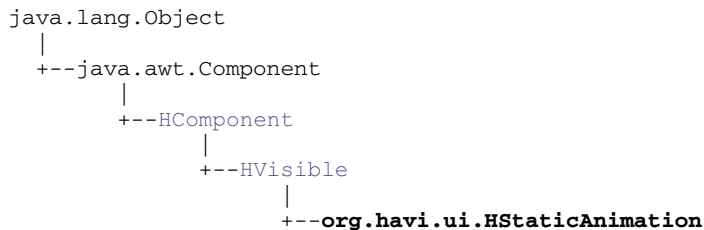
`HVisible`

org.havi.ui

HStaticAnimation

Syntax

public class HStaticAnimation extends HVisible implements HNoInputPreferred, HAnimateEffect



Direct Known Subclasses:

[HAnimation](#)

All Implemented Interfaces:

[HAnimateEffect](#), [HMatteLayer](#), [HNoInputPreferred](#), [HState](#),
[java.awt.image.ImageObserver](#), [java.awt.MenuContainer](#), [java.io.Serializable](#), [TestOpacity](#)

Description

The [HStaticAnimation](#) is a user interface component used to display animated graphical content but which does *not* permit the user to navigate (focus) upon it. By default it uses the [HAnimateLook](#) to render itself.

The [HStaticAnimation](#) class supports animating images a finite number of times or infinitely (continuously), and either forward or in alternating directions with a specified time delay between the rendering of consecutive images. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds

images-Normal	The array of images to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	<code>setAnimateContent (Image[] , int)</code>	<code>getAnimateContent (int)</code>
delay	The delay between the presentation of successive content in the animation, in units of 0.1 second	1 (i.e. 0.1 seconds)	<code>setDelay (int)</code>	<code>getDelay ()</code>
repeat-Count	The number of times that the animation is to be played.	<code>REPEAT_INFINITE</code>	<code>setRepeatCount (int)</code>	<code>getRepeatCount ()</code>
playMode	The playing mode for the animation.	<code>PLAY_REPEATING</code>	<code>setPlayMode (int)</code>	<code>getPlayMode ()</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte (HMatte)</code>	<code>getMatte ()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager (HTextLayoutManager)</code>	<code>getTextLayoutManager ()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode (int)</code>	<code>getBackgroundMode ()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize (Dimension)</code>	<code>getDefaultSize ()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment (int)</code>	<code>getHorizontalAlignment ()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment (int)</code>	<code>getVerticalAlignment ()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode (int)</code>	<code>getResizeMode ()</code>
The initial piece of content to be presented, i.e. its position in the content array.	0	<code>setPosition (int)</code>	<code>getPosition ()</code>
By default the animation should be stopped. Hence, to start the animation its start method must be explicitly invoked. This mechanism allows for animations that are programmatically controlled, e.g. via the <code>setPosition</code> method.	"stopped"	<code>start () / stop ()</code>	<code>isAnimated ()</code>

The default "look" for this class.	A platform specific <code>HAnimateLook</code>	<code>setDefaultLook(HAnimateLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HAnimateLook</code> returned from <code>HStaticAnimation.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>

Constructors

`HStaticAnimation()`

```
public HStaticAnimation()
```

Creates an `HStaticAnimation` object. See the class description for details of constructor parameters and default values.

`HStaticAnimation(Image[], int, int, int)`

```
public HStaticAnimation(java.awt.Image[] imagesNormal, int delay, int playMode,
                        int repeatCount)
```

Creates an `HStaticAnimation` object. See the class description for details of constructor parameters and default values.

`HStaticAnimation(Image[], int, int, int, int, int, int, int)`

```
public HStaticAnimation(java.awt.Image[] imagesNormal, int delay, int playMode,
                        int repeatCount, int x, int y, int width, int height)
```

Creates an `HStaticAnimation` object. See the class description for details of constructor parameters and default values.

Methods

`getDefaultLook()`

```
public static HAnimateLook getDefaultLook()
```

Returns the currently set default `HLook` for `HStaticAnimation` components.

Returns:

The `HLook` that is used by default when creating a new `HStaticAnimation` component.

`getDelay()`

```
public int getDelay()
```

Gets the presentation delay for this `HStaticAnimation`.

Specified By:

`getDelay()` in interface `HAnimateEffect`

Returns:

the presentation delay in units of 0.1 seconds.

getPlayMode()

```
public int getPlayMode()
```

Gets the playing mode for this `HStaticAnimation`.

Specified By:

`getPlayMode()` in interface `HAnimateEffect`

Returns:

the play mode for this `HStaticAnimation`.

getPosition()

```
public int getPosition()
```

Get the current index into the content array which this `HStaticAnimation` is using to display content.

Specified By:

`getPosition()` in interface `HAnimateEffect`

Returns:

the index of the content currently being displayed, in the range $0 \leq \text{index} < \text{length}$

getRepeatCount()

```
public int getRepeatCount()
```

Gets the number of times that this `HStaticAnimation` is to be played. Note that this method does *not* return the number of repeats that are remaining to be played.

Specified By:

`getRepeatCount()` in interface `HAnimateEffect`

Returns:

the total number of times that an `HStaticAnimation` is to be played. The returned value shall be greater than zero, or `REPEAT_INFINITE`.

isAnimated()

```
public boolean isAnimated()
```

This method indicates the animation (running) state of the `HStaticAnimation`.

Specified By:

`isAnimated()` in interface `HAnimateEffect`

Returns:

`true` if this `HStaticAnimation` is running, i.e. the `start` method has been invoked - `false` otherwise.

setDefaultLook(HAnimateLook)

```
public static void setDefaultLook(HAnimateLook hlook)
```

Sets the default `HLook` for further `HStaticAnimation` Components.

Parameters:

`hlook` - The `HLook` that will be used by default when creating a new `HStaticAnimation` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setDelay(int)

```
public void setDelay(int count)
```

Sets the delay between the presentation of successive pieces of content (frames).

After calling `setDelay(int)` on a currently playing `HStaticAnimation`, there is no guarantee that one or more frames will not be displayed using the previous delay until the new delay value takes effect.

Specified By:

`setDelay(int)` in interface `HAnimateEffect`

Parameters:

`count` - the content presentation delay in units of 0.1 seconds duration. If `count` is less than one "unit", then it shall be treated as if it were a delay of one "unit", i.e. 0.1 seconds.

setLook(HLook)

```
public void setLook(HLook hlook)
```

Sets the `HLook` for this component.

Overrides:

`setLook(HLook)` in class `HVisible`

Parameters:

`hlook` - The `HLook` that is to be used for this component. Note that this parameter may be null, in which case the component will not draw itself until a look is set.

Throws:

`HInvalidLookException` - If the `HLook` is not an `HAnimateLook`.

setPlayMode(int)

```
public void setPlayMode(int mode)
```

Sets the playing mode for this `HStaticAnimation`. If the animation is already running a call to `setPlayMode` will change the current value and affect the animation immediately. The position of the animation is unchanged.

Specified By:

`setPlayMode(int)` in interface `HAnimateEffect`

Parameters:

`mode` - the play mode for this `HStaticAnimation`, which must be either `PLAY_ALTERNATING` or `PLAY_REPEATING`.

setPosition(int)

```
public void setPosition(int position)
```

Set this `HStaticAnimation` to display the content at the specified position. If the animation is already running a call to `setPosition` will change the current value and affect the animation immediately.

Specified By:

`setPosition(int)` in interface `HAnimateEffect`

Parameters:

`position` - an index into the content array which specifies the next piece of content to be displayed. If `position` is less than 0, then the array element at index 0 is displayed, if `position` is greater than or equal to the length of the content array, then the array element at index `[length-1]` will be used.

setRepeatCount(int)

```
public void setRepeatCount(int count)
```

Sets the number of times that this `HStaticAnimation` should be played. If the animation is already running a call to `setRepeatCount` will change the current value and reset the current number of repeats to 0, affecting the animation immediately.

Specified By:

`setRepeatCount(int)` in interface `HAnimateEffect`

Parameters:

`count` - the number of times that an `HStaticAnimation` should be played. Valid values of the repeat count are one or more, and `REPEAT_INFINITE`.

start()

```
public void start()
```

This method starts this `HStaticAnimation` playing. If `start` is called when the animation is already running it resets the animation according to the current play mode, as returned by `getPlayMode()`.

Specified By:

`start()` in interface `HAnimateEffect`

stop()

```
public void stop()
```

This method indicates that the running `HStaticAnimation` should be stopped. After calling this method, there is no guarantee that one or more frames will not be displayed before the animation actually stops playing. If the animation is already stopped further calls to `stop` have no effect.

Specified By:

`stop()` in interface `HAnimateEffect`

org.havi.ui HStaticIcon

Syntax

public class HStaticIcon extends HVisible implements HNoInputPreferred

```

java.lang.Object
|
+--java.awt.Component
    |
    +--HComponent
        |
        +--HVisible
            |
            +--org.havi.ui.HStaticIcon
  
```

Direct Known Subclasses:

[HIcon](#)

All Implemented Interfaces:

[HMatteLayer](#), [HNoInputPreferred](#), [HState](#), [java.awt.image.ImageObserver](#), [java.awt.MenuContainer](#), [java.io.Serializable](#), [TestOpacity](#)

Description

The [HStaticIcon](#) is a user interface component used to display static graphical content which does *not* permit the user to navigate (focus) upon it. By default it uses the [HGraphicLook](#) to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
imageNormal	The image to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	setGraphicContent(Image, int)	getGraphicContent(int)

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
The default "look" for this class.	A platform specific <code>HGraphicLook</code>	<code>setDefaultLook(HGraphicLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HGraphicLook</code> returned from <code>HStaticIcon.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>

Constructors

HStaticIcon()

```
public HStaticIcon()
```

Creates an `HStaticIcon` object. See the class description for details of constructor parameters and default values.

HStaticIcon(Image)

```
public HStaticIcon(java.awt.Image imageNormal)
```

Creates an `HStaticIcon` object. See the class description for details of constructor parameters and default values.

HStaticIcon(Image, int, int, int, int)

```
public HStaticIcon(java.awt.Image imageNormal, int x, int y, int width, int height)
```

Creates an `HStaticIcon` object. See the class description for details of constructor parameters and default values.

Methods

getDefaultLook()

```
public static HGraphicLook getDefaultLook()
```

Returns the currently set default `HLook` for `HStaticIcon` components.

Returns:

The `HLook` that is used by default when creating a new `HStaticIcon` component.

setDefaultLook(HGraphicLook)

```
public static void setDefaultLook(HGraphicLook hlook)
```

Sets the default `HLook` for further `HStaticIcon` Components.

Parameters:

`hlook` - The `HLook` that will be used by default when creating a new `HStaticIcon` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setLook(HLook)

```
public void setLook(HLook hlook)
```

Sets the `HLook` for this component.

Overrides:

`setLook(HLook)` in class `HVisible`

Parameters:

`hlook` - The `HLook` that is to be used for this component. Note that this parameter may be null, in which case the component will not draw itself until a look is set.

Throws:

`HInvalidLookException` - If the `HLook` is not an `HGraphicLook`.

org.havi.ui HStaticRange

Syntax

public class HStaticRange extends HVisible implements HNoInputPreferred, HOrientable

```

java.lang.Object
|
+--java.awt.Component
    |
    +--HComponent
        |
        +--HVisible
            |
            +--org.havi.ui.HStaticRange
  
```

Direct Known Subclasses:

HRange

All Implemented Interfaces:

HMatteLayer, HNoInputPreferred, HOrientable, HState, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

The `HStaticRange` is a user interface component used to display a static value which is within a fixed range, but does *not* permit the user to navigate (focus) upon it. By default it uses the `HRangeLook` to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
orientation	The "orientation" of the range object.	ORIENT_LEFT_T O_RIGHT	setOrientation(int)	getOrientation()

minimum	The minimum value that can be returned by this range object.	0	<code>setRange(int, int)</code>	<code>getMinValue()</code>
maximum	The maximum value that can be returned by this range object.	100	<code>setRange(int, int)</code>	<code>getMaxValue()</code>
value	The current value returned by this range object.	0	<code>setValue(int)</code>	<code>getValue()</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
The default "look" for this class.	A platform specific <code>HRangeLook</code>	<code>setDefaultLook(HRangeLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HRangeLook</code> returned from <code>HStaticRange.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The offsets for the "thumb" of this range control	min = 0, max = 0	<code>setThumbOffsets(int, int)</code>	<code>getThumbMinOffset()</code> / <code>getThumbMaxOffset()</code>
The behavior of this range object with respect to its "thumb" values	<code>SLIDER_BEHAVIOR</code>	<code>setBehavior(int)</code>	<code>getBehavior()</code>

Fields

SCROLLBAR_BEHAVIOR

```
public static final int SCROLLBAR_BEHAVIOR
```

The `HStaticRange` should behave as a scrollbar, i.e. the allowable values that may be set / returned for the `HStaticRange` should be affected by the "thumb" offsets, and hence its value should be able to vary between `[minimum + minThumbOffset, maximum - maxThumbOffset]`.

SLIDER_BEHAVIOR

```
public static final int SLIDER_BEHAVIOR
```

The `HStaticRange` should behave as a slider, i.e. the allowable values that may be set / returned for the `HStaticRange` should not be affected by the "thumb" offsets, and hence its value should be able to vary between `[minimum, maximum]`.

Constructors

`HStaticRange()`

```
public HStaticRange()
```

Creates an `HStaticRange` object. See the class description for details of constructor parameters and default values.

`HStaticRange(int, int, int, int)`

```
public HStaticRange(int orientation, int minimum, int maximum, int value)
```

Creates an `HStaticRange` object. See the class description for details of constructor parameters and default values.

`HStaticRange(int, int, int, int, int, int, int, int)`

```
public HStaticRange(int orientation, int minimum, int maximum, int value, int x, int y,
                    int width, int height)
```

Creates an `HStaticRange` object. See the class description for details of constructor parameters and default values.

Methods

`getBehavior()`

```
public int getBehavior()
```

Returns the behavior for this `HStaticRange`.

Returns:

the behavior for this `HStaticRange` .

getDefaultLook()

```
public static HRangeLook getDefaultLook()
```

Returns the currently set default `HLook` for `HStaticRange` components.

Returns:

The `HLook` that is used by default when creating a new `HStaticRange` component.

getMaxValue()

```
public int getMaxValue()
```

Get the maximum value of the range

Returns:

The maximum value of the range.

getMinValue()

```
public int getMinValue()
```

Gets the minimum of the range.

Returns:

The minimum value for the range

getOrientation()

```
public int getOrientation()
```

Retrieve the orientation of the `HStaticRange` . The orientation controls how an associated `HLook` lays out the component and affects the visual behavior of the `HAdjustmentEvent` and `HItemEvent` events. For example, the system might use this information to select appropriate key mappings for these events.

Specified By:

`getOrientation()` in interface `HOrientable`

Returns:

one of `ORIENT_LEFT_TO_RIGHT` , `ORIENT_RIGHT_TO_LEFT` , `ORIENT_TOP_TO_BOTTOM` , or `ORIENT_BOTTOM_TO_TOP` .

getThumbMaxOffset()

```
public int getThumbMaxOffset()
```

Returns the thumb offset for its maximum value.

Returns:

the thumb offset for its maximum value.

getThumbMinOffset()

```
public int getThumbMinOffset()
```

Returns the thumb offset for its minimum value.

Returns:

the thumb offset for its minimum value.

getValue()

```
public int getValue()
```

Gets the value of the control. Note that the recovered value is subject to the control's current behavior.

See Also:

`SLIDER_BEHAVIOR`, `SCROLLBAR_BEHAVIOR`

setBehavior(int)

```
public void setBehavior(int behavior)
```

Sets the behavior for this `HStaticRange` .

Parameters:

`behavior` - the behavior for this `HStaticRange` (`SLIDER_BEHAVIOR` or `SCROLLBAR_BEHAVIOR`).

setDefaultLook(HRangeLook)

```
public static void setDefaultLook(HRangeLook look)
```

Sets the default `HLook` for further `HStaticRange` Components.

Parameters:

`look` - The `HLook` that will be used by default when creating a new `HStaticRange` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setLook(HLook)

```
public void setLook(HLook hlook)
```

Sets the `HLook` for this component.

Overrides:

`setLook(HLook)` in class `HVisible`

Parameters:

`hlook` - The `HLook` that is to be used for this component. Note that this parameter may be null, in which case the component will not draw itself until a look is set.

Throws:

`HInvalidLookException` - If the Look is not an `HRangeLook` .

setOrientation(int)

```
public void setOrientation(int orient)
```

Set the orientation of the `HStaticRange` . The orientation controls how the associated `HLook` lays out the component.

Specified By:

`setOrientation(int)` in interface `HOrientable`

Parameters:

`orient` - one of `ORIENT_LEFT_TO_RIGHT` , `ORIENT_RIGHT_TO_LEFT` , `ORIENT_TOP_TO_BOTTOM` , or `ORIENT_BOTTOM_TO_TOP` .

setRange(int, int)

```
public boolean setRange(int minimum, int maximum)
```

Sets the range of values for the control.

Parameters:

`minimum` - The minimum value of the range control

`maximum` - The maximum value of the range control

Returns:

Indicates if the min and max values have been set correctly. Returns false if the minimum value is greater than or equal to the maximum value, otherwise returns true

setThumbOffsets(int, int)

```
public void setThumbOffsets(int minOffset, int maxOffset)
```

Set the offsets for the "thumb" area on this range control. The "thumb" is then drawn from (value - minOffset), to (value + maxOffset) positions outside of the HRange values [minimum:maximum] are clipped to the closest value.

There is no requirement that minOffset == maxOffset. For example, both offsets may be zero, yielding a thermometer-like range object. All measurements are in the same units as the minimum / maximum values on the `HStaticRange` object. The size of the "thumb" is the application author's responsibility. By default the "thumb" does not affect the range over which the value of the `HStaticRange` may be modified. It is recommended that the `HRangeLook` provides mechanisms to denote the value of the `HStaticRange`, in addition to indicating the extent of the thumb as defined by the offsets.

See Also:

`setBehavior(int)`

setValue(int)

```
public void setValue(int value)
```

Sets the value of the control, subject to its current behavior.

Parameters:

`value` - the value to which the control should be set.

See Also:

`SLIDER_BEHAVIOR`, `SCROLLBAR_BEHAVIOR`

org.havi.ui

HStaticText

Syntax

```
public class HStaticText extends HVisible implements HNoInputPreferred
```

```
java.lang.Object
|
+--java.awt.Component
|   |
|   +--HComponent
|       |
|       +--HVisible
|           |
|           +--org.havi.ui.HStaticText
```

Direct Known Subclasses:

`HText`

All Implemented Interfaces:

`HMatteLayer`, `HNoInputPreferred`, `HState`, `java.awt.image.ImageObserver`, `java.awt.MenuContainer`, `java.io.Serializable`, `TestOpacity`

Description

The `HStaticText` is a user interface component used to display static read-only textual content which does *not* permit the user to navigate (focus) upon it. By default it uses the `HTextLook` to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
height	height of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>

text-Normal	The string to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	<code>setTextContent (String, int)</code>	<code>getTextContent (int)</code>
tlm	The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager (HTextLayoutManager)</code>	<code>getTextLayoutManager ()</code>
font	The font for this component.	---	<code>java.awt.Component#setFont</code>	<code>java.awt.Component#getFont</code>
background	The background color for this component.	---	<code>java.awt.Component#getBackground</code>	<code>java.awt.Component#setBackground</code>
foreground	The foreground color for this component.	---	<code>java.awt.Component#getForeground</code>	<code>java.awt.Component#setForeground</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte (HMatte)</code>	<code>getMatte ()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager (HTextLayoutManager)</code>	<code>getTextLayoutManager ()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode (int)</code>	<code>setBackgroundMode ()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize (Dimension)</code>	<code>getDefaultSize ()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment (int)</code>	<code>getHorizontalAlignment ()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment (int)</code>	<code>getVerticalAlignment ()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode (int)</code>	<code>getResizeMode ()</code>
The default "look" for this class.	A platform specific <code>HTextLook</code>	<code>setDefaultLook (HTextLook)</code>	<code>getDefaultLook ()</code>

The "look" for this object.

The `HTextLook` returned from `setLook(HLook)` `getLook()`
`HStaticText.getDefaultLook`
 when this object was created.

See Also:

`HDefaultTextLayoutManager`, `HTextLayoutManager`

Constructors

HStaticText()

```
public HStaticText()
```

Creates an `HStaticText` object. See the class description for details of constructor parameters and default values.

HStaticText(String)

```
public HStaticText(java.lang.String textNormal)
```

Creates an `HStaticText` object. See the class description for details of constructor parameters and default values.

HStaticText(String, Font, Color, Color, HTextLayoutManager)

```
public HStaticText(java.lang.String textNormal, java.awt.Font font,
    java.awt.Color foreground, java.awt.Color background, HTextLayoutManager tlm)
```

Creates an `HStaticText` object. See the class description for details of constructor parameters and default values.

HStaticText(String, int, int, int, int)

```
public HStaticText(java.lang.String textNormal, int x, int y, int width, int height)
```

Creates an `HStaticText` object. See the class description for details of constructor parameters and default values.

HStaticText(String, int, int, int, int, Font, Color, Color, HTextLayoutManager)

```
public HStaticText(java.lang.String textNormal, int x, int y, int width, int height,
    java.awt.Font font, java.awt.Color foreground, java.awt.Color background,
    HTextLayoutManager tlm)
```

Creates an `HStaticText` object. See the class description for details of constructor parameters and default values.

Methods

getDefaultLook()

```
public static HTextLook getDefaultLook()
```

Returns the currently set default `HLook` for `HStaticText` components.

Returns:

The `HLook` that is used by default when creating a new `HStaticText` component.

setDefaultLook(HTextLook)

```
public static void setDefaultLook(HTextLook hlook)
```

Sets the default `HLook` for further `HStaticText` Components.

Parameters:

`hlook` - The `HLook` that will be used by default when creating a new `HStaticText` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setLook(HLook)

```
public void setLook(HLook hlook)
```

Sets the `HLook` for this component.

Overrides:

`setLook(HLook)` in class `HVisible`

Parameters:

`hlook` - The `HLook` that is to be used for this component. Note that this parameter may be null, in which case the component will not draw itself until a look is set.

Throws:

`HInvalidLookException` - if the Look is not an `HTextLook`.

org.havi.ui HStillImageBackgroundConfiguration

Syntax

```
public class HStillImageBackgroundConfiguration extends HBackgroundConfiguration
```

```
java.lang.Object
|
+--HScreenConfiguration
    |
    +--HBackgroundConfiguration
        |
        +--org.havi.ui.HStillImageBackgroundConfiguration
```

Description

This class represents a background configuration which supports the installation of still images. The platform using the HAVi user-interface specification must specify which image formats are supported. The `java.awt.Image` class is intentionally not used in order to allow the support of image formats which carry sufficient restrictions that expressing them through the API of that class would require extensive use of runtime errors. One specific example of this is MPEG I-frames. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HStillImageBackgroundConfiguration()

```
protected HStillImageBackgroundConfiguration()
```

It is not intended that applications should directly construct `HStillImageBackgroundConfiguration` objects.

Creates an `HStillImageBackgroundConfiguration` object. See the class description for details of constructor parameters and default values.

Methods

displayImage(HBackgroundImage)

```
public void displayImage(HBackgroundImage image)
```

Display an image. If the data for the image has not been loaded then this method will block while the data is loaded. It is platform dependent whether this image is scaled to fit or whether it is cropped (where too large) or repeated (where too small). The position of the image is platform-dependent. If the platform does not scale the image to fit, the previous color set using `setColor(Color)` is shown in the areas where no image is displayed. If no color has been set what is shown in this area is platform dependent. What is displayed while the image is loading is implementation specific.

Note that the image may be removed by calling the `setColor(Color)` method.

If the `image` parameter is null a `java.lang.NullPointerException` is thrown.

Parameters:

`image` - the image to display.

Throws:

`java.io.IOException` - if the data for the `HBackgroundImage` is not loaded and loading the data is impossible or fails.

`java.lang.IllegalArgumentException` - if the `HBackgroundImage` does not contain an image in a supported image encoding format

`HPermissionDeniedException` - if the `HBackgroundDevice` concerned is not reserved.

`HConfigurationException` - if the `HStillImageBackgroundConfiguration` is not the currently set configuration for its `HBackgroundDevice`.

displayImage(HBackgroundImage, HScreenRectangle)

```
public void displayImage(HBackgroundImage image, HScreenRectangle r)
```

Display an image to cover a particular area of the screen. If the data for the image has not been loaded then this method will block while the data is loaded. It is platform dependent whether this image is scaled to fit or whether it is cropped (where too large) or repeated (where too small). The position of the image within the rectangle is platform-dependent. If the platform does not scale the image to fit, or the rectangle does not cover the entire display area, the previous color set using `setColor(Color)` is shown in the areas where no image is displayed. If no color has been set what is shown in this area is platform dependent.

Note that the image may be removed by calling the `setColor(Color)` method.

If either or both parameters are null a `java.lang.NullPointerException` is thrown.

Parameters:

`image` - the image to display

`r` - the area of the screen to cover with the image

Throws:

`java.io.IOException` - if the data for the `HBackgroundImage` is not loaded and loading the data is impossible or fails.

`java.lang.IllegalArgumentException` - if the `HBackgroundImage` does not contain an image in a supported image encoding format

`HPermissionDeniedException` - if the `HBackgroundDevice` concerned is not reserved.

`HConfigurationException` - if the `HStillImageBackgroundConfiguration` is not the currently set configuration for its `HBackgroundDevice`.

setColor(Color)

```
public void setColor(java.awt.Color color)
```

Set the current color of this background. On platforms where there is a sub-class of `java.awt.Color` supporting transparency of any kind, passing an object representing a non-opaque color is illegal. Platforms with a limited color resolution for backgrounds may approximate this value to the nearest available. The `getColor()` method will return the actual value used.

Note that calling this method will clear any image currently displayed by the `HBackgroundDevice`.

Overrides:

```
setColor(Color) in class HBackgroundConfiguration
```

Parameters:

`color` - the color to be used for the background

Throws:

`HPermissionDeniedException` - if this `HBackgroundDevice` does not have the right to control the background

`HConfigurationException` - if the color specified is illegal for this platform.

org.havi.ui

HSwitchable

Syntax

```
public interface HSwitchable extends HActionable
```

All Superinterfaces:

```
HActionable, HActionInputPreferred, HNavigable, HNavigationInputPreferred
```

All Known Implementing Classes:

```
HToggleButton
```

Description

This interface is implemented for all user interface components that can be actioned such that they "toggle" on and off and maintain the chosen state.

Event Behavior

Subclasses of `HComponent` which implement `HSwitchable` must respond to `HFocusEvent` and `HActionEvent` events.

Applications should assume that classes which implement `HSwitchable` can generate events of the types `HFocusEvent` and `HActionEvent` in response to other types of input event.

An application may add one or more `HActionListener` listeners to the component. The `actionPerformed` method of the `HActionListener` is invoked whenever the `HSwitchable` is actioned.

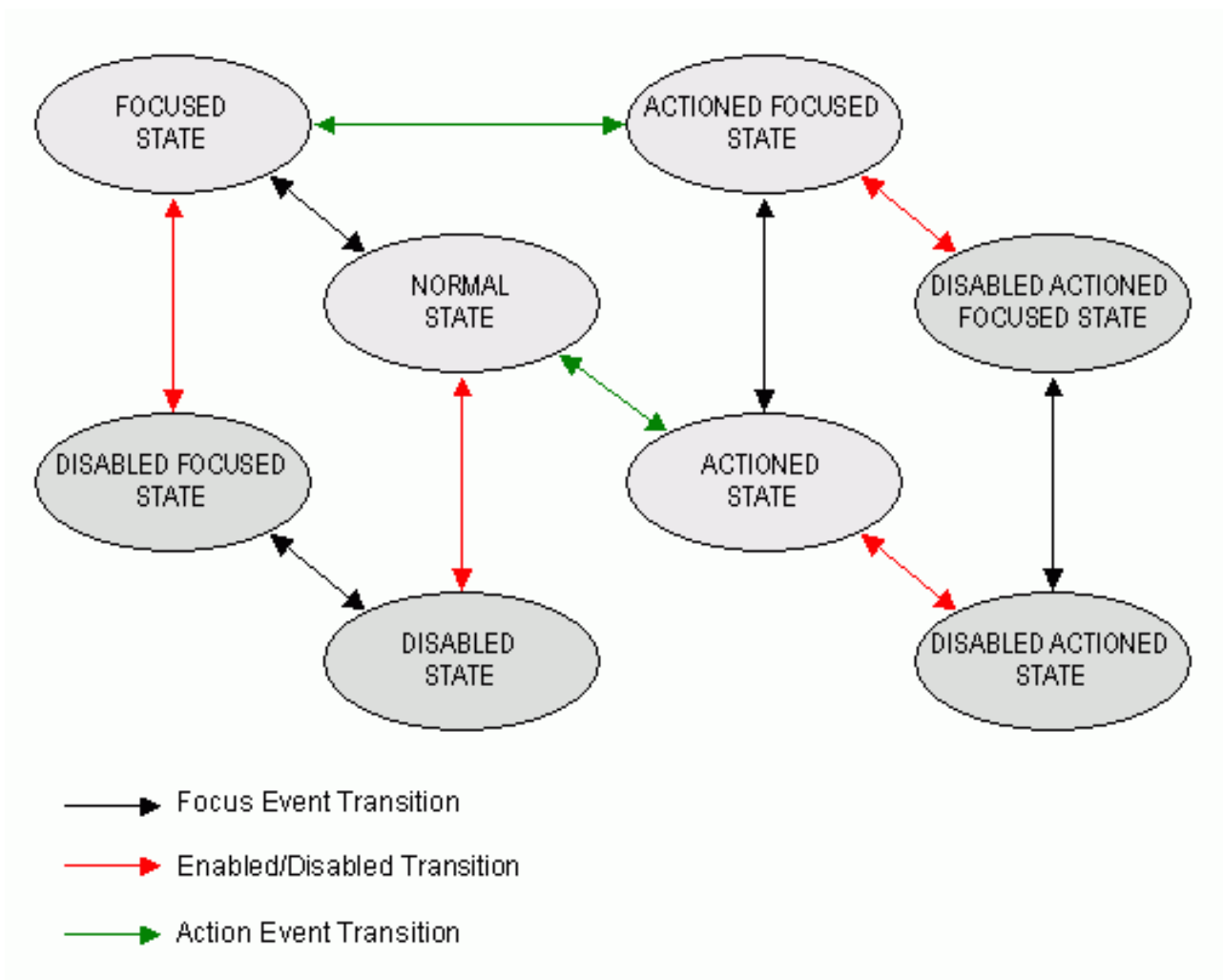
HAVi action events are discussed in detail in the `HActionInputPreferred` interface description.

Interaction States

The following interaction states are valid for this `HSwitchable` component:

- `NORMAL_STATE`
- `FOCUSED_STATE`
- `ACTIONED_STATE`
- `ACTIONED_FOCUSED_STATE`
- `DISABLED_STATE`
- `DISABLED_FOCUSED_STATE`
- `DISABLED_ACTIONED_STATE`
- `DISABLED_ACTIONED_FOCUSED_STATE`

The state machine diagram below shows the valid state transitions for an `HSwitchable` component.



Unlike `HActionable` components there are no automatic transitions to other states. Actioned states (i.e. those with the `ACTIONED_STATE_BIT` bit set) may persist after any registered `HActionListener` listeners have been called, until a further `HActionEvent` is received.

Platform Classes

The following HAVi platform classes implement or inherit the `HSwitchable` interface. These classes shall all generate both `HFocusEvent` and `HActionEvent` events in addition to any other events specified in the respective class descriptions.

- `HToggleButton`

See Also:

`HNavigable`, `HActionable`, `HActionInputPreferred`, `HActionEvent`, `HActionListener`

Methods

getSwitchableState()

```
public boolean getSwitchableState()
```

Returns the current switchable state of this `HSwitchable`.

Returns:

the current switchable state of this `HSwitchable`.

getUnsetActionSound()

```
public HSound getUnsetActionSound()
```

Get the sound to be played when the interaction state of the `HSwitchable` makes the following transitions:

- `ACTIONED_STATE` to `NORMAL_STATE`
- `ACTIONED_FOCUSED_STATE` to `FOCUSED_STATE`

Returns:

the sound to be played when the `HSwitchable` transitions from an actioned state.

setSwitchableState(boolean)

```
public void setSwitchableState(boolean state)
```

Sets the current state of the button. Note that `ActionListeners` are only called when an `ACTION_PERFORMED` event is received, or if they are called directly, e.g. via `processActionEvent`, they are not called by `setSwitchableState(boolean)`.

setUnsetActionSound(HSound)

```
public void setUnsetActionSound(HSound sound)
```

Associate a sound to be played when the interaction state of the `HSwitchable` makes the following transitions:

- `ACTIONED_STATE` to `NORMAL_STATE`
- `ACTIONED_FOCUSED_STATE` to `FOCUSED_STATE`

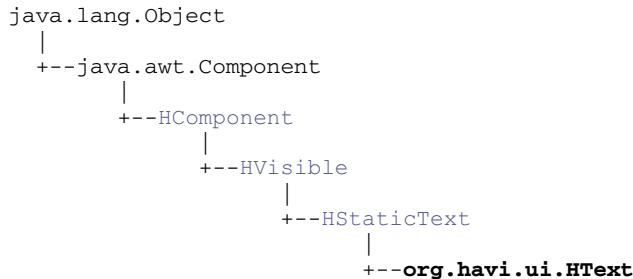
Parameters:

`sound` - a sound to be played when the `HSwitchable` transitions from an actioned state. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

org.havi.ui HText

Syntax

public class HText extends HStaticText implements HNavigable



Direct Known Subclasses:

HTextButton

All Implemented Interfaces:

HMatteLayer, HNavigable, HNavigationInputPreferred, HNoInputPreferred, HState, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

The `HText` is a user interface component used to display static read-only textual content (as `HStaticText`) which additionally enables a user to navigate to it, i.e. it can have the input focus. By default it uses the `HTextLook` to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
width	width of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds

text	The text to be used as the content for every permissible state of this component.	null	setTextContent (String, int)	getTextContent (int)
text-Normal	The string to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	setTextContent (String, int)	getTextContent (int)
text-Focus	The string to be used as the content for the focused state of this component.	null	setTextContent (String, int)	getTextContent (int)
tlm	The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	setTextLayoutManager (HTextLayoutManager)	getTextLayoutManager ()
font	The font for this component.	---	java.awt.Component#setFont	java.awt.Component#getFont
background	The background color for this component.	---	java.awt.Component#getBackground	java.awt.Component#setBackground
foreground	The foreground color for this component.	---	java.awt.Component#getForeground	java.awt.Component#setForeground

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte (HMatte)</code>	<code>getMatte ()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager (HTextLayoutManager)</code>	<code>getTextLayoutManager ()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode (int)</code>	<code>getBackgroundMode ()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize (Dimension)</code>	<code>getDefaultSize ()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment (int)</code>	<code>getHorizontalAlignment ()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment (int)</code>	<code>getVerticalAlignment ()</code>

The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>
The default "look" for this class.	A platform specific <code>HTextLook</code>	<code>setDefaultLook(HTextLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HTextLook</code> returned from <code>HText.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The gain focus sound.	<code>null</code>	<code>setGainFocusSound(HSound)</code>	<code>getGainFocusSound()</code>
The lose focus sound.	<code>null</code>	<code>setLoseFocusSound(HSound)</code>	<code>getLoseFocusSound()</code>

See Also:

`HStaticText`, `HDefaultTextLayoutManager`, `HTextLayoutManager`, `HNavigable`

Constructors

HText()

```
public HText()
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

HText(String)

```
public HText(java.lang.String text)
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

HText(String, Font, Color, Color, HTextLayoutManager)

```
public HText(java.lang.String text, java.awt.Font font, java.awt.Color foreground,
             java.awt.Color background, HTextLayoutManager tlm)
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

HText(String, int, int, int, int)

```
public HText(java.lang.String text, int x, int y, int width, int height)
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

HText(String, int, int, int, int, Font, Color, Color, HTextLayoutManager)

```
public HText(java.lang.String text, int x, int y, int width, int height,  
             java.awt.Font font, java.awt.Color foreground, java.awt.Color background,  
             HTextLayoutManager tlm)
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

HText(String, String)

```
public HText(java.lang.String textNormal, java.lang.String textFocus)
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

HText(String, String, Font, Color, Color, HTextLayoutManager)

```
public HText(java.lang.String textNormal, java.lang.String textFocus, java.awt.Font font,  
             java.awt.Color foreground, java.awt.Color background, HTextLayoutManager tlm)
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

HText(String, String, int, int, int, int)

```
public HText(java.lang.String textNormal, java.lang.String textFocus, int x, int y,  
             int width, int height)
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

HText(String, String, int, int, int, int, Font, Color, Color, HTextLayoutManager)

```
public HText(java.lang.String textNormal, java.lang.String textFocus, int x, int y,  
             int width, int height, java.awt.Font font, java.awt.Color foreground,  
             java.awt.Color background, HTextLayoutManager tlm)
```

Creates an `HText` object. See the class description for details of constructor parameters and default values.

Methods

getDefaultLook()

```
public static HTextLook getDefaultLook()
```

Returns the currently set default `HLook` for `HText` components.

Returns:

The `HLook` that is used by default when creating a new `HText` component.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

`getGainFocusSound()` in interface `HNavigable`

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

`getLoseFocusSound()` in interface `HNavigable`

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

`getMove(int)` in interface `HNavigable`

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns null.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

`getNavigationKeys()` in interface `HNavigationInputPreferred`

Returns:

an array of key codes, or null if no navigation targets are set on this component.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

`isSelected()` in interface `HNavigable`

Returns:

true if the component has focus, otherwise returns false.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HText`.

Specified By:

```
processHFocusEvent(HFocusEvent) in interface HNavigationInputPreferred
```

Parameters:

`evt` - the `HFocusEvent` to process.

setDefaultLook(HTextLook)

```
public static void setDefaultLook(HTextLook look)
```

Sets the default `HLook` for further `HText` Components.

Parameters:

`look` - The `HLook` that will be used by default when creating a new `HText` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
                             HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

```
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) in
interface HNavigable
```

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` KeyEvent. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` KeyEvent. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` KeyEvent. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` KeyEvent. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setGainFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Parameters:

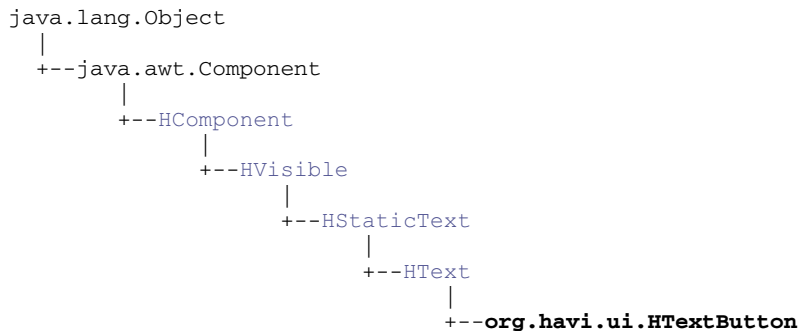
`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

org.havi.ui HTextButton

Syntax

```
public class HTextButton extends HText implements HActionable
```



All Implemented Interfaces:

`HActionable`, `HActionInputPreferred`, `HMatteLayer`, `HNavigable`,
`HNavigationInputPreferred`, `HNoInputPreferred`, `HState`,
`java.awt.image.ImageObserver`, `java.awt.MenuContainer`, `java.io.Serializable`, `TestOpacity`

Description

The `HTextButton` is a user interface component representing a push-button with static read-only textual content. This component can be navigated to, i.e. it can have the input focus, and it can also be actioned as defined by the `HActionable` interface. By default it uses the `HTextLook` class to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>

height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
text	The text to be used as the content for every permissible state of this component.	null	setTextContent (String, int)	getTextContent (int)
text-Normal	The string to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	setTextContent (String, int)	getTextContent (int)
text-Focus	The string to be used as the content for the focused state of this component.	null	setTextContent (String, int)	getTextContent (int)
text-Action	The string to be used as the content for the actioned states of this component.	null	setTextContent (String, int)	getTextContent (int)
tlm	The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	setTextLayoutManager (HTextLayoutManager)	getTextLayoutManager ()
font	The font for this component.	---	java.awt.Component#setFont	java.awt.Component#getFont
background	The background color for this component.	---	java.awt.Component#getBackground	java.awt.Component#setBackground
foreground	The foreground color for this component.	---	java.awt.Component#getForeground	java.awt.Component#setForeground

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte (HMatte)</code>	<code>getMatte ()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager (HTextLayoutManager)</code>	<code>getTextLayoutManager ()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode (int)</code>	<code>setBackgroundMode ()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize (Dimension)</code>	<code>getDefaultSize ()</code>

The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAl ignment(int)</code>	<code>getHorizontalAl ignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlig nment(int)</code>	<code>getVerticalAlig nment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(i nt)</code>	<code>getResizeMode()</code>
The default "look" for this class.	A platform specific <code>HTextLook</code>	<code>setDefaultLook(HTextLook)</code>	<code>getDefaultLook()</code>
The "look" for this object.	The <code>HTextLook</code> returned from <code>HTextButton.getDefaultLook</code> when this object was created.	<code>setLook(HLook)</code>	<code>getLook()</code>
The gain focus sound.	<code>null</code>	<code>setGainFocusSou nd(HSound)</code>	<code>getGainFocusSou nd()</code>
The lose focus sound.	<code>null</code>	<code>setLoseFocusSou nd(HSound)</code>	<code>getLoseFocusSou nd()</code>
The action sound.	<code>null</code>	<code>setActionSound(HSound)</code>	<code>getActionSound()</code>

See Also:

`HStaticText`, `HText`, `HDefaultTextLayoutManager`, `HTextLayoutManager`, `HNavigable`, `HActionable`

Constructors

HTextButton()

```
public HTextButton()
```

Creates an `HTextButton` object. See the class description for details of constructor parameters and default values.

HTextButton(String)

```
public HTextButton(java.lang.String text)
```

Creates an `HTextButton` object. See the class description for details of constructor parameters and default values.

HTextButton(String, Font, Color, Color, HTextLayoutManager)

```
public HTextButton(java.lang.String text, java.awt.Font font, java.awt.Color foreground,  
java.awt.Color background, HTextLayoutManager tlm)
```


Creates an `HTextButton` object. See the class description for details of constructor parameters and default values.

HTextButton(String, int, int, int, int)

```
public HTextButton(java.lang.String text, int x, int y, int width, int height)
```

Creates an `HTextButton` object. See the class description for details of constructor parameters and default values.

HTextButton(String, int, int, int, int, Font, Color, Color, HTextLayoutManager)

```
public HTextButton(java.lang.String text, int x, int y, int width, int height,
    java.awt.Font font, java.awt.Color foreground, java.awt.Color background,
    HTextLayoutManager tlm)
```

Creates an `HTextButton` object. See the class description for details of constructor parameters and default values.

Methods

addActionListener(HActionListener)

```
public void addActionListener(HActionListener l)
```

Adds the specified `HActionListener` to receive `HActionEvent` events sent from this `HTextButton`. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Specified By:

`addActionListener(HActionListener)` in interface `HActionable`

Parameters:

l - the `HActionListener`.

getActionCommand()

```
public java.lang.String getActionCommand()
```

Gets the command name for the `HActionEvent` event fired by this `HTextButton`.

Specified By:

`getActionCommand()` in interface `HActionable`

Returns:

A `String` representing the command name of the `HActionEvent` fired by this `HTextButton`.

See Also:

`getActionCommand()`

getActionSound()

```
public HSound getActionSound()
```

Associate a sound to be played when the interaction state of the `HTextButton` makes the following transitions:

- `_NORMAL_STATE` to `_ACTIONED_STATE`
- `_FOCUSED_STATE` to `_ACTIONED_FOCUSED_STATE`

Specified By:

`getActionSound()` in interface `HActionable`

Returns:

The sound played when the component is actioned.

getDefaultLook()

```
public static HTextLook getDefaultLook()
```

Returns the currently set default `HLook` for `HTextButton` components.

Returns:

The `HLook` that is used by default when creating a new `HTextButton`.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

`getGainFocusSound()` in interface `HNavigable`

Overrides:

`getGainFocusSound()` in class `HText`

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

`getLoseFocusSound()` in interface `HNavigable`

Overrides:

`getLoseFocusSound()` in class `HText`

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

`getMove(int)` in interface `HNavigable`

Overrides:

`getMove(int)` in class `HText`

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns `null`.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

```
getNavigationKeys() in interface HNavigationInputPreferred
```

Overrides:

```
getNavigationKeys() in class HText
```

Returns:

an array of key codes, or `null` if no navigation targets are set on this component.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

```
isSelected() in interface HNavigable
```

Overrides:

```
isSelected() in class HText
```

Returns:

`true` if the component has focus, otherwise returns `false`.

processHActionEvent(HActionEvent)

```
public void processHActionEvent(HActionEvent evt)
```

Process an `HActionEvent` sent to this `HTextButton`.

Specified By:

```
processHActionEvent(HActionEvent) in interface HActionInputPreferred
```

Parameters:

`evt` - the `HActionEvent` to process.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HTextButton`.

Specified By:

```
processHFocusEvent(HFocusEvent) in interface HNavigationInputPreferred
```

Overrides:

```
processHFocusEvent(HFocusEvent) in class HText
```

Parameters:

`evt` - the `HFocusEvent` to process.

removeHActionListener(HActionListener)

```
public void removeHActionListener(HActionListener l)
```

Removes the specified `HActionListener` so that it no longer receives `HActionEvent` events from this `HTextButton`. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Specified By:

`removeHActionListener(HActionListener)` in interface `HActionable`

Parameters:

l - the `HActionListener`.

setActionCommand(String)

```
public void setActionCommand(java.lang.String command)
```

Sets the command name for the `HActionEvent` event fired by this `HTextButton`.

Specified By:

`setActionCommand(String)` in interface `HActionable`

Parameters:

command - a `String` used to set the action command.

See Also:

`getActionCommand()`

setActionSound(HSound)

```
public void setActionSound(HSound sound)
```

Associate a sound to be played when the interaction state of the `HTextButton` makes the following transitions:

- `_NORMAL_STATE` to `_ACTIONED_STATE`
- `_FOCUSED_STATE` to `_ACTIONED_FOCUSED_STATE`

Specified By:

`setActionSound(HSound)` in interface `HActionable`

Parameters:

sound - the sound to be played, when the component is actioned. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setDefaultLook(HTextLook)

```
public static void setDefaultLook(HTextLook hlook)
```

Sets the default `HLook` for further `HTextButton` components.

Parameters:

hlook - The `HLook` that will be used by default when creating a new `HTextButton`. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
    HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in interface `HNavigable`

Overrides:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in class `HText`

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` KeyEvent. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` KeyEvent. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` KeyEvent. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` KeyEvent. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setGainFocusSound(HSound)` in interface `HNavigable`

Overrides:

`setGainFocusSound(HSound)` in class `HText`

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Overrides:

`setLoseFocusSound(HSound)` in class `HText`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Overrides:

`setMove(int, HNavigable)` in class `HText`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

org.havi.ui HTextLayoutManager

Syntax

```
public interface HTextLayoutManager
```

All Known Implementing Classes:

```
DVBTextLayoutManager, HDefaultTextLayoutManager
```

Description

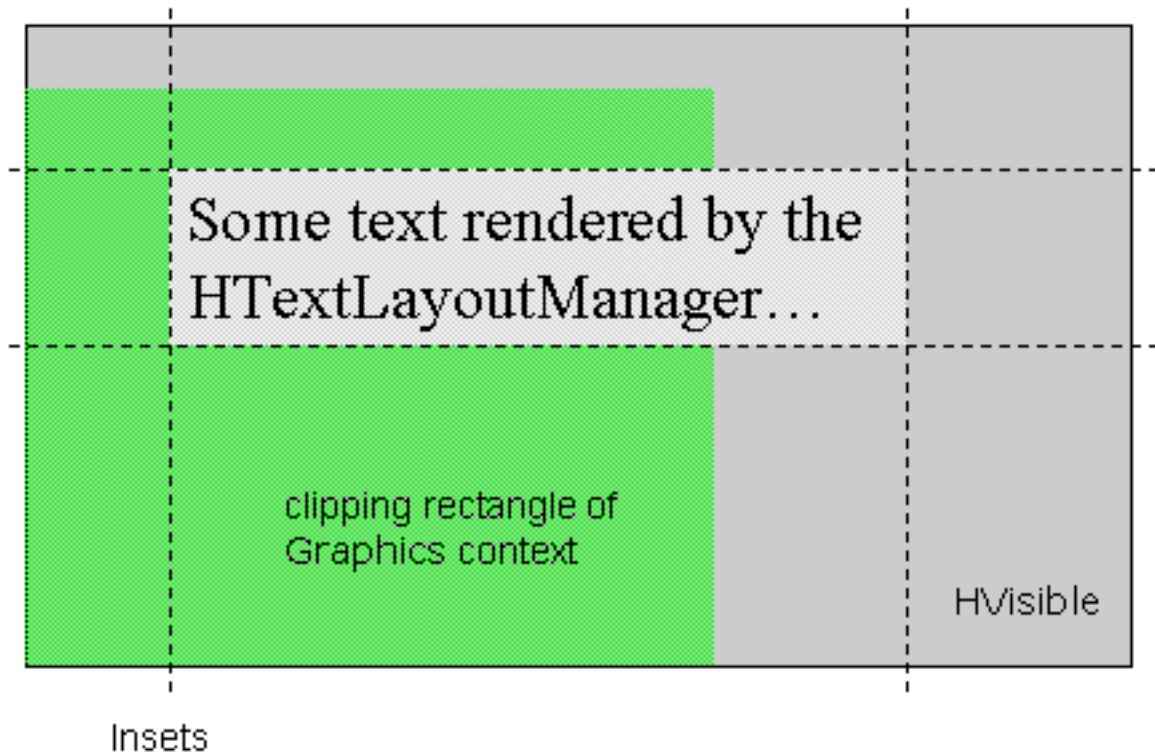
The `HTextLayoutManager` class manages the layout and rendering on-screen of a "marked-up" string.

Possible implementations of `HTextLayoutManager` could enable the following behaviors:

- Interpreting basic markup, such as changing color or font, and forced line breaks.
- Providing text alignment, as in the `HDefaultTextLayoutManager`.
- Providing text wrapping policies, such as word-wrap.
- Providing text orientations, such as right-to-left, or top-to-bottom rendering.
- Providing specialized support for missing characters, or fonts.
- Providing specific language support.
- Additional text styles, such as drop capitals or "shadow" characters.

`HTextLayoutManager` supports passing a `java.awt.Insets` object as argument to the `render(String, Graphics, HVisible, Insets)` method to restrict the area in which text may be rendered. If the insets are zero, the text is rendered into the area defined by the bounds of the `HVisible` passed to the `render(String, Graphics, HVisible, Insets)` method.

The clipping rectangle of the `Graphics` object passed to the `render(String, Graphics, HVisible, Insets)` method is *not* used to determine the area in which text is rendered, as its size and position is not guaranteed to cover the entire `HVisible` - for example, when partial repainting of an `HVisible` is performed. The diagram below shows a possible scenario:



The gray area shows the bounds of the `HVisible`. The green area shows the clipping rectangle of the `Graphics` context, and the dashed lines show the insets passed to the `render(String, Graphics, HVisible, Insets)` method. The text is laid out into the rectangle defined by the `HVisible` bounds after subtracting the insets. However, only the part of the text covered by the clipping rectangle is actually drawn to the screen, as shown in the diagram below:



The behavior of the render method when the text to be rendered does not fit in the current area specified is implementation-specific.

See Also:

`HDefaultTextLayoutManager`

Methods

render(String, Graphics, HVisible, Insets)

```
public void render(java.lang.String markedUpString, java.awt.Graphics g, HVisible v,
                  java.awt.Insets insets)
```

Render the string. The `HTextLayoutManager` should use the passed `HVisible` object to determine any additional information required to render the string, e.g. `Font`, `Color` etc.

The text should be laid out in the layout area, which is defined by the bounds of the specified `HVisible`, after subtracting the insets. If the insets are `null` the full bounding rectangle is used as the area to render text into.

The `HTextLayoutManager` should not modify the clipping rectangle of the `Graphics` object.

Parameters:

`markedUpString` - the string to render.

`g` - the graphics context, including a clipping rectangle which encapsulates the area within which rendering is permitted. If a valid insets value is passed to this method then text must only be rendered into the bounds of the widget after the insets are subtracted. If the insets value is `null` then text is rendered into the entire bounding area of the `HVisible`. It is implementation specific whether or not the renderer takes into account the intersection of the clipping rectangle in each case for optimization purposes.

`v` - the `HVisible` into which to render.

`insets` - the insets to determine the area in which to layout the text, or `null`.

org.havi.ui

HTextLook

Syntax

```
public class HTextLook implements HLook
```

```
java.lang.Object
|
+--org.havi.ui.HTextLook
```

All Implemented Interfaces:

```
java.lang.Cloneable, HLook
```

Description

The `HTextLook` class is used by any `HVisible` component to display static text content. This look will be provided by the platform and the exact way in which it is rendered will be platform dependant.

The `HTextLook` class draws the content set on an `HVisible`. It uses the `getTextContent(int)` [getTextContent\(int\)](#)

In addition to the basic class behavior defined by the `HLook` interface the `HTextLook` associated with a given `HVisible` should use:

- `HVisible.getTextLayoutManager()` to determine the `HTextLayoutManager` to perform the rendering. If the returned object is null, then the text should not be rendered.

Implementations of `HTextLook` need not use the alignment mode methods on `HVisible`, since all rendering of content is deferred to the associated `HTextLayoutManager` which will use these methods accordingly.

This is the default look that is used by `HListElement`, `HStaticText` and their subclasses. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

```
HStaticText, HDefaultTextLayoutManager
```

Constructors

HTextLook()

```
public HTextLook()
```

Creates a `HTextLook` object. See the class description for details of constructor parameters and default values.

Methods

getInsets(HVisible)

```
public java.awt.Insets getInsets(HVisible visible)
```

Determines the insets of this `HLook`, which indicate the size of the border. This area is reserved for the `HLook` to use for drawing borders around the associated `HVisible`.

Specified By:

`getInsets(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

the insets of this `HLook`.

getMaximumSize(HVisible)

```
public java.awt.Dimension getMaximumSize(HVisible hvisible)
```

Gets the maximum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) then the return value is the current size of the `HVisible` (as returned by `HVisible#getSize`).
2. If the `HLook` does not support scaling of content or no scaling is requested, and content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If there is no content set then a maximum size of `[Short.MAX_VALUE, Short.MAX_VALUE]` is returned as a `Dimension`.

Specified By:

`getMaximumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` maximum size.

See Also:

`getMaximumSize()`

getMinimumSize(HVisible)

```
public java.awt.Dimension getMinimumSize(HVisible hvisible)
```

Gets the minimum size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If the `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the return value is the size of the smallest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If the `HLook` does not support scaling of content or no scaling is requested, *and* content is set then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If no content is available but a default preferred size has been set using `setDefaultSize(Dimension)` has been called to set then the return value is this value (as obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
4. If there is no content or default size set then the return value is an implementation-specific minimum size plus any additional dimensions that the `HLook` requires for border decoration etc.

Specified By:

`getMinimumSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating this `HLook` minimum size.

See Also:

`getMinimumSize()`

getPreferredSize(HVisible)

```
public java.awt.Dimension getPreferredSize(HVisible hvisible)
```

Gets the preferred size of the `HVisible` component when drawn with this `HLook`.

This size may be determined in several ways depending on the information available to the look. These steps are performed in order and the first available result is returned. For the purposes of this algorithm `HLook` classes that do not use content (e.g. `HRangeLook`) are treated as if no content was present.

The extra space required for border decoration can be determined from the `getInsets(HVisible)` method.

1. If a default preferred size has been set for this `HVisible` (using `setDefaultSize(Dimension)`) then the return value is this size (obtained with `getDefaultSize()`) plus any additional dimensions that the `HLook` requires for border decoration etc.
2. If this `HLook` does not support scaling of content or no scaling is requested, and content is present then the return value is the size of the largest piece of content plus any additional dimensions that the `HLook` requires for border decoration etc.
3. If this `HLook` supports the scaling of its content (e.g. an `HGraphicLook`) and content is set then the

return value is the current size of the `HVisible` as returned by `getSize`).

4. If there is no content and no default size set then the return value is the current size of the `HVisible` as returned by `getSize`).

Specified By:

`getPreferredSize(HVisible)` in interface `HLook`

Parameters:

`hvisible` - `HVisible` to which this `HLook` is attached.

Returns:

A dimension object indicating the preferred size of the `HVisible` when drawn with this `HLook` .

See Also:

`getPreferredSize()` , `setDefaultSize(Dimension)`

isOpaque(HVisible)

```
public boolean isOpaque(HVisible visible)
```

Returns true if the entire painted area of the `HVisible` when using this look is fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`.

The default value is implementation specific and depends on the background painting mode of the given `HVisible` . The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque(HVisible)` in interface `HLook`

Parameters:

`visible` - the visible to test

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method of an `HVisible` using this look are fully opaque, i.e. the `showLook(Graphics, HVisible, int)` method guarantees that all pixels are painted in an opaque `Color`, otherwise false.

showLook(Graphics, HVisible, int)

```
public void showLook(java.awt.Graphics g, HVisible visible, int state)
```

The `showLook(Graphics, HVisible, int)` method is responsible for repainting the entire `HVisible` component, (including any content set on the component, and the component background), subject to the `clipRect` of the `Graphics` object passed to it.

The `showLook(Graphics, HVisible, int)` method should not modify the `clipRect` of the `Graphics` object that is passed to it.

For looks which draw content (e.g. `HTextLook` , `HGraphicLook` and `HAnimateLook`), if no content is associated with the component, the `showLook(Graphics, HVisible, int)` method paints the component with its current background `Color` according to the `setBackgroundMode(int)` method of `HVisible` and draws any (implementation-specific) borders. Note that by default the background mode is set so as to **not** paint a background. Furthermore on platforms which support transparent colors the background `Color` may be partially or completely transparent.

Any resources **explicitly** associated with an `HLook` should be loaded by the `HLook` during its creation, etc., or via its `setXXX()` methods. Note that the "standard" looks don't load content by default.

This method is called from the `paint(Graphics)` method of `HVisible` and must never be called from elsewhere. Components wishing to redraw themselves should call their repaint method in the usual way.

Specified By:

```
showLook(Graphics, HVisible, int) in interface HLook
```

Parameters:

`g` - the graphics context.

`visible` - the visible.

`state` - the state parameter indicates the state of the visible, allowing the look to render the appropriate content for that state. Note that some components (e.g. `HStaticRange`, `HRange`, `HRangeValue`) do not use state-based content).

widgetChanged(HVisible, HChangeData[])

```
public void widgetChanged(HVisible visible, HChangeData[] changes)
```

Called by the `HVisible` whenever its content, state, or any other data changes. See the class description of `HVisible` for more information about the `changes` parameter.

The implementation of this method should work out which graphical areas of the `HVisible` have changed and make any relevant calls to trigger the repainting of those areas.

A minimum implementation of this method could simply call

```
visible.repaint()
```

Specified By:

```
widgetChanged(HVisible, HChangeData[] ) in interface HLook
```

Parameters:

`visible` - the `HVisible` which has changed

`changes` - an array containing hint data and associated hint objects. If this argument is `null` a full repaint will be triggered.

org.havi.ui

HTextValue

Syntax

```
public interface HTextValue extends HNavigable, HKeyboardInputPreferred
```

All Superinterfaces:

```
HKeyboardInputPreferred, HNavigable, HNavigationInputPreferred
```

All Known Implementing Classes:

```
HSinglelineEntry
```

Description

This interface is implemented by all HAVi UI components which have have editable text content (e.g. a text entry control).

Event Behavior

Subclasses of `HComponent` which implement `HTextValue` must respond to `HFocusEvent`, `HKeyEvent` and `HTextEvent` events.

Applications should assume that classes which implement `HTextValue` can generate events of the types `HFocusEvent` and `HTextEvent` in response to other types of input event.

An application may add one or more `HTextListener` listeners to the component. The `textChanged(HTextEvent)` method of the `HTextListener` is invoked whenever the text in the `HTextValue` is changed, and the `caretMoved(HTextEvent)` method of the `HTextListener` is invoked whenever the text caret position is altered.

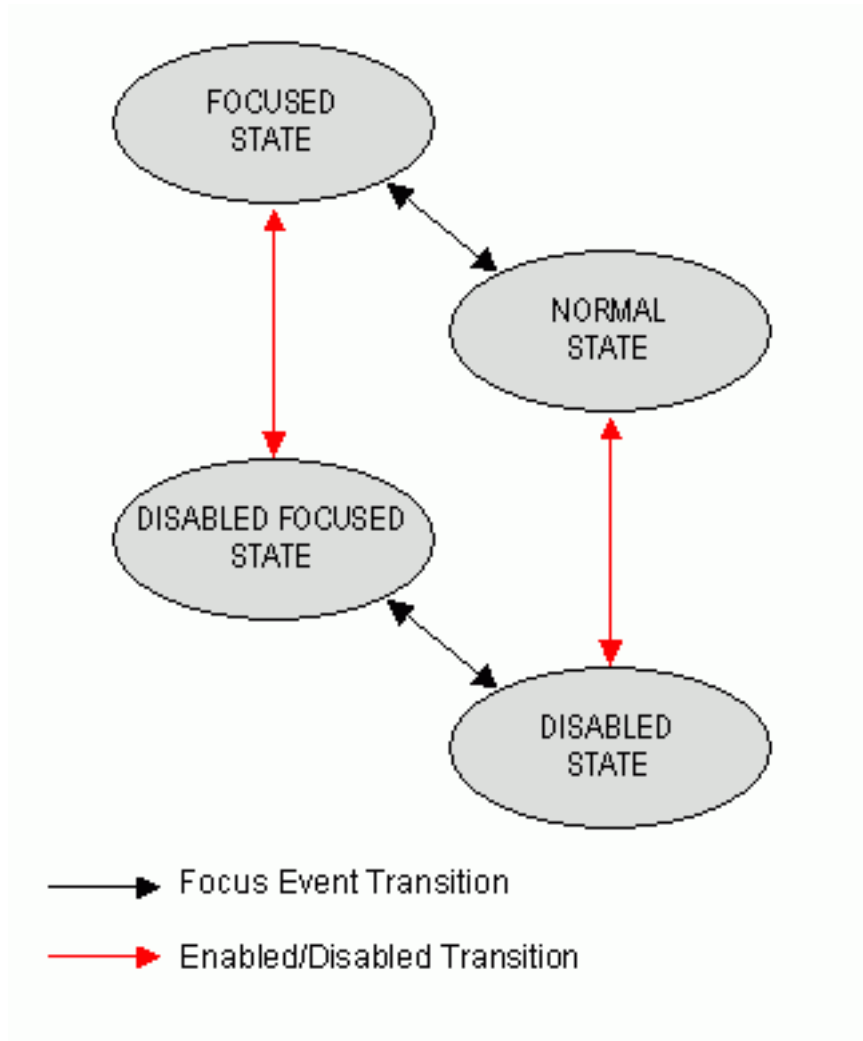
HAVi text events are discussed in detail in the `HKeyboardInputPreferred` interface description.

Interaction States

The following interaction states are valid for this `HTextValue` component:

- `NORMAL_STATE`
- `FOCUSED_STATE`
- `DISABLED_STATE`
- `DISABLED_FOCUSED_STATE`

The state machine diagram below shows the valid state transitions for an `HTextValue` component.



Platform Classes

The following HAVi platform classes implement or inherit the `HTextValue` interface. These classes shall all generate both `HFocusEvent` and `HTextEvent` events in addition to any other events specified in the respective class descriptions.

- `HSinglelineEntry`
- `HMultilineEntry`

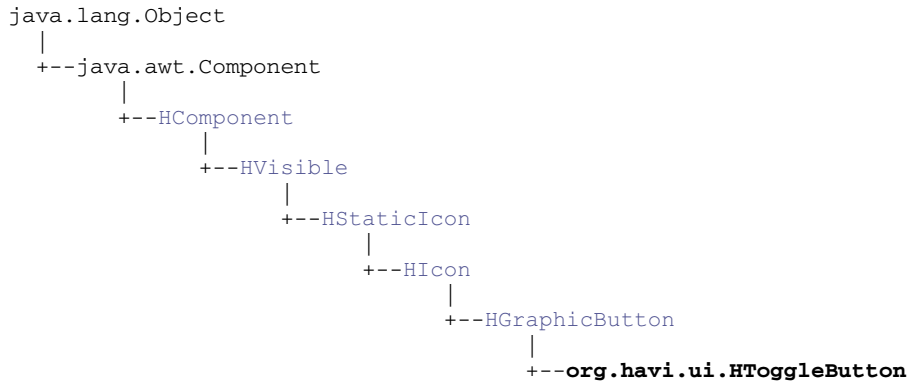
See Also:

`HNavigable`, `HKeyboardInputPreferred`, `HTextEvent`, `HTextListener`

org.havi.ui HToggleButton

Syntax

```
public class HToggleButton extends HGraphicButton implements HSwitchable
```



All Implemented Interfaces:

`HActionable`, `HActionInputPreferred`, `HMatteLayer`, `HNavigable`,
`HNavigationInputPreferred`, `HNoInputPreferred`, `HState`, `HSwitchable`,
`java.awt.image.ImageObserver`, `java.awt.MenuContainer`, `java.io.Serializable`, `TestOpacity`

Description

The `HToggleButton` is a user interface component representing a "check box", or with the support of the `HToggleGroup` class, "radio buttons". It displays static read-only graphical content. This component can be navigated to, i.e. it can have the input focus, and it can be actioned as defined by the `HSwitchable` interface. This means that the interaction state persists after `HActionEvent` event processing is complete.

The current switchable state can be manipulated using `setSwitchableState(boolean)` and `getSwitchableState()`

By default it uses the `HGraphicLook` class to render itself. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>

height	height of this component in pixels (subject to layout management).	---	java.awt.Component#setBounds	java.awt.Component#getBounds
image	The image to be used as the content for every state of this component.	null	setGraphicContent (Image, int)	getGraphicContent (int)
imageNormal	The image to be used as the content for the <code>NORMAL_STATE</code> state of this component.	null	setGraphicContent (Image, int)	getGraphicContent (int)
imageFocus	The image to be used as the content for the focused states of this component.	null	setGraphicContent (Image, int)	getGraphicContent (int)
imageAction	The image to be used as the content for the actioned states of this component.	null	setGraphicContent (Image, int)	getGraphicContent (int)
imageNormal-Actioned	The image to be used as the content for the actioned without focus states of this component.	null	setGraphicContent (Image, int)	getGraphicContent (int)
state	The switchable state of this <code>HToggleButton</code> .	false	setSwitchableState (boolean)	getSwitchableState ()
group	The <code>HToggleGroup</code> with which to associate this <code>HToggleButton</code> .	null	setToggleGroup (HToggleGroup)	getToggleGroup ()

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte (HMatte)</code>	<code>getMatte ()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager (HTextLayoutManager)</code>	<code>getTextLayoutManager ()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode (int)</code>	<code>getBackgroundMode ()</code>
The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize (Dimension)</code>	<code>getDefaultSize ()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment (int)</code>	<code>getHorizontalAlignment ()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment (int)</code>	<code>getVerticalAlignment ()</code>

The content scaling mode	RESIZE_NONE	setResizeMode (int)	getResizeMode ()
The default "look" for this class.	A platform specific HGraphicLook	setDefaultLook (HGraphicLook)	getDefaultLook ()
The "look" for this object.	The HGraphicLook returned from HToggleButton.getDefaultLook when this object was created.	setLook (HLook)	getLook ()
The gain focus sound.	null	setGainFocusSound (HSound)	getGainFocusSound ()
The lose focus sound.	null	setLoseFocusSound (HSound)	getLoseFocusSound ()
The action sound.	null	setActionSound (HSound)	getActionSound ()
The unset action sound.	null	setUnsetActionSound (HSound)	getUnsetActionSound ()

See Also:

HStaticIcon, HIcon, HNavigable, HActionable, HSwitchable

Constructors

HToggleButton()

```
public HToggleButton()
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image)

```
public HToggleButton(java.awt.Image image)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image, boolean, HToggleGroup)

```
public HToggleButton(java.awt.Image image, boolean state, HToggleGroup group)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image, Image, Image, Image, boolean)

```
public HToggleButton(java.awt.Image imageNormal, java.awt.Image imageFocused,
    java.awt.Image imageActioned, java.awt.Image imageNormalActioned,
    boolean state)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image, Image, Image, Image, boolean, HToggleGroup)

```
public HToggleButton(java.awt.Image imageNormal, java.awt.Image imageFocused,
    java.awt.Image imageActioned, java.awt.Image imageNormalActioned,
    boolean state, HToggleGroup group)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image, Image, Image, Image, int, int, int, int, boolean)

```
public HToggleButton(java.awt.Image imageNormal, java.awt.Image imageFocused,
    java.awt.Image imageActioned, java.awt.Image imageNormalActioned, int x,
    int y, int width, int height, boolean state)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image, Image, Image, Image, int, int, int, int, boolean, HToggleGroup)

```
public HToggleButton(java.awt.Image imageNormal, java.awt.Image imageFocused,
    java.awt.Image imageActioned, java.awt.Image imageNormalActioned, int x,
    int y, int width, int height, boolean state, HToggleGroup group)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image, int, int, int, int)

```
public HToggleButton(java.awt.Image image, int x, int y, int width, int height)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image, int, int, int, int, boolean)

```
public HToggleButton(java.awt.Image image, int x, int y, int width, int height,
    boolean state)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

HToggleButton(Image, int, int, int, int, boolean, HToggleGroup)

```
public HToggleButton(java.awt.Image image, int x, int y, int width, int height,
    boolean state, HToggleGroup group)
```

Creates an `HToggleButton` object. See the class description for details of constructor parameters and default values.

Methods

addActionListener(HActionListener)

```
public void addActionListener(HActionListener l)
```

Adds the specified `HActionListener` to receive `HActionEvent` events sent from this `HToggleButton`. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Specified By:

`addActionListener(HActionListener)` in interface `HActionable`

Overrides:

`addActionListener(HActionListener)` in class `HGraphicButton`

Parameters:

`l` - the `HActionListener`.

getActionCommand()

```
public java.lang.String getActionCommand()
```

Gets the command name for the `HActionEvent` event fired by this `HToggleButton`.

Specified By:

`getActionCommand()` in interface `HActionable`

Overrides:

`getActionCommand()` in class `HGraphicButton`

Returns:

A `String` representing the command name of the `HActionEvent` fired by this `HToggleButton`.

See Also:

`getActionCommand()`

getActionSound()

```
public HSound getActionSound()
```

Associate a sound to be played when the interaction state of the `HToggleButton` makes the following transitions:

- `_NORMAL_STATE` to `_ACTIONED_STATE`
- `_FOCUSED_STATE` to `_ACTIONED_FOCUSED_STATE`

Specified By:

`getActionSound()` in interface `HActionable`

Overrides:

`getActionSound()` in class `HGraphicButton`

Returns:

The sound played when the component is actioned.

getDefaultLook()

```
public static HGraphicLook getDefaultLook()
```

Returns the currently set default `HLook` for `HToggleButton` components.

Returns:

The `HLook` that is used by default when creating a new `HToggleButton` component.

getGainFocusSound()

```
public HSound getGainFocusSound()
```

Get the sound associated with the gain focus event.

Specified By:

`getGainFocusSound()` in interface `HNavigable`

Overrides:

`getGainFocusSound()` in class `HGraphicButton`

Returns:

The sound played when the component gains focus. If no sound is associated with gaining focus, then null shall be returned.

getLoseFocusSound()

```
public HSound getLoseFocusSound()
```

Get the sound associated with the lost focus event.

Specified By:

`getLoseFocusSound()` in interface `HNavigable`

Overrides:

`getLoseFocusSound()` in class `HGraphicButton`

Returns:

The sound played when the component loses focus. If no sound is associated with losing focus, then null shall be returned.

getMove(int)

```
public HNavigable getMove(int keyCode)
```

Provides the `HNavigable` object that is navigated to when a particular key is pressed.

Specified By:

`getMove(int)` in interface `HNavigable`

Overrides:

`getMove(int)` in class `HGraphicButton`

Parameters:

`keyCode` - The key code of the pressed key.

Returns:

Returns the `HNavigable` object, or if no `HNavigable` is associated with the `keyCode` then returns null.

getNavigationKeys()

```
public int[] getNavigationKeys()
```

Retrieve the set of key codes which this component maps to navigation targets.

Specified By:

`getNavigationKeys()` in interface `HNavigationInputPreferred`

Overrides:

`getNavigationKeys()` in class `HGraphicButton`

Returns:

an array of key codes, or `null` if no navigation targets are set on this component.

getSwitchableState()

```
public boolean getSwitchableState()
```

Returns the current switchable state of this `HSwitchable`.

Specified By:

`getSwitchableState()` in interface `HSwitchable`

Returns:

the current switchable state of this `HSwitchable`.

getToggleGroup()

```
public HToggleGroup getToggleGroup()
```

Gets the `HToggleGroup` the `HToggleButton` is associated with.

Returns:

The `HToggleGroup` the `HToggleButton` is associated with, or `null` if the `HToggleButton` is not associated with an `HToggleGroup`.

getUnsetActionSound()

```
public HSound getUnsetActionSound()
```

Get the sound to be played when the interaction state of the `HSwitchable` makes the following transitions:

- `_ACTIONED_STATE` to `_NORMAL_STATE`
- `_ACTIONED_FOCUSED_STATE` to `_FOCUSED_STATE`

Specified By:

`getUnsetActionSound()` in interface `HSwitchable`

Returns:

the sound to be played when the `HSwitchable` transitions from an actioned state.

isSelected()

```
public boolean isSelected()
```

Indicates if this component has focus.

Specified By:

`isSelected()` in interface `HNavigable`

Overrides:

`isSelected()` in class `HGraphicButton`

Returns:

`true` if the component has focus, otherwise returns `false`.

processHActionEvent(HActionEvent)

```
public void processHActionEvent(HActionEvent evt)
```

Process an `HActionEvent` sent to this `HToggleButton`.

Specified By:

`processHActionEvent(HActionEvent)` in interface `HActionInputPreferred`

Overrides:

`processHActionEvent(HActionEvent)` in class `HGraphicButton`

Parameters:

`evt` - the `HActionEvent` to process.

processHFocusEvent(HFocusEvent)

```
public void processHFocusEvent(HFocusEvent evt)
```

Process an `HFocusEvent` sent to this `HToggleButton`.

Specified By:

`processHFocusEvent(HFocusEvent)` in interface `HNavigationInputPreferred`

Overrides:

`processHFocusEvent(HFocusEvent)` in class `HGraphicButton`

Parameters:

`evt` - the `HFocusEvent` to process.

removeHActionListener(HActionListener)

```
public void removeHActionListener(HActionListener l)
```

Removes the specified `HActionListener` so that it no longer receives `HActionEvent` events from this `HToggleButton`. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Specified By:

`removeHActionListener(HActionListener)` in interface `HActionable`

Overrides:

`removeHActionListener(HActionListener)` in class `HGraphicButton`

Parameters:

`l` - the `HActionListener`.

removeToggleGroup()

```
public void removeToggleGroup()
```

Removes the button from the toggle group that it has been added to. This method does nothing if the button had not been previously added to an `HToggleGroup`.

setActionCommand(String)

```
public void setActionCommand(java.lang.String command)
```

Sets the command name for the `HActionEvent` event fired by this `HToggleButton`.

Specified By:

`setActionCommand(String)` in interface `HActionable`

Overrides:

`setActionCommand(String)` in class `HGraphicButton`

Parameters:

`command` - a `String` used to set the action command.

See Also:

`getActionCommand()`

setActionSound(HSound)

```
public void setActionSound(HSound sound)
```

Associate a sound to be played when the interaction state of the `HToggleButton` makes the following transitions:

- `_NORMAL_STATE` to `_ACTIONED_STATE`
- `_FOCUSED_STATE` to `_ACTIONED_FOCUSED_STATE`

Specified By:

`setActionSound(HSound)` in interface `HActionable`

Overrides:

`setActionSound(HSound)` in class `HGraphicButton`

Parameters:

`sound` - the sound to be played, when the component is actioned. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setDefaultLook(HGraphicLook)

```
public static void setDefaultLook(HGraphicLook hlook)
```

Sets the default `HLook` for further `HToggleButton` components.

Parameters:

`hlook` - The `HLook` that will be used by default when creating a new `HToggleButton` component. Note that this parameter may be null, in which case newly created components shall not draw themselves until a non-null look is set using the `setLook(HLook)` method.

setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)

```
public void setFocusTraversal(HNavigable up, HNavigable down, HNavigable left,
    HNavigable right)
```

Set the focus control for an `HNavigable` component. Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is a convenience function for application programmers where a standard up, down, left and right focus traversal between components is required.

Note `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Note that this API does not prevent the creation of "isolated" `HNavigable` components --- authors should endeavor to avoid confusing the user.

Specified By:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in interface `HNavigable`

Overrides:

`setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` in class `HGraphicButton`

Parameters:

`up` - The `HNavigable` component to move to, when the user generates a `VK_UP` KeyEvent. If there is no `HNavigable` component to move "up" to, then null should be specified.

`down` - The `HNavigable` component to move to, when the user generates a `VK_DOWN` `KeyEvent`. If there is no `HNavigable` component to move "down" to, then null should be specified.

`left` - The `HNavigable` component to move to, when the user generates a `VK_LEFT` `KeyEvent`. If there is no `HNavigable` component to move "left" to, then null should be specified.

`right` - The `HNavigable` component to move to, when the user generates a `VK_RIGHT` `KeyEvent`. If there is no `HNavigable` component to move "right" to, then null should be specified.

setGainFocusSound(HSound)

```
public void setGainFocusSound(HSound sound)
```

Associate a sound with gaining focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_GAINED`. This sound will start to be played when an object implementing this interface gains focus. It is not guaranteed to be played to completion. If the object implementing this interface loses focus before the audio completes playing, the audio will be truncated. Applications wishing to ensure the audio is always played to completion must implement special logic to slow down the focus transitions.

By default, an `HNavigable` object does not have any gain focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setGainFocusSound(HSound)` in interface `HNavigable`

Overrides:

`setGainFocusSound(HSound)` in class `HGraphicButton`

Parameters:

`sound` - the sound to be played, when the component gains focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setLoseFocusSound(HSound)

```
public void setLoseFocusSound(HSound sound)
```

Associate a sound with losing focus, i.e. when the `HNavigable` receives a `java.awt.event.FocusEvent` event of type `FOCUS_LOST`. This sound will start to be played when an object implementing this interface loses focus. It is not guaranteed to be played to completion. It is implementation dependent whether and when this sound will be truncated by any gain focus sound played by the next object to gain focus.

By default, an `HNavigable` object does not have any lose focus sound associated with it.

Note that the ordering of playing sounds is dependent on the order of the focus lost, gained events.

Specified By:

`setLoseFocusSound(HSound)` in interface `HNavigable`

Overrides:

`setLoseFocusSound(HSound)` in class `HGraphicButton`

Parameters:

`sound` - the sound to be played, when the component loses focus. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

setMove(int, HNavigable)

```
public void setMove(int keyCode, HNavigable target)
```

Defines the navigation path from the current `HNavigable` to another `HNavigable` when a particular key is pressed.

Note that `setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable)` is equivalent to multiple calls to `setMove(int, HNavigable)`, where the key codes `VK_UP`, `VK_DOWN`, `VK_LEFT`, `VK_RIGHT` are used.

Specified By:

`setMove(int, HNavigable)` in interface `HNavigable`

Overrides:

`setMove(int, HNavigable)` in class `HGraphicButton`

Parameters:

`keyCode` - The key code of the pressed key. Any numerical keycode is allowed, but the platform may not be able to generate all keycodes. Application authors should only use keys for which `HRcCapabilities.isSupported()` or `HKeyCapabilities.isSupported()` returns true.

`target` - The target `HNavigable` object that should be navigated to. If a target is to be removed from a particular navigation path, then `null` should be specified.

setSwitchableState(boolean)

```
public void setSwitchableState(boolean state)
```

Sets the current state of the button. Note that `ActionListeners` are only called when an `ACTION_PERFORMED` event is received, or if they are called directly, e.g. via `processActionEvent`, they are not called by `setSwitchableState(boolean)`.

Specified By:

`setSwitchableState(boolean)` in interface `HSwitchable`

setToggleGroup(HToggleGroup)

```
public void setToggleGroup(HToggleGroup group)
```

Associates the `HToggleButton` with an `HToggleGroup`. If this `HToggleButton` is already in a different `HToggleGroup`, it is first taken out of that group.

Parameters:

`group` - The `HToggleGroup` the `HToggleButton` is to be associated with.

setUnsetActionSound(HSound)

```
public void setUnsetActionSound(HSound sound)
```

Associate a sound to be played when the interaction state of the `HSwitchable` makes the following transitions:

- `_ACTIONED_STATE` to `_NORMAL_STATE`
- `_ACTIONED_FOCUSED_STATE` to `_FOCUSED_STATE`

Specified By:

`setUnsetActionSound(HSound)` in interface `HSwitchable`

Parameters:

`sound` - a sound to be played when the `HSwitchable` transitions from an actioned state. If sound content is already set, the original content is replaced. To remove the sound specify a null `HSound`.

org.havi.ui HToggleGroup

Syntax

```
public class HToggleGroup

java.lang.Object
|
+--org.havi.ui.HToggleGroup
```

Description

`HToggleButton` within the same `HToggleGroup` will behave so that a maximum of one `HToggleButton` has switchable state `true`, as returned by `getSwitchableState()`, so as to achieve a "radio button" effect. When an `HToggleButton` is acted upon to change its switchable state to `true`, then if any other `HToggleButton` within the `HToggleGroup` currently has switchable state `true`, it will have its switchable state set to `false`. Similarly, if an `HToggleButton` is added which has switchable state `true`, then any current `HToggleButton` within the `HToggleGroup` with switchable state `true`, shall have its switchable state modified to `false`.

If the forced selection mode for the `HToggleGroup` is set via a call to `setForcedSelection(true)` then there will always be one `HToggleButton` selected (i.e. with switchable state `true`), and if necessary the `HToggleGroup` will automatically force a selection to ensure this. If forced selection mode is not set it is valid for there to be no selection, i.e. all `HToggleButton` may have switchable state `false`. By default forced selection mode is not set.

Note that when an `HToggleButton` has switchable state `true` this implies that the interaction state as returned by `getInteractionState()` will be either the `ACTIONED_STATE` or `ACTIONED_FOCUSED_STATE` state.

Similarly, a switchable state of `false` implies that the interaction state is any other state for which the `ACTIONED_STATE_BIT` is not set. See the `HSwitchable` class description for more information about the valid interaction states. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Enable or disable buttons in group	<code>enable</code>	<code>setEnabled(boolean)</code>	<code>isEnabled()</code>
Forced selection mode.	<code>false</code>	<code>setForcedSelection(boolean)</code>	<code>getForcedSelection()</code>

Constructors

HToggleGroup()

```
public HToggleGroup()
```

Creates a new version instance of an `HToggleGroup`

Methods

add(HToggleButton)

```
protected void add(HToggleButton button)
```

Add the specified `HToggleButton` to this `HToggleGroup`. The `HToggleButton` will be enabled or disabled as necessary to match the current state of the `HToggleGroup` as determined by the `isEnabled()` method.

If the `HToggleGroup` is empty and forced selection mode is active then the `HToggleButton` will automatically have its switchable state set to `true`. Note that any `ActionListeners` registered with the `HToggleButton` are not called as a result of this operation.

This method is protected to allow the platform to override it in subclasses of `HToggleGroup`. It is not intended for use by the application and conformant applications shall not use this method.

Parameters:

`button` - the `HToggleButton` to add to the `HToggleGroup`.

getCurrent()

```
public HToggleButton getCurrent()
```

Returns the `HToggleButton` from this `HToggleGroup` which has state `true`, or null otherwise, for example, if there are no `HToggleButton` associated with this `HToggleGroup`, or if all `HToggleButton` within this `HToggleGroup` have state `false`.

Returns:

the currently selected `HToggleButton` or null if no such `HToggleButton` exists.

getForcedSelection()

```
public boolean getForcedSelection()
```

Return the current forced selection mode of the group.

Returns:

the current forced selection mode. If this value is `true` the group is forced to always have one `HToggleButton` selected (i.e. with switchable state `true`). Otherwise, the group may have either one or zero `HToggleButton` selected.

isEnabled()

```
public boolean isEnabled()
```

Determines whether the `HToggleGroup` is enabled. `HToggleGroup` are enabled initially by default. A group may be enabled or disabled by calling its `setEnabled` method.

Returns:

`true` if the component is enabled; `false` otherwise.

See Also:

```
setEnabled(boolean)
```

remove(HToggleButton)

```
protected void remove(HToggleButton button)
```

Remove the specified `HToggleButton` to this `HToggleGroup`. If `button` is not part of this `HToggleGroup` this method throws a `java.lang.IllegalArgumentException`.

If the `HToggleButton` is the currently selected button in this group and forced selection mode is set the first remaining `HToggleButton` will automatically have its switchable state set to true. Note that any `ActionListeners` registered with the `HToggleButton` are not called as a result of this operation.

This method is protected to allow the platform to override it in subclasses of `HToggleGroup`. It is not intended for use by the application and conformant applications shall not use this method.

Parameters:

`button` - the `HToggleButton` to remove from the `HToggleGroup`.

Throws:

`java.lang.IllegalArgumentException` - if `button` is not a member of this `HToggleGroup`.

setCurrent(HToggleButton)

```
public void setCurrent(HToggleButton selection)
```

If the specified `HToggleButton` is a member of this `HToggleGroup`, then it is selected, its state is set to true and consequently any other `HToggleButton` within the `HToggleGroup` will have their states set to false.

If the specified `HToggleButton` is not a member of this `HToggleGroup`, then no actions are performed.

Parameters:

`selection` - the `HToggleButton` to be set as the currently selected item within the `HToggleGroup`.

setEnabled(boolean)

```
public void setEnabled(boolean enable)
```

Enables or disables the group, depending on the value of the parameter `enable`. An enabled group's `HToggleButton` can respond to user input and generate events. An `HToggleGroup` is initially enabled by default.

Enabling or disabling an `HToggleGroup` enables or disables all the `HToggleButton` components in the group by calling their `setEnabled` methods.

Whether or not a group is enabled does not affect the adding or removing of `HToggleButton` from that group.

Parameters:

`enable` - true to enable all the `HToggleButton` components in the group, false to disable them.

See Also:

`isEnabled()`

setForcedSelection(boolean)

```
public void setForcedSelection(boolean forceSelection)
```

Set the forced selection mode of the group. If `forceSelection` is `true` and no `HToggleButton` is currently selected in the group the first `HToggleButton` automatically has its switchable state set to `true`. If no `HToggleButton` components have been added to this group there will be no visual indication of the mode change.

Parameters:

`forceSelection` - if this parameter is `true` the group is forced to always have one `HToggleButton` selected (i.e. with switchable state `true`). Otherwise, the group may have either one or zero `HToggleButton` selected.

org.havi.ui HUIException

Syntax

```
public class HUIException extends java.lang.Exception
```

```
java.lang.Object
|
+--java.lang.Throwable
    |
    +--java.lang.Exception
        |
        +--org.havi.ui.HUIException
```

Direct Known Subclasses:

`HInvalidLookException`, `HMatteException`

All Implemented Interfaces:

`java.io.Serializable`

Description

`HUIException` is a generic exception that indicates that the desired user-interface mechanism cannot be performed for some reason. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
message	Message explaining why the exception was thrown	null	-	<code>java.lang.Throwable#getMessage</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HUIException()

```
public HUIException()
```

Creates an `HUIException` object. See the class description for details of constructor parameters and default values.

HUIException(String)

```
public HUIException(java.lang.String message)
```

Creates an HUIException object with a specified reason string.

Parameters:

message - the reason why the exception was raised

org.havi.ui

HVersion

Syntax

```
public interface HVersion
```

Description

The `HVersion` interface defines some versioning constants that are accessible by using the `java.lang.System` method `getProperty`, with the appropriate property name.

Note that it is a valid implementation to return empty strings for the implementation, vendor and name strings.

Fields

HAVI_IMPLEMENTATION_NAME

```
public static final java.lang.String HAVI_IMPLEMENTATION_NAME
```

A string constant describing the HAVi implementation name, as returned via `java.lang.System.getProperty(havi.implementation.name)`.

HAVI_IMPLEMENTATION_VENDOR

```
public static final java.lang.String HAVI_IMPLEMENTATION_VENDOR
```

A string constant describing the HAVi implementation vendor, as returned via `java.lang.System.getProperty(havi.implementation.vendor)`.

HAVI_IMPLEMENTATION_VERSION

```
public static final java.lang.String HAVI_IMPLEMENTATION_VERSION
```

A string constant describing the HAVi implementation version, as returned via `java.lang.System.getProperty(havi.implementation.version)`.

HAVI_SPECIFICATION_NAME

```
public static final java.lang.String HAVI_SPECIFICATION_NAME
```

A string constant describing the HAVi specification name, as returned via `java.lang.System.getProperty(havi.specification.name)`.

HAVI_SPECIFICATION_VENDOR

```
public static final java.lang.String HAVI_SPECIFICATION_VENDOR
```

A string constant describing the HAVi specification vendor, as returned via `java.lang.System.getProperty(havi.specification.vendor)`.

HAVI_SPECIFICATION_VERSION

```
public static final java.lang.String HAVI_SPECIFICATION_VERSION
```

A string constant describing the HAVi specification version, as returned via `java.lang.System.getProperty(havi.specification.version)`.

org.havi.ui HVideoComponent

Syntax

public class HVideoComponent extends HComponent

```

java.lang.Object
|
+--java.awt.Component
    |
    +--HComponent
        |
        +--org.havi.ui.HVideoComponent
  
```

All Implemented Interfaces:

HMatteLayer, java.awt.image.ImageObserver, java.awt.MenuContainer, java.io.Serializable, TestOpacity

Description

`HVideoComponent` is an opaque class encapsulating the presentation of a video source *within* an application, i.e. contained within a conventional AWT hierarchy.

An `HVideoComponent` obeys all conventional `java.awt.Component` semantics, including being clipped by its parent container, etc. An `HVideoComponent` also obeys all `HComponent` semantics including Z-ordering, etc. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HVideoComponent()

```
protected HVideoComponent()
```

It is not intended that applications should directly construct `HVideoComponent` objects.

Creates an `HVideoComponent` object. See the class description for details of constructor parameters and default values.

Methods

addOnScreenLocationModifiedListener(HScreenLocationModifiedListener)

```
public void addOnScreenLocationModifiedListener(HScreenLocationModifiedListener slml)
```

Register a listener to determine if the Component's on-screen location is modified - irrespective of its relative location to its parent Container. If the listener has already been added further calls will add further references to the listener, which will then receive multiple copies of a single event.

Parameters:

`slml` - listener to be notified when the on-screen location of the component is modified.

getVideoDevice()

```
public HVideoDevice getVideoDevice()
```

Returns the `HVideoDevice` that this `HVideoComponent` is associated with.

Returns:

the `HVideoDevice` that this `HVideoComponent` is associated with, or null if this cannot be determined.

removeOnScreenLocationModifiedListener(HScreenLocationModifiedListener)

```
public void removeOnScreenLocationModifiedListener(HScreenLocationModifiedListener slml)
```

Remove a listener that determines if the Component's on-screen location is modified - irrespective of its relative location to its parent Container. If the specified listener is not registered, the method has no effect. If multiple references to a single listener have been registered it should be noted that this method will only remove one reference per call.

Parameters:

`slml` - listener to be notified when the on-screen location of the component is modified.

org.havi.ui HVideoConfigTemplate

Syntax

```
public class HVideoConfigTemplate extends HScreenConfigTemplate
```

```
java.lang.Object
|
+--HScreenConfigTemplate
|
+--org.havi.ui.HVideoConfigTemplate
```

Description

The `HVideoConfigTemplate` class is used to obtain a valid `HVideoConfiguration`. An application instantiates one of these objects and then sets all non-default attributes as desired. The object is then passed to the `getBestConfiguration(HVideoConfigTemplate)` method found in the `HVideoDevice` class. If possible, a valid `HVideoConfiguration` is returned which meets or exceeds the requirements set in the `HVideoConfigTemplate`.

This class may be subclassed to support additional properties of video configurations which may be requested by applications. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

`HScreenConfigTemplate`, `HBackgroundConfigTemplate`, `HGraphicsConfigTemplate`

Fields

GRAPHICS_MIXING

```
public static final int GRAPHICS_MIXING
```

A value for use in the preference field of the `setPreference(int, int)` and `getPreferencePriority(int)` methods in the `HVideoConfigTemplate` that indicates that the device configuration supports the display of graphics in addition to video streams. This display includes both configurations where the video pixels and graphics pixels are fully aligned (same size) as well as configurations where they are displayed together but where a more complex relationship exists between the two pixel coordinate spaces. The graphics configuration for mixing is specified as an `HGraphicsConfiguration`.

This preference is used by the platform as a constraint in selecting configurations. Templates generated by the platform and then returned to applications (e.g. from a `getConfigTemplate` method) shall not have this preference filled in by the platform.

Constructors

HVideoConfigTemplate()

```
public HVideoConfigTemplate()
```

Creates an `HVideoConfigTemplate` object. See the class description for details of constructor parameters and default values.

Methods

getPreferenceObject(int)

```
public java.lang.Object getPreferenceObject(int preference)
```

Return the preference object for the specified preference.

Instances of `HVideoConfigTemplate` which have not had this preference set shall return null for this object. Note that instances constructed by the platform and returned to applications are required to have all preferences (except where explicitly identified) set by the platform before it is returned.

Overrides:

```
getPreferenceObject(int) in class HScreenConfigTemplate
```

Parameters:

`preference` - the preference to be indicated. Valid values for an `HVideoConfigTemplate` are: `VIDEO_GRAPHICS_PIXEL_ALIGNED`, `PIXEL_ASPECT_RATIO`, `PIXEL_RESOLUTION`, `SCREEN_RECTANGLE`, and `GRAPHICS_MIXING`.

Subclasses may add further valid values. A `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HVideoConfigTemplate`, or if `preference` does not have an associated value object.

Returns:

the preference object for the specified preference.

getPreferencePriority(int)

```
public int getPreferencePriority(int preference)
```

Return the priority for the specified preference.

By default the preferences in a template returned from the system will have an `DONT_CARE` priority unless specified otherwise. Any configuration always satisfies these attributes.

Overrides:

```
getPreferencePriority(int) in class HScreenConfigTemplate
```

Parameters:

`preference` - the preference to be indicated. Valid values for an `HVideoConfigTemplate` are: `ZERO_BACKGROUND_IMPACT`, `ZERO_GRAPHICS_IMPACT`, `ZERO_VIDEO_IMPACT`, `INTERLACED_DISPLAY`, `FLICKER_FILTERING`, `VIDEO_GRAPHICS_PIXEL_ALIGNED`,

PIXEL_ASPECT_RATIO , PIXEL_RESOLUTION , SCREEN_RECTANGLE and GRAPHICS_MIXING .

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HVideoConfigTemplate`

Returns:

the priority for the specified preference.

isConfigSupported(HVideoConfiguration)

```
public boolean isConfigSupported(HVideoConfiguration hvc)
```

Returns a boolean indicating whether or not the specified `HVideoConfiguration` can be used to create a video plane that supports the features set in this template.

Parameters:

`hvc` -- the `HVideoConfiguration` object to test against this template.

Returns:

true if this `HVideoConfiguration` object can be used to create a video plane that supports the features set in this template, false otherwise.

setPreference(int, Object, int)

```
public void setPreference(int preference, java.lang.Object object, int priority)
```

Set the indicated preference (and associated value object) to have the specified priority. If the preference has been previously set, then the previous object and priority shall be overwritten.

Attributes that are not filled in in a template (through `setPreference(int, Object, int)`), shall have the priority `DONT_CARE` . Any configuration always satisfies these attributes.

An application which wishes to remove a preference from an existing template (e.g. one generated by the platform) may call this method with null for the object parameter.

Overrides:

`setPreference(int, Object, int)` in class `HScreenConfigTemplate`

Parameters:

`preference` - the preference to be indicated. Valid values for an `HScreenConfigTemplate` are: `PIXEL_ASPECT_RATIO` , `PIXEL_RESOLUTION` , `SCREEN_RECTANGLE` , `VIDEO_GRAPHICS_PIXEL_ALIGNED` and `GRAPHICS_MIXING` .

Subclasses may add further valid values. An `IllegalArgumentException` shall be thrown if the preference is not a valid value for this instance of `HVideoConfigTemplate`

`object` - the Object associated with the given preference, or null.

`priority` - the priority of the preference. Valid values include: `REQUIRED` , `PREFERRED` , `DONT_CARE` , `PREFERRED_NOT` and `REQUIRED_NOT` .

If `priority` is not a valid priority as defined here a `java.lang.IllegalArgumentException` will be thrown.

org.havi.ui HVideoConfiguration

Syntax

```
public class HVideoConfiguration extends HScreenConfiguration
```

```
java.lang.Object
|
+--HScreenConfiguration
|
+--org.havi.ui.HVideoConfiguration
```

Description

The `HVideoConfiguration` class describes the characteristics (settings) of an `HVideoDevice`. There can be many `HVideoConfiguration` objects associated with a single `HVideoDevice`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

[HVideoDevice](#)

Constructors

HVideoConfiguration()

```
protected HVideoConfiguration()
```

It is not intended that applications should directly construct `HVideoConfiguration` objects.

Creates an `HVideoConfiguration` object. See the class description for details of constructor parameters and default values.

Methods

getConfigTemplate()

```
public HVideoConfigTemplate getConfigTemplate()
```

Returns an `HVideoConfigTemplate` object that describes and uniquely identifies this `HVideoConfiguration`.

Hence, the following sequence should return the original `HVideoConfiguration`.

```
HVideoDevice.getBestMatch(HVideoConfiguration.getConfigTemplate())
```

Features that are implemented in the `HVideoConfiguration` will return `REQUIRED` priority. Features that are not implemented in the `HVideoConfiguration` will return `REQUIRED_NOT` priority.

Returns:

an `HVideoConfigTemplate` object which both describes and uniquely identifies this `HVideoConfiguration`.

getDevice()

```
public HVideoDevice getDevice()
```

Returns the `HVideoDevice` associated with this `HVideoConfiguration`.

Returns:

the `HVideoDevice` object that is associated with this `HVideoConfiguration`,

org.havi.ui HVideoDevice

Syntax

```
public class HVideoDevice extends HScreenDevice
```

```
java.lang.Object
|
+--HScreenDevice
|
+--org.havi.ui.HVideoDevice
```

All Implemented Interfaces:

org.davic.resources.ResourceProxy, org.davic.resources.ResourceServer

Description

The `HVideoDevice` class describes the logical video devices which can contribute to the appearance of a particular screen. Each `HVideoDevice` has one or more `HVideoConfiguration` objects associated with it. These objects specify the different configurations (settings) in which the `HVideoDevice` can be used. This class represents the presentation only of video and does not provide for the selection of which video is to be presented. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

See Also:

`HVideoConfiguration`, `HScreenDevice`, `HScreen`

Fields

NOT_CONTRIBUTING

```
public static final HVideoConfiguration NOT_CONTRIBUTING
```

Constant indicating that a video device is not contributing to the output of its `HScreen`. This shall only be used in implementations where an `HVideoDevice` shares an underlying MPEG decoder with an `HBackgroundDevice` when the `HBackgroundDevice` is in an `HStillImageBackgroundConfiguration`. In such implementations, this configuration shall be returned from the `getCurrentConfiguration()` method when the underlying video decoder is being used for displaying `HBackgroundImage`. It shall not be returned from any other method. The

`setVideoConfiguration(HVideoConfiguration)` method shall consider this to be an invalid configuration for this device and fail as specified.

On implementations where `getCurrentConfiguration()` never returns this value, `NOT_CONTRIBUTING` shall be null.

Constructors

HVideoDevice()

```
protected HVideoDevice()
```

It is not intended that applications should directly construct `HVideoDevice` objects.

Creates an `HVideoDevice` object. See the class description for details of constructor parameters and default values.

Methods

getBestConfiguration(HVideoConfigTemplate)

```
public HVideoConfiguration getBestConfiguration(HVideoConfigTemplate hvct)
```

Returns the "best" configuration possible that passes the criteria defined in the `HVideoConfigTemplate` or null.

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`
3. satisfy as many as possible of the preferences whose priority was `PREFERRED`.
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT`.

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

`hvct` - an `HVideoConfigTemplate` object used to obtain a valid `HVideoConfiguration`. If this parameter is null the default configuration for the platform shall be returned.

Returns:

an `HVideoConfiguration` that passes the criteria defined in the specified `HVideoConfigTemplate` or null if no `HVideoConfiguration` passes the criteria.

getBestConfiguration(HVideoConfigTemplate[])

```
public HVideoConfiguration getBestConfiguration(HVideoConfigTemplate[] hvcta)
```

Returns the "best" configuration possible that passes the criteria defined in one of the `HVideoConfigTemplate` objects within the specified array or null. The `HVideoTemplate` objects should be considered for matching in priority order from 0 to (`hvcta.length - 1`).

Equally best in this sense means that the configurations satisfy an equal number of preferences with priorities `PREFERRED` and `PREFERRED_NOT` and all preferences with priorities `REQUIRED` and `REQUIRED_NOT`.

Configurations are chosen according to the following algorithm, based on the priority as supplied to `setPreference(int, int)`. Configurations must:

1. satisfy ALL the preferences whose priority was `REQUIRED`
2. satisfy NONE of the preferences whose priority was `REQUIRED_NOT`
3. satisfy as many as possible of the preferences whose priority was `PREFERRED`.
4. satisfy as few as possible of the preferences whose priority was `PREFERRED_NOT`.

Preferences whose priority was `DONT_CARE` are ignored.

This method returns null if no configuration exists that satisfies all `REQUIRED` and `REQUIRED_NOT` priorities.

Parameters:

`hvcta` - the `HVideoConfigTemplate` array used to obtain a valid `HVideoConfiguration`.

Returns:

an `HVideoConfiguration` that passes the criteria defined in one of the `HVideoConfigTemplate` objects within the specified array

getConfigurations()

```
public HVideoConfiguration[] getConfigurations()
```

Returns all of the `HVideoConfiguration` objects associated with this `HVideoDevice`.

Returns:

an array of `HVideoConfiguration` objects

See Also:

`HVideoConfiguration`

getCurrentConfiguration()

```
public HVideoConfiguration getCurrentConfiguration()
```

Returns the current `HVideoConfiguration` for this `HVideoDevice`.

Returns:

the current `HVideoConfiguration` for this `HVideoDevice`.

See Also:

`HVideoConfiguration`

getDefaultConfiguration()

```
public HVideoConfiguration getDefaultConfiguration()
```

Returns the default `HVideoConfiguration` associated with this `HVideoDevice`. This (single) default configuration should correspond to some well-behaved settings for the device, such as, a minimal configuration or factory preset settings.

Returns:

the default `HVideoConfiguration` of this `HVideoDevice`.

See Also:

[HVideoConfiguration](#)

getVideoController()

```
public java.lang.Object getVideoController()
```

Obtain a reference to the object which controls the presentation of the video. Null is returned if no video is being presented. In systems based on JMF, this would be the `javax.media.Player` instance which owns the resource.

Returns:

the object which controls the presentation of the video

Throws:

`SecurityException` - if the application does not have sufficient rights to get the `VideoPlayer` object.

`HPermissionDeniedException` - (`HPermissionDeniedException`) if the application does not currently have the right to get the `VideoPlayer` object.

getVideoSource()

```
public java.lang.Object getVideoSource()
```

Obtain a reference to the source of the video being presented by this device at this moment. The precise class to be returned must be specified outside the HAVi user- interface specification. Null is returned if no video is being presented.

Returns:

a reference to the source of the video

Throws:

`SecurityException` - if the application does not have sufficient rights to get the `VideoSource` object.

`HPermissionDeniedException` - (`HPermissionDeniedException`) if the application does not currently have the right to get the `VideoSource` object.

setVideoConfiguration(HVideoConfiguration)

```
public boolean setVideoConfiguration(HVideoConfiguration hvc)
```

Set the video configuration for the device.

An application is only allowed to call this method after it reserved the device explicitly and subject to the security policy of the platform. Subject to this, the following rules determine whether this method can succeed.

- If the application selects a configuration that is not conflicting with the configurations of all the other devices on the same `HScreen` then that configuration is selected.
- If an application tries to select a configuration that conflicts with a configuration of another device on this `HScreen` which this application cannot control due to platform security policy then this method shall fail with a `SecurityException`.
- If an application tries to select a configuration that conflicts with a configuration of another device on this `HScreen` which this application cannot control due to another application owning the right to control that device and the platform not giving that right to this application then this method shall fail with an `HPermissionDeniedException`.
- If an application tries to select a configuration that conflicts with a configuration of another device which this application can control due to either this or no application having reserved the device, then the configuration of the other device is automatically changed. There is no change in the resource ownership of the

other device.

Applications can prevent or limit changes to configurations of other, not intended, devices by using constants `ZERO_GRAPHICS_IMPACT` and `ZERO_VIDEO_IMPACT` in their configuration templates. The first one will cause no changes to already running graphical applications. This means that no changes may be applied to the graphics device. Similarly the second constant will result in no changes to the video device.

Any modifications made to the configurations of other devices shall be reflected by the API for the devices concerned. The `getCurrentConfiguration()` method for those devices shall return the new configuration.

On successful change to the specified configuration, the device shall fire one or more `HScreenConfigurationEvent` for all listeners that are currently registered (if the criteria for receiving such an event has been satisfied). If the new configuration differs by more than one characteristic from the previous configuration then the device may fire one or more `HScreenConfigurationEvent`. This behavior is implementation specific.

If an attempt is made to set the identical configuration to that which is current, then no such event(s) shall be fired.

Parameters:

`hvc` - the `HVideoConfiguration` to which this device should be set.

Returns:

A boolean indicating whether the configuration could be applied successfully. If the configuration could not be applied successfully, the configuration after this method may not match the configuration of the device prior to this method being called --- applications should take steps to determine whether a partial change of settings has been made.

Throws:

`SecurityException` - if the application does not have sufficient rights to set the configuration for this device.

{ [@link - org.havi.ui.HPermissionDeniedException](#) `HPermissionDeniedException`} if the application does not currently have the right to set the configuration for this device.

{ [@link - org.havi.ui.HConfigurationException](#) `HConfigurationException`} if the specified configuration is not valid for this device, or if it conflicts with other devices whose configuration(s) cannot be changed by this application.

`HConfigurationException`, `HPermissionDeniedException`

org.havi.ui HVisible

Syntax

```
public class HVisible extends HComponent implements HState
```

```
java.lang.Object
|
+--java.awt.Component
|
+--HComponent
|
+--org.havi.ui.HVisible
```

Direct Known Subclasses:

```
HListGroup, HSinglelineEntry, HStaticAnimation, HStaticIcon, HStaticRange,
HStaticText
```

All Implemented Interfaces:

```
HMatteLayer, HState, java.awt.image.ImageObserver, java.awt.MenuContainer,
java.io.Serializable, TestOpacity
```

Description

The `HVisible` class is the base class for all non-interactive components.

If a layout manager is associated with the Container into which a `HVisible` component is placed, the size and location of the component will be controlled by the layout manager.

`HVisible` provides the following features for the use of subclasses:

- support for interaction states.
- a mechanism to associate the component with a pluggable `HLook` class to which all drawing is delegated.
- support for state-related content which is drawn by the associated `HLook`.
- support for scalable and alignable content.
- support for private look data.
- support for preferred sizes when used with a layout manager.
- control over the background painting behavior.
- a pluggable text layout management mechanism.

Some of these features are discussed in more detail below.

Interaction State

Interaction states for `HVisible` components are defined in the `HState` interface. The only interaction states valid for a plain (un-subclassed) `HVisible` are:

- `NORMAL_STATE` - indicating that the component is in its normal interaction state.
- `DISABLED_STATE` - indicating that the component is disabled. While this has no effect on user interaction with a plain `HVisible` (since there is no user interaction) it will affect the visual appearance.

Subclasses of `HVisible` may use other states. However, `setInteractionState(int)` is the only means by which state can be changed and will throw an `IllegalArgumentException` if the state is not valid for a particular component type. Subclasses of `HVisible` must not manipulate state in other ways.

The `getInteractionState()` method is provided to allow any class to read the current state of a component.

State-based content

Specific content may be set for any interaction state defined in `HState`, irrespective of whether the subclass of `HVisible` can ever be in that state.

Note that content is set on the various `STATE` constants defined in `HState`, and *not* on the `STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown by any method which takes a state as a parameter if a `STATE_BIT` rather than a `STATE` is passed.

By default it is possible to set content for any of eight discrete states. However, if no content has been set for a particular state, the associated `HLook` should use content from the nearest matching state as defined below:

State	Content if missing	Example style
<code>NORMAL_STATE</code>	none	no special style
<code>FOCUSED_STATE</code>	<code>NORMAL_STATE</code>	highlighted
<code>ACTIONED_STATE</code>	<code>FOCUSED_STATE</code>	pushed in
<code>ACTIONED_FOCUSED_STATE</code>	<code>FOCUSED_STATE</code>	highlighted & pushed in
<code>DISABLED_STATE</code>	<code>NORMAL_STATE</code>	grayed out
<code>DISABLED_FOCUSED_STATE</code>	<code>DISABLED_STATE</code>	grayed out & highlighted
<code>DISABLED_ACTIONED_STATE</code>	<code>ACTIONED_STATE</code>	grayed out & pushed in
<code>DISABLED_ACTIONED_FOCUSED_STATE</code>	<code>DISABLED_STATE</code>	grayed out & highlighted & pushed

It is recommended that `HLook` implementations be capable of drawing components in styles that allow the interaction state to be visually distinguished even when no content is set, or the content is the same for several states.

Most content is stored by reference, but text content is copied as `java.lang.String` objects are immutable.

Content for any component may be changed "on the fly" using the `setContent` methods. However, some components (e.g. `HStaticAnimation` and `HAnimation`) may be asynchronously referencing their content (i.e. through a separate implementation-specific animation thread). Therefore the following restrictions apply to the `setAnimateContent(Image[], int)` method when the instance of `HVisible` on which it is invoked implements the `HAnimateEffect` interface:

- The method must be synchronized with any implementation-specific animation thread such that content cannot be changed while a different thread is using it.
- If the animation was running the method should stop the animation in a synchronized manner before changing content.
- The method should reset the animation to a starting position defined by the current play mode. The repeat count of the animation should be reset to 0.
- If the animation was running the method should start the animation.

Alternative platform-specific animation schemes which do not use `HAnimateEffect` are outside the scope of this document. However, a similar strategy should be employed to avoid synchronization problems.

Content Scaling and Alignment

Where state-based content is used, it is an implementation option to support scaling of the content to fit the `HVisible`. Some looks also support alignment of content. See the class description of `HLook` for

details of which looks support scaling and alignment. See the fields description of this class for constants which can be used to specify scaling and alignment modes.

The following methods are used to get and set alignment of content:

- `setHorizontalAlignment(int)`
- `setVerticalAlignment(int)`
- `getHorizontalAlignment()`
- `getVerticalAlignment()`

The following methods are used to get and set the scaling of content. Scaling support is optional, however all implementations must support the `RESIZE_NONE` scaling mode. Platforms are *not* required to support scaling of textual content by default.

- `setResizeMode(int)`
- `getResizeMode()`
- Repaint Hints

An associated `HLook` provides a mechanism of efficiently repainting an `HVisible`, based on a hint which provides data about the change which triggered the redrawing. The `widgetChanged(HVisible, HChangeData[])` method should be called in preference to `repaint` whenever the `HVisible` requires a redraw to change its appearance.

The `widgetChanged(HVisible, HChangeData[])` method requires an array of one or more `HChangeData` objects, which contain a hint, and associated data. All keys are `java.lang.Integer` objects, with values defined as constants in this class. The following hints are defined:

Hint (key)	Data (value)	Data Interpretation
<code>TEXT_CONTENT_CHANGE</code>	<code>Object[9]</code>	[Integer <code>changedState</code> , String <code>oldNORMAL_STATEtext</code> , String <code>oldFOCUSED_STATEtext</code> , String <code>oldACTIONED_STATEtext</code> , String <code>oldACTIONED_FOCUSED_STATEtext</code> , String <code>oldDISABLED_STATEtext</code> , String <code>oldDISABLED_FOCUSED_STATEtext</code> , String <code>oldDISABLED_ACTIONED_STATEtext</code> , String <code>oldDISABLED_ACTIONED_FOCUSED_STATEtext</code>]
<code>GRAPHIC_CONTENT_CHANGE</code>	<code>Object[9]</code>	[Integer <code>changedState</code> , Image <code>oldNORMAL_STATEimage</code> , Image <code>oldFOCUSED_STATEimage</code> , Image <code>oldACTIONED_STATEimage</code> , Image <code>oldACTIONED_FOCUSED_STATEimage</code> , Image <code>oldDISABLED_STATEimage</code> , Image <code>oldDISABLED_FOCUSED_STATEimage</code> , Image <code>oldDISABLED_ACTIONED_STATEimage</code> , Image <code>oldDISABLED_ACTIONED_FOCUSED_STATEimage</code>]
<code>ANIMATE_CONTENT_CHANGE</code>	<code>Object[9]</code>	[Integer <code>changedState</code> , Image[] <code>oldNORMAL_STATEanimation</code> , Image[] <code>oldFOCUSED_STATEanimation</code> , Image[] <code>oldACTIONED_STATEanimation</code> , Image[] <code>oldACTIONED_FOCUSED_STATEanimation</code> , Image[] <code>oldDISABLED_STATEanimation</code> , Image[] <code>oldDISABLED_FOCUSED_STATEanimation</code> , Image[] <code>oldDISABLED_ACTIONED_STATEanimation</code> , Image[] <code>oldDISABLED_ACTIONED_FOCUSED_STATEanimation</code>]

CONTENT_CHANGE	Object[9]	[Integer changedState, Object oldNORMAL_STATEcontent, Object oldFOCUSED_STATEcontent, Object oldACTIONED_STATEcontent, Object oldACTIONED_FOCUSED_STATEcontent, Object oldDISABLED_STATEcontent, Object oldDISABLED_FOCUSED_STATEcontent, Object oldDISABLED_ACTIONED_STATEcontent, Object oldDISABLED_ACTIONED_FOCUSED_STATEcontent]
STATE_CHANGE	Integer	oldState
CARET_POSITION_CHANGE	Integer	oldPosition
ECHO_CHAR_CHANGE	Character	oldEcho
EDIT_MODE_CHANGE	Boolean	oldEditMode
MIN_MAX_CHANGE	Integer[2]	[oldMin, oldMax]
THUMB_OFFSETS_CHANGE	Integer[2]	[oldMin, oldMax]
ORIENTATION_CHANGE	Integer	oldOrientation
TEXT_VALUE_CHANGE	Integer	oldValue
ITEM_VALUE_CHANGE	Integer	oldValue
ADJUSTMENT_VALUE_CHANGE	Integer	oldIndex
LIST_CONTENT_CHANGE	HListElement[]	oldContent
LIST_ICONSIZING_CHANGE	Dimension	oldSize
LIST_LABELSIZING_CHANGE	Dimension	oldSize
LIST_MULTISELECTION_CHANGE	Boolean	oldSelection
LIST_SCROLLPOSITION_CHANGE	Integer	oldScrollPosition
UNKNOWN_CHANGE	Integer	UNKNOWN_CHANGE

Note that implementations of `HLook` may not actually implement more efficient drawing code for a given hint. In particular, simply repainting the entire `HVisible` is a valid implementation option.

The following code for the `setThumbOffsets(int, int)` method demonstrates how hint objects are used. Note that the values passed in the hint are always the *old* values, since the `HLook` can always retrieve the new values as needed from the `HVisible`. Variables starting with "my" are member variables of the class.

```

public void setThumbOffsets(int min, int max)
{
    int oldValue = myValue;
    HChangeData[] array = new HChangeData[1];
    array[0] = null;
    // valid argument checking elided
    // create hint object with the OLD values
    HChangeData d = new HChangeData(HVisible.MIN_MAX_CHANGE,
    new Integer[] { new Integer(myMin),
    new Integer(myMax) });
    // update the values
    myMin = min;
    myMax = max;

    // check bounds
    myValue = Math.min(myMin, Math.max(myMax, myValue));

    // create value hint if needed
    if (myValue != oldValue)
        array[0] = d;

    // tell the look to repaint as needed
    myLook.widgetChanged(this, array);
}

```

Private HLook data

Private data for the use of an associated `HLook` to optimize the redraw of the component may be set on any `HVisible`. Examples of such data are:

- cached bitmap representations of complex drawing operations
- scrolling metrics and positions
- cached layout data

Data is set using the `setLookData(Object, Object)` method, and retrieved with the `getLookData(Object)` method.

To keep the on-screen representation of an `HVisible` synchronized with its state, any class may call `setLookData(Object, Object)` with a parameter of `null` to invalidate any cached data. Instances of `HLook` must be able to regenerate any data they store on `HVisible` classes at any time. This mechanism is intended for implementation optimization only and shall not be used for storing content.

Use of this mechanism is an implementation option. If this mechanism is not used by an implementation, `getLookData(Object)` shall always return `null` and `setLookData(Object, Object)` shall do nothing. Interoperable systems shall not assume that this mechanism is implemented.

Preferred Sizes

The `setDefaultSize(Dimension)` and `getDefaultSize()` methods provide support for a user-defined default preferred size to be passed to a layout manager. This value is returned to the layout manager through the `getPreferredSize(HVisible)` method and if set overrides any look-specific value based on content calculated by the `HLook`.

Note that the interpretation of the size passed to `setDefaultSize(Dimension)` is *not* the overall size of the component, but the area available to the look to render the component into excluding any look-specific borders. Therefore when a layout manager is in use the *actual* size of the component is likely to be larger than this default size. See the descriptions of `getMinimumSize(HVisible)`, `getPreferredSize(HVisible)` and `getMaximumSize(HVisible)` in `HLook` for details of the exact algorithm used.

Note that constructors of `HVisible` and subclasses which accept `width` and `height` parameters shall set the default size to `[width, height]` as if these parameters were passed to `setDefaultSize(Dimension)`. If a layout manager is in use the actual size of the component will probably be larger than this size after layout due to the `HLook` adding borders. However, if no layout manager is used the `width` and `height` parameters are simply used to set the *actual* size of the component.

Background Painting

Normally the associated `HLook` does not paint the background of the `HVisible`, allowing for non-rectangular components and text overlaying bitmaps. However, `HVisible` provides for components which require their background to be painted through the `setBackgroundMode` method. Note that if the mode is set to `BACKGROUND_FILL` the return value of the `isOpaque()` method *may* be true, depending on whether the current background color of the `HVisible` is opaque. If the background mode is set to `NO_BACKGROUND_FILL` the `isOpaque()` method *must* return false.

Event Handling

While implementations of `HVisible` may enable certain `java.awt.AWTEvents`, applications should assume that an `HVisible` class does not generate or respond to any `java.awt.AWTEvents`. If this behavior is required the standard AWT mechanisms (i.e. `processEvent` and similar functions) may be used to handle events on `HVisible` or subclasses. However, it is strongly recommended that component implementors use the HAVi events defined in the `org.havi.ui.event` package where possible.

For example, a component wishing to respond to user action should normally subclass `HComponent`, implement the `HActionInputPreferred` interface and handle `HActionEvent` events in the `processHActionEvent(HActionEvent)` method, instead of overriding `java.awt.Component#processEvent` or similar. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
x	x-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
y	y-coordinate of top left hand corner of this component in pixels, relative to its parent container (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
width	width of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>
height	height of this component in pixels (subject to layout management).	---	<code>java.awt.Component#setBounds</code>	<code>java.awt.Component#getBounds</code>

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
Associated matte (<code>HMatte</code>).	none (i.e. <code>getMatte()</code> returns null)	<code>setMatte(HMatte)</code>	<code>getMatte()</code>
The text layout manager responsible for text formatting.	An <code>HDefaultTextLayoutManager</code> object.	<code>setTextLayoutManager(HTextLayoutManager)</code>	<code>getTextLayoutManager()</code>
The background painting mode	<code>NO_BACKGROUND_FILL</code>	<code>setBackgroundMode(int)</code>	<code>getBackgroundMode()</code>

The default preferred size	not set (i.e. null) unless specified by width and height parameters	<code>setDefaultSize(Dimension)</code>	<code>getDefaultSize()</code>
The horizontal content alignment	<code>HALIGN_CENTER</code>	<code>setHorizontalAlignment(int)</code>	<code>getHorizontalAlignment()</code>
The vertical content alignment	<code>VALIGN_CENTER</code>	<code>setVerticalAlignment(int)</code>	<code>getVerticalAlignment()</code>
The content scaling mode	<code>RESIZE_NONE</code>	<code>setResizeMode(int)</code>	<code>getResizeMode()</code>

Fields

ADJUSTMENT_VALUE_CHANGE

```
public static final int ADJUSTMENT_VALUE_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the value of an `HAdjustmentValue` component has changed. The value for this hint is a `java.lang.Integer` which contains the old index.

ANIMATE_CONTENT_CHANGE

```
public static final int ANIMATE_CONTENT_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the animated content has changed. The value for this hint is an array, `java.lang.Object[9]`, which contains the state for which the content changed (a `java.lang.Integer`) and the old content (a `java.awt.Image[]`) for all 8 states.

BACKGROUND_FILL

```
public static final int BACKGROUND_FILL
```

A constant for use with the `setBackgroundMode(int)` method of `HVisible` which indicates that an associated `HLook` should fill the bounding rectangle of the `HVisible` with its current background color before drawing any content. Any previous content will be erased during the repainting of the `HVisible`.

CARET_POSITION_CHANGE

```
public static final int CARET_POSITION_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the caret position has changed. The value for this hint is a `java.lang.Integer` which has the value of the old caret position.

CONTENT_CHANGE

```
public static final int CONTENT_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the miscellaneous content has changed. The value for this hint is an array, `java.lang.Object[9]`, which contains the state for which the content changed (a `java.lang.Integer`) and the old content (a `java.lang.Object`) for all 8 states.

ECHO_CHAR_CHANGE

```
public static final int ECHO_CHAR_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the echo character has changed. The value for this hint is a `java.lang.Character` which has the value of the old echo character.

EDIT_MODE_CHANGE

```
public static final int EDIT_MODE_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the editing mode has changed. The value for this hint is a `java.lang.Boolean` which has the value of the old edit mode.

FIRST_CHANGE

```
public static final int FIRST_CHANGE
```

A constant which indicates the first change value for use with the hinting mechanism.

GRAPHIC_CONTENT_CHANGE

```
public static final int GRAPHIC_CONTENT_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the graphical content has changed. The value for this hint is an array, `java.lang.Object[9]`, which contains the state for which the content changed (a `java.lang.Integer`) and the old content (a `java.awt.Image`) for all 8 states.

HALIGN_CENTER

```
public static final int HALIGN_CENTER
```

A constant for use with the `setHorizontalAlignment(int)` method of `HVisible` which indicates that content should be centered horizontally.

HALIGN_JUSTIFY

```
public static final int HALIGN_JUSTIFY
```

A constant for use with the `setHorizontalAlignment(int)` method of `HVisible` which indicates that content should be fully justified (horizontally).

HALIGN_LEFT

```
public static final int HALIGN_LEFT
```

A constant for use with the `setHorizontalAlignment(int)` method of `HVisible` which indicates that content should be left aligned.

HALIGN_RIGHT

```
public static final int HALIGN_RIGHT
```

A constant for use with the `setHorizontalAlignment(int)` method of `HVisible` which indicates that content should be right aligned.

ITEM_VALUE_CHANGE

```
public static final int ITEM_VALUE_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the value of an `HItemValue` component has changed. The value for this hint is a `java.lang.Integer` which contains the old value.

LAST_CHANGE

```
public static final int LAST_CHANGE
```

A constant which indicates the last defined value for use with the hinting mechanism.

LIST_CONTENT_CHANGE

```
public static final int LIST_CONTENT_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the content of an `HListGroup` component has changed. The value for this hint is a `java.lang.Integer` which contains the old content.

LIST_ICONSIZING_CHANGE

```
public static final int LIST_ICONSIZING_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the iconsize of an `HListGroup` component has changed. The value for this hint is a `java.lang.Integer` which contains the old size.

LIST_LABELSIZING_CHANGE

```
public static final int LIST_LABELSIZING_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the labelsize of an `HListGroup` component has changed. The value for this hint is a `java.lang.Integer` which contains the old size.

LIST_MULTISELECTION_CHANGE

```
public static final int LIST_MULTISELECTION_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the multiselection setting of an `HListGroup` component has changed. The value for this hint is a `java.lang.Integer` which contains the old setting.

LIST_SCROLLPOSITION_CHANGE

```
public static final int LIST_SCROLLPOSITION_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the scrollposition of an `HListGroup` component has changed. The value for this hint is a `java.lang.Integer` which contains the old position.

MIN_MAX_CHANGE

```
public static final int MIN_MAX_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the range of an `HAdjustmentValue` component has changed. The value for this hint is an array, `java.lang.Object[2]`, which contains the old minimum and maximum extents of the range as `java.lang.Integer`.

NO_BACKGROUND_FILL

```
public static final int NO_BACKGROUND_FILL
```

A constant for use with the `setBackgroundMode(int)` method of `HVisible` which indicates that an associated `HLook` should not fill the bounding rectangle of the `HVisible` with its current background color before drawing any content. Therefore any previous content will NOT necessarily be erased during the repainting of the `HVisible`.

NO_DEFAULT_HEIGHT

```
public static final int NO_DEFAULT_HEIGHT
```

A constant for use with the `setDefaultSize(Dimension)` and `getDefaultSize()` methods of `HVisible` which indicates that no default height is desired for the `HVisible`.

NO_DEFAULT_SIZE

```
public static final java.awt.Dimension NO_DEFAULT_SIZE
```

A constant for use with the `setDefaultSize(Dimension)` and `getDefaultSize()` methods of `HVisible` which indicates that no default size is desired for the `HVisible`.

NO_DEFAULT_WIDTH

```
public static final int NO_DEFAULT_WIDTH
```

A constant for use with the `setDefaultSize(Dimension)` and `getDefaultSize()` methods of `HVisible` which indicates that no default width is desired for the `HVisible`.

ORIENTATION_CHANGE

```
public static final int ORIENTATION_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the orientation of an `HOrientable` component has changed. The value for this hint is a `java.lang.Integer` which has the value of the old orientation.

RESIZE_ARBITRARY

```
public static final int RESIZE_ARBITRARY
```

A constant for use with the `setResizeMode(int)` method of `HVisible` which indicates that content should be scaled to fit the component. Aspect ratios of the content need not be preserved.

RESIZE_NONE

```
public static final int RESIZE_NONE
```

A constant for use with the `setResizeMode(int)` method of `HVisible` which indicates that content should not be scaled to fit the component.

RESIZE_PRESERVE_ASPECT

```
public static final int RESIZE_PRESERVE_ASPECT
```

A constant for use with the `setResizeMode(int)` method of `HVisible` which indicates that content should be scaled to fit the component while preserving the aspect ratio of the content. Areas of the component that are not filled by the content will be look dependent.

STATE_CHANGE

```
public static final int STATE_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the interaction state has changed. The value for this hint is a `java.lang.Integer` which has the value of the old state.

TEXT_CONTENT_CHANGE

```
public static final int TEXT_CONTENT_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the text content has changed. The value for this hint is an array, `java.lang.Object[9]`, which contains the state for which the content changed (a `java.lang.Integer`) and the old content (a `java.lang.String`) for all 8 states.

TEXT_VALUE_CHANGE

```
public static final int TEXT_VALUE_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the value of an `HTextValue` component has changed. The value for this hint is a `java.lang.Integer` which contains the old value.

THUMB_OFFSETS_CHANGE

```
public static final int THUMB_OFFSETS_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that the thumb offsets of an `HAdjustmentValue` component have changed. The value for this hint is an array, `java.lang.Object[2]`, which contains the old minimum and maximum thumb offsets as `java.lang.Integer`.

UNKNOWN_CHANGE

```
public static final int UNKNOWN_CHANGE
```

A constant for use with the hinting mechanism (see the `widgetChanged(HVisible, HChangeData[])` method in `HLook`). This hint indicates that some unspecified change has occurred. The value for this hint is a `java.lang.Integer` which also has the value `UNKNOWN_CHANGE`.

VALIGN_BOTTOM

```
public static final int VALIGN_BOTTOM
```

A constant for use with the `setVerticalAlignment(int)` method of `HVisible` which indicates that content should be vertically aligned to the bottom of the component.

VALIGN_CENTER

```
public static final int VALIGN_CENTER
```

A constant for use with the `setVerticalAlignment(int)` method of `HVisible` which indicates that content should be centered vertically.

VALIGN_JUSTIFY

```
public static final int VALIGN_JUSTIFY
```

A constant for use with the `setVerticalAlignment(int)` method of `HVisible` which indicates that content should be fully justified (vertically).

VALIGN_TOP

```
public static final int VALIGN_TOP
```

A constant for use with the `setVerticalAlignment(int)` method of `HVisible` which indicates that content should be vertically aligned to the top of the component.

Constructors

HVisible()

```
public HVisible()
```

Creates an `HVisible` component with no `HLook`. See the class description for details of constructor parameters and default values.

HVisible(HLook)

```
public HVisible(HLook hlook)
```

Creates an `HVisible` component with the given `HLook`. See the class description for details of constructor parameters and default values.

Parameters:

`hlook` - The `HLook` associated with the `HVisible` component.

HVisible(HLook, int, int, int, int)

```
public HVisible(HLook hlook, int x, int y, int width, int height)
```

Creates an `HVisible` component with the given `HLook` and the specified location and size. See the class description for details of constructor parameters and default values.

Parameters:

`hlook` - The `HLook` associated with the `HVisible` component.

`x` - the x-coordinate of the `HVisible` component within its Container.

`y` - the y-coordinate of the `HVisible` component within its Container.

`width` - the width of the `HVisible` component in pixels.

`height` - the height of the `HVisible` component in pixels.

Methods

getAnimateContent(int)

```
public java.awt.Image[] getAnimateContent(int state)
```

Gets the animate content for this component.

Parameters:

`state` - The state for which content is to be retrieved. Note that content is set on the `XXX_STATE` constants defined in `HState`, and *not* on the `XXX_STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

Returns:

The animate content associated with the specified state. If no animate content has been set for the specified state, then `null` is returned.

getBackgroundMode()

```
public int getBackgroundMode()
```

Get the background mode of this `HVisible`. The return value specifies how the look should draw the background (i.e. a rectangle filling the bounds of the `HVisible`).

Returns:

one of `NO_BACKGROUND_FILL` or `BACKGROUND_FILL`.

getContent(int)

```
public java.lang.Object getContent(int state)
```

Gets the content for this component.

Parameters:

`state` - The state for which content is to be retrieved. Note that content is set on the `XXX_STATE` constants defined in `HState`, and *not* on the `XXX_STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

Returns:

The content associated with the specified state. If no content has been set for the specified state, then `null` is returned.

getDefaultSize()

```
public java.awt.Dimension getDefaultSize()
```

Returns the default preferred size to be used for this component when a layout manager is in use. If no default size has been set using the `setDefaultSize(Dimension)` method `NO_DEFAULT_SIZE` is returned.

If the parent Container into which the `HVisible` is placed has no layout manager the default preferred size has no effect.

The default size of a component is to be interpreted as the area in which the component can be rendered, *excluding* look-specific borders.

Returns:

the default preferred size to be used for this component when a layout manager is in use.

getGraphicContent(int)

```
public java.awt.Image getGraphicContent(int state)
```

Gets the graphic content for this component.

Parameters:

`state` - The state for which content is to be retrieved. Note that content is set on the `XXX_STATE` constants defined in `HState`, and *not* on the `XXX_STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

Returns:

The graphical content associated with the specified state. If no graphical content has been set for the specified state, then `null` is returned.

getHorizontalAlignment()

```
public int getHorizontalAlignment()
```

Get the horizontal alignment of any state-based content rendered by an associated `HLook`. If content is not used in the rendering of this `HVisible` the value returned shall be valid, but has no affect on the rendered representation.

Returns:

the current horizontal alignment mode, one of `HALIGN_LEFT`, `HALIGN_CENTER`, `HALIGN_RIGHT` or `HALIGN_JUSTIFY`.

getInteractionState()

```
public int getInteractionState()
```

Return the interaction state the component is currently in.

Returns:

the interaction state the component is currently in.

See Also:

[HState](#)

getLook()

```
public HLook getLook()
```

Gets the [HLook](#) for this component.

Returns:

the [HLook](#) that is being used by this component - if no [HLook](#) has been set, then returns null.

getLookData(Object)

```
public java.lang.Object getLookData(java.lang.Object key)
```

Retrieve a look-specific private data object. Instances of [HLook](#) may use this method to retrieve private data (e.g. layout hints, cached images etc.) from the [HVisible](#). Use of this mechanism is an implementation option. If this mechanism is not used by an implementation, or no data has been set for the specified key this method returns null.

Parameters:

key - an object which uniquely identifies the type of look for which the private data is to be retrieved. Keys need not be unique across different instances of the same look class.

Returns:

a private data object as previously set using `setLookData(Object, Object)`, or null.

See Also:

[HLook](#), `setLookData(Object, Object)`

getMaximumSize()

```
public java.awt.Dimension getMaximumSize()
```

Gets the maximum size of the [HVisible](#). The `getMaximumSize` method of the [HLook](#) that is associated with this [HVisible](#) will be called to calculate the dimensions.

Overrides:

`java.awt.Component.getMaximumSize()` in class `java.awt.Component`

Returns:

A dimension object indicating this [HVisible](#)'s maximum size - if no [HLook](#) has been associated with the [HVisible](#), then the current [HVisible](#) dimensions as determined with `getSize` will be returned.

See Also:

`getMaximumSize(HVisible)`

getMinimumSize()

```
public java.awt.Dimension getMinimumSize()
```

Gets the minimum size of the [HVisible](#). The `getMinimumSize` method of the [HLook](#) that is associated with this [HVisible](#) will be called to calculate the dimensions.

Overrides:

`java.awt.Component.getMinimumSize()` in class `java.awt.Component`

Returns:

A dimension object indicating this `HVisible` 's minimum size - if no `HLook` has been associated with the `HVisible` , then the current `HVisible` dimensions as determined with `getSize` will be returned.

See Also:

`getMinimumSize(HVisible)`

getPreferredSize()

```
public java.awt.Dimension getPreferredSize()
```

Gets the preferred size of the `HVisible` . The `getPreferredSize` method of the `HLook` that is associated with this `HVisible` will be called to calculate the dimensions.

Overrides:

`java.awt.Component.getPreferredSize()` in class `java.awt.Component`

Returns:

A dimension object indicating this `HVisible` 's preferred size - if no `HLook` has been associated with the `HVisible` , then the current `HVisible` dimensions as determined with `getSize` will be returned.

See Also:

`getPreferredSize(HVisible)`

getResizeMode()

```
public int getResizeMode()
```

Get the scaling mode for scaling any state-based content rendered by an associated `HLook` . If content is not used in the rendering of this `HVisible` the value returned shall be valid, but has no affect on the rendered representation.

Returns:

the current scaling mode, one of `RESIZE_NONE` , `RESIZE_PRESERVE_ASPECT` or `RESIZE_ARBITRARY`

getTextContent(int)

```
public java.lang.String getTextContent(int state)
```

Gets the text content for this component.

Parameters:

`state` - The state for which content is to be retrieved. Note that content is set on the `XXX_STATE` constants defined in `HState` , and *not* on the `XXX_STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

Returns:

The text content associated with the specified state. If no text content has been set for the specified state, then `null` is returned.

getTextLayoutManager()

```
public HTextLayoutManager getTextLayoutManager()
```

Gets the text layout manager that is being used to layout this text.

Returns:

The `HTextLayoutManager` that is being used by this component.

getVerticalAlignment()

```
public int getVerticalAlignment()
```

Get the vertical alignment of any state-based content rendered by an associated `HLook`. If content is not used in the rendering of this `HVisible` the value returned shall be valid, but has no affect on the rendered representation.

Returns:

the current vertical alignment mode, one of `VALIGN_TOP`, `VALIGN_CENTER`, `VALIGN_BOTTOM` or `VALIGN_JUSTIFY`.

isFocusTraversable()

```
public boolean isFocusTraversable()
```

By default an `HVisible` component is not focus-traversable.

Overrides:

`java.awt.Component.isFocusTraversable()` in class `java.awt.Component`

Returns:

false

See Also:

`java.awt.Component.isFocusTraversable()`

isOpaque()

```
public boolean isOpaque()
```

Returns true if the entire `HVisible` area, as given by the `java.awt.Component#getBounds` method, is fully opaque, i.e. its `HLook` guarantees that all pixels are painted in an opaque `Color`.

This method will call the `isOpaque(HVisible)` method of an associated `HLook` if one is set. If no `HLook` is associated this method returns false.

The default return value is implementation specific and depends on the background painting mode of the given `HVisible`. The consequences of an invalid overridden value are implementation specific.

Specified By:

`isOpaque()` in interface `TestOpacity`

Overrides:

`isOpaque()` in class `HComponent`

Returns:

true if all the pixels with the `java.awt.Component#getBounds` method are fully opaque, i.e. its associated `HLook` guarantees that all pixels are painted in an opaque `Color`.

paint(Graphics)

```
public void paint(java.awt.Graphics g)
```

Draws the current state of the component, by calling the `showLook(Graphics, HVisible, int)` method of the associated `HLook`. If no `HLook` is associated with the component, (i.e. the `HVisible` was created with a null `HLook` or the look has been set to null using `setLook(HLook)`) then the paint method should do nothing. This mechanism may be used for components that wish to extend `HVisible`, and override the paint method, without supporting the `HLook` interface.

Overrides:

java.awt.Component.paint(java.awt.Graphics) in class java.awt.Component

Parameters:

g - the graphics context to use for painting.

setAnimateContent(Image[], int)

```
public void setAnimateContent(java.awt.Image[] imageArray, int state)
```

Sets an array of graphical content (primarily used for animation), per state. Different (single arrays of) content can be associated with the different states of a component.

Note that the content is not copied, merely its object reference.

If the `HVisible` has an associated `HLook`, then it should repaint itself.

Parameters:

`imageArray` - An array of images that make up the animation. If the array is null, then any currently assigned content shall be removed for the specified state.

`state` - The state of the component for which this content should be displayed. Note that content is set on the `XXX_STATE` constants defined in `HState`, and *not* on the `XXX_STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

setBackgroundMode(int)

```
public void setBackgroundMode(int mode)
```

Set the background drawing mode. The value specifies how the look should draw the background (i.e. a rectangle filling the bounds of the `HVisible`).

Parameters:

`mode` - one of `NO_BACKGROUND_FILL` or `BACKGROUND_FILL`

setContent(Object, int)

```
public void setContent(java.lang.Object object, int state)
```

Sets a single piece of content for this component, per state. Different (single pieces of) content can be associated with the different states of a component.

Note that the content is not copied, merely its object reference.

If the `HVisible` has an associated `HLook`, then it should repaint itself.

Parameters:

`object` - The content. If the content is null, then any currently assigned content shall be removed for the specified state.

`state` - The state of the component for which this content should be displayed. Note that content is set on the `XXX_STATE` constants defined in `HState`, and *not* on the `XXX_STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

setDefaultSize(Dimension)

```
public void setDefaultSize(java.awt.Dimension defaultSize)
```

Set the preferred default size for this component when a layout manager is in use. If the parent Container into which the `HVisible` is placed has no layout manager this method has no effect.

Note that the size set with this method is not a *guaranteed* size; if set it will be passed to the layout manager through the `getPreferredSize(HVisible)` method. The default size of a component is to be interpreted as the area in which the component can be rendered, *excluding* look-specific borders.

Valid arguments include `NO_DEFAULT_SIZE`, and Dimensions containing `NO_DEFAULT_WIDTH` or `NO_DEFAULT_HEIGHT`

Parameters:

`defaultSize` - specifies the default preferred size. If this parameter is null a `java.lang.NullPointerException` will be thrown.

If this parameter or specifies a size smaller than an implementation-defined minimum size a `java.lang.IllegalArgumentException` will be thrown.

setGraphicContent(Image, int)

```
public void setGraphicContent(java.awt.Image image, int state)
```

Sets a single piece of graphical content for this component, per state. Different (single pieces of) content can be associated with the different states of a component.

Note that the content is not copied, merely its object reference.

If the `HVisible` has an associated `HLook`, then it should repaint itself.

Parameters:

`image` - The content. If the content is null, then any currently assigned content shall be removed for the specified state.

`state` - The state of the component for which this content should be displayed. Note that content is set on the `XXX_STATE` constants defined in `HState`, and *not* on the `XXX_STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

setHorizontalAlignment(int)

```
public void setHorizontalAlignment(int halign)
```

Set the horizontal alignment of any state-based content rendered by an associated `HLook`. If content is not used in the rendering of this `HVisible` calls to this method shall change the current alignment mode, but this will not affect the rendered representation.

Parameters:

`halign` - the new horizontal alignment mode, one of `HALIGN_LEFT`, `HALIGN_CENTER`, `HALIGN_RIGHT` or `HALIGN_JUSTIFY`.

setInteractionState(int)

```
protected void setInteractionState(int state)
```

Set the interaction state for this component. This method is provided for the use by subclasses of `HVisible` to change the interaction state of the `HVisible`. Subclasses *MUST NOT* manipulate the state by any other mechanism.

Attempts to set states which are not valid for the subclass will cause an `java.lang.IllegalArgumentException` to be thrown. See the class descriptions of each component for the definitions of which states are valid.

Parameters:

`state` - the interaction state for this component. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

See Also:

[HState](#)

setLook(HLook)

```
public void setLook(HLook hlook)
```

Sets the `HLook` for this component.

Parameters:

`hlook` - The `HLook` that is to be used for this component. Note that this parameter may be null, in which case the component will not draw itself until a look is set.

Throws:

`HInvalidLookException` - If the Look is not compatible with this type of component, for example a graphic look being set on a text component, an `HInvalidLookException` is thrown. Note that `HVisible` itself will never throw this exception, but it may be thrown by a subclass which has overridden this method.

setLookData(Object, Object)

```
public void setLookData(java.lang.Object key, java.lang.Object data)
```

Set a look-specific private data object. Instances of `HLook` may use this method to set private data (e.g. layout hints, cached images etc.) on the `HVisible`. Use of this mechanism is an implementation option. If this mechanism is not used by an implementation, this method will have no effect and calls to `getLookData(Object)` shall return `null`.

Parameters:

`key` - an object which uniquely identifies the type of look for which the private data is to be retrieved. Keys need not be unique across different instances of the same look class.

`data` - a private data object, or null to remove any current object set on this `HVisible`.

See Also:

[HLook](#), [getLookData\(Object\)](#)

setResizeMode(int)

```
public void setResizeMode(int resize)
```

Set the scaling mode for scaling any state-based content rendered by an associated `HLook`. If content is not used in the rendering of this `HVisible` calls to this method shall change the current alignment mode, but this will not affect the rendered representation.

Parameters:

`resize` - the new scaling mode, one of `RESIZE_NONE`, `RESIZE_PRESERVE_ASPECT` or `RESIZE_ARBITRARY`

setTextContent(String, int)

```
public void setTextContent(java.lang.String string, int state)
```

Sets a single piece of text content for this component, per state. Different (single pieces of) content can be associated with the different states of a component. Note that unlike `setGraphicContent(Image, int)`, `setAnimateContent(Image[], int)` and

`setContent(Object, int)` , the content is copied as it is not possible to store a reference to a `java.lang.String`.

If the `HVisible` has an associated `HLook` , then it should repaint itself.

Parameters:

`string` - The content. If the content is null, then any currently assigned content shall be removed for the specified state.

`state` - The state of the component for which this content should be displayed. Note that content is set on the `XXX_STATE` constants defined in `HState` , and *not* on the `XXX_STATE_BIT` constants. A `java.lang.IllegalArgumentException` will be thrown if a `STATE_BIT` rather than a `STATE` is passed.

setTextLayoutManager(HTextLayoutManager)

```
public void setTextLayoutManager(HTextLayoutManager manager)
```

Sets the text layout manager that should be used to layout the text for this component.

Parameters:

`manager` - the `HTextLayoutManager` to be used by this component.

setVerticalAlignment(int)

```
public void setVerticalAlignment(int valign)
```

Set the vertical alignment of any state-based content rendered by an associated `HLook` . If content is not used in the rendering of this `HVisible` calls to this method shall change the current alignment mode, but this will not affect the rendered representation.

Parameters:

`valign` - the new vertical alignment mode, one of `VALIGN_TOP` , `VALIGN_CENTER` , `VALIGN_BOTTOM` or `VALIGN_JUSTIFY` .

update(Graphics)

```
public void update(java.awt.Graphics g)
```

The `update()` method in `HVisible` overrides that in `Component` and does not clear the background of the component, it simply modifies the current `Color` of the `Graphics` object to match that of the components background `Color`, and calls the `paint()` method.

Overrides:

`java.awt.Component.update(java.awt.Graphics)` in class `java.awt.Component`

Parameters:

`g` - the graphics context to use for updating.

Package org.havi.ui.event

Class Summary	
Interfaces	
<code>HActionListener</code>	The <code>HActionListener</code> interface enables the reception of <code>HActionEvent</code> events, as generated by objects implementing <code>HActionable</code> .
<code>HAdjustmentListener</code>	The <code>HAdjustmentListener</code> interface enables the reception of <code>HAdjustmentEvent</code> , as generated by objects implementing <code>HAdjustmentValue</code> .
<code>HBackgroundImageListener</code>	The listener interface for receiving events related to <code>HBackgroundImage</code> objects.
<code>HFocusListener</code>	The <code>HFocusListener</code> interface enables the reception of <code>HFocusEvent</code> events, as generated by objects implementing <code>HNavigable</code> .
<code>HItemListener</code>	The <code>HItemListener</code> interface enables the reception of <code>HItemEvent</code> , as generated by objects implementing <code>HItemValue</code> .
<code>HKeyListener</code>	The <code>HKeyListener</code> interface enables the reception of <code>HKeyEvent</code> events.
<code>HScreenConfigurationListener</code>	This listener is used to monitor when the configuration of an <code>HScreenDevice</code> is modified.
<code>HScreenLocationModifiedListener</code>	This listener is used to monitor when a component, such as an <code>HVideoComponent</code> on-screen location is modified.
<code>HTextListener</code>	The <code>HTextListener</code> interface enables the reception of <code>HTextEvent</code> , as generated by objects implementing <code>HTextValue</code> .
Classes	
<code>HActionEvent</code>	An <code>HActionEvent</code> event is used to interact with a component implementing the <code>HActionInputPreferred</code> interface as follows:
<code>HAdjustmentEvent</code>	An <code>HAdjustmentEvent</code> event is used to interact with a component implementing the <code>HAdjustmentValue</code> interface as follows:
<code>HBackgroundImageEvent</code>	This event informs an application that a loading operation for an <code>HBackgroundImage</code> has finished.
<code>HEventRepresentation</code>	This class is able to describe the representation of an event generator as a string, color or symbol (such as a triangle, '>', for 'play').
<code>HFocusEvent</code>	An <code>HFocusEvent</code> event is used to interact with a component implementing the <code>HNavigationInputPreferred</code> interface as follows:
<code>HItemEvent</code>	An <code>HItemEvent</code> event is used to interact with a component implementing the <code>HSelectionInputPreferred</code> interface as follows:
<code>HKeyCapabilities</code>	This class is used to describe the (basic) keyboard capabilities of the platform.
<code>HKeyEvent</code>	An <code>HKeyEvent</code> event is used to interact with a component implementing the <code>HKeyboardInputPreferred</code> interface as follows:
<code>HMouseCapabilities</code>	This class is used to describe the (basic) mouse capabilities of the platform.
<code>HRcCapabilities</code>	This class is used to describe the (basic) remote control capabilities of the platform.
<code>HRcEvent</code>	The remote control event class.

Class Summary	
<code>HScreenConfigurationEvent</code>	This event is sent to all registered <code>HScreenConfigurationListener</code> when an <code>HScreenDevice</code> modifies its configuration.
<code>HScreenDeviceReleasedEvent</code>	This event informs an application that a device for this <code>HScreen</code> has been released by an application or other entity in the system.
<code>HScreenDeviceReservedEvent</code>	This event informs that a device on this <code>HScreen</code> has been reserved by an application or other entity in the system.
<code>HScreenLocationModifiedEvent</code>	This event is generated by the system when a component is moved on-screen, rather than within a container.
<code>HTextEvent</code>	An <code>HTextEvent</code> event is used to interact with a component implementing the <code>HKeyboardInputPreferred</code> interface as follows:

org.havi.ui.event HActionEvent

Syntax

```
public class HActionEvent extends java.awt.event.ActionEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--java.awt.AWTEvent
|
+--java.awt.event.ActionEvent
|
+--org.havi.ui.event.HActionEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

An `HActionEvent` event is used to interact with a component implementing the `HActionInputPreferred` interface as follows:

- An `HActionEvent` event may be sent from the HAVi system to the component to cause the component to become actioned.
- An `HActionEvent` event is sent from the component to all registered `HActionListener` whenever the component is actioned.

All interoperable HAVi components which expect to receive `HActionEvent` events must implement the `HActionInputPreferred` interface.

Constructors

HActionEvent(HActionable, int, String)

```
public HActionEvent(HActionable source, int id, java.lang.String command)
```

Constructs an `HActionEvent`.

Parameters:

`source` - The `HActionable` component which has been actioned.

`id` - The event id of the `HActionEvent` generated by the `HActionable` component. This is the value that will be returned by the event object's `getID` method.

`command` - A String which is used as the action command string for this event.

Methods

getActionCommand()

```
public java.lang.String getActionCommand()
```

Retrieve the action command string associated with this event.

Overrides:

java.awt.event.ActionEvent.getActionCommand() in class java.awt.event.ActionEvent

Returns:

the String which was used as the action command string when this event was constructed.

getModifiers()

```
public int getModifiers()
```

Returns any modifiers held down during this action event.

Modifiers are not used with the HAVi platform. Interoperable HAVi applications shall not use the return value of this method.

Overrides:

java.awt.event.ActionEvent.getModifiers() in class java.awt.event.ActionEvent

Returns:

an implementation-specific value.

org.havi.ui.event HActionListener

Syntax

```
public interface HActionListener extends java.awt.event.ActionListener
```

All Superinterfaces:

java.awt.event.ActionListener, java.util.EventListener

All Known Implementing Classes:

HEventMulticaster

Description

The `HActionListener` interface enables the reception of `HActionEvent` events, as generated by objects implementing `HActionable`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

org.havi.ui.event HAdjustmentEvent

Syntax

```
public class HAdjustmentEvent extends java.awt.AWTEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--java.awt.AWTEvent
|
+--org.havi.ui.event.HAdjustmentEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

An `HAdjustmentEvent` event is used to interact with a component implementing the `HAdjustmentValue` interface as follows:

- An `HAdjustmentEvent` event may be sent from the HAVi system to the component to cause a change to the value or editable mode of the component as a result of user interaction. For example, this event may be generated by a virtual keyboard user interface on a platform which lacks suitable adjustment keys.
- An `HAdjustmentEvent` event is sent from the component to all registered `HAdjustmentListener` when a change to the value or editable mode of the component occurs.

All interoperable HAVi components which expect to receive `HAdjustmentEvent` events should also implement the `HAdjustmentInputPreferred` interface. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Fields

ADJUST_END_CHANGE

```
public static final int ADJUST_END_CHANGE
```

An adjustment event with this id indicates that the value of an `HAdjustmentValue` component has been finally set. This event is sent when the user causes the component to leave its editable mode. Note that it is a platform specific implementation option for such components to leave editable mode

automatically e.g. when they lose input focus. In such a case the order in which the `HFocusEvent` and `HAdjustmentEvent` are sent is platform specific.

See Also:

`getAdjustMode()`

ADJUST_FIRST

```
public static final int ADJUST_FIRST
```

The first integer id in the range of event ids supported by the `HAdjustmentEvent` class.

ADJUST_LAST

```
public static final int ADJUST_LAST
```

The last integer id in the range of event ids supported by the `HAdjustmentEvent` class.

ADJUST_LESS

```
public static final int ADJUST_LESS
```

An adjustment event with this id is sent whenever the value of an `HAdjustmentValue` component is decreased by one unit.

See Also:

`setUnitIncrement(int)`, `getUnitIncrement()`

ADJUST_MORE

```
public static final int ADJUST_MORE
```

An adjustment event with this id is sent whenever the value of an `HAdjustmentValue` component is increased by one unit.

See Also:

`setUnitIncrement(int)`, `getUnitIncrement()`

ADJUST_PAGE_LESS

```
public static final int ADJUST_PAGE_LESS
```

An adjustment event with this id is sent whenever the value of an `HAdjustmentValue` component is decreased by one block.

See Also:

`setBlockIncrement(int)`, `getBlockIncrement()`

ADJUST_PAGE_MORE

```
public static final int ADJUST_PAGE_MORE
```

An adjustment change event with this id is sent whenever the value of an `HAdjustmentValue` component is increased by one block.

See Also:

`setBlockIncrement(int)`, `getBlockIncrement()`

ADJUST_START_CHANGE

```
public static final int ADJUST_START_CHANGE
```

An adjustment event with this id indicates that the value of an `HAdjustmentValue` component may be about to change. This event is sent when the user causes the component to enter its editable mode. Note that it is a platform specific implementation option for such components to enter editable mode automatically e.g. when they receive input focus. In such a case the order in which the `HFocusEvent` and `HAdjustmentEvent` are sent is platform specific.

See Also:

```
getAdjustMode()
```

Constructors

HAdjustmentEvent(HAdjustmentValue, int)

```
public HAdjustmentEvent(HAdjustmentValue source, int id)
```

Constructs an `HAdjustmentEvent`.

Parameters:

`source` - The `HAdjustmentValue` component whose value has been modified.

`id` - The event id of the `HAdjustmentEvent` generated by the `HAdjustmentValue` component. This is the value that will be returned by the event object's `getID` method.

org.havi.ui.event HAdjustmentListener

Syntax

```
public interface HAdjustmentListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

All Known Implementing Classes:

HEventMulticaster

Description

The `HAdjustmentListener` interface enables the reception of `HAdjustmentEvent`, as generated by objects implementing `HAdjustmentValue`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

Methods

valueChanged(HAdjustmentEvent)

```
public void valueChanged(HAdjustmentEvent e)
```

Called when the value of the component has started to be changed, is changed, or has finished changing.

Parameters:

`e` - is the `HAdjustmentEvent` generated by the object implementing `HAdjustmentValue`.

org.havi.ui.event HBackgroundImageEvent

Syntax

```
public class HBackgroundImageEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.havi.ui.event.HBackgroundImageEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event informs an application that a loading operation for an [HBackgroundImage](#) has finished. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Fields

BACKGROUNDIMAGE_FILE_NOT_FOUND

```
public static final int BACKGROUNDIMAGE_FILE_NOT_FOUND
```

The loading failed before attempting to load any data from the file. e.g. the file not existing or due to a badly formed or otherwise broken filename

BACKGROUNDIMAGE_FIRST

```
public static final int BACKGROUNDIMAGE_FIRST
```

Marks the first integer for the range of background image events

BACKGROUNDIMAGE_INVALID

```
public static final int BACKGROUNDIMAGE_INVALID
```

The loading failed because the data loaded is not valid. e.g. not a supported coding format for background images.

BACKGROUNDIMAGE_IOERROR

```
public static final int BACKGROUNDIMAGE_IOERROR
```

The loading failed due to an error while loading the data. e.g. the file is not accessible or loading of it was interrupted

BACKGROUNDIMAGE_LAST

```
public static final int BACKGROUNDIMAGE_LAST
```

Marks the last integer for the range of background image events

BACKGROUNDIMAGE_LOADED

```
public static final int BACKGROUNDIMAGE_LOADED
```

The loading succeeded

Constructors

HBackgroundImageEvent(Object, int)

```
public HBackgroundImageEvent(java.lang.Object source, int id)
```

Constructs a new `HBackgroundImageEvent`.

Parameters:

`source` - the `HBackgroundImage` which has been loaded.

`id` - the type of event (one of `BACKGROUNDIMAGE_LOADED`, `BACKGROUNDIMAGE_FILE_NOT_FOUND`, `BACKGROUNDIMAGE_IOERROR` or `BACKGROUNDIMAGE_INVALID`).

Methods

getID()

```
public int getID()
```

Returns the type for this event.

Returns:

the event type (one of `BACKGROUNDIMAGE_LOADED`, `BACKGROUNDIMAGE_FILE_NOT_FOUND`, `BACKGROUNDIMAGE_IOERROR` or `BACKGROUNDIMAGE_INVALID`).

getSource()

```
public java.lang.Object getSource()
```

Returns the `HBackgroundImage` for which the data has been loaded.

Overrides:

java.util.EventObject.getSource() in class java.util.EventObject

Returns:

the object which has been loaded.

org.havi.ui.event

HBackgroundImageListener

Syntax

```
public interface HBackgroundImageListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

All Known Implementing Classes:

`HEventMulticaster`

Description

The listener interface for receiving events related to `HBackgroundImage` objects.

Methods

imageLoaded(HBackgroundImageEvent)

```
public void imageLoaded(HBackgroundImageEvent e)
```

Invoked when the data for an `HBackgroundImage` has been loaded.

Parameters:

e - the event describing the loading

imageLoadFailed(HBackgroundImageEvent)

```
public void imageLoadFailed(HBackgroundImageEvent e)
```

Invoked when loading of an `HBackgroundImage` fails.

Parameters:

e - the event describing the failure

org.havi.ui.event HEventRepresentation

Syntax

```
public class HEventRepresentation
{
    java.lang.Object
    |
    +--org.havi.ui.event.HEventRepresentation
}
```






Description












This class is able to describe the representation of an event generator as a string, color or symbol (such as a triangle, '>', for 'play'). This allows an application to describe a button on an input device correctly for a given platform.

The particular text, color, or symbol can be determined by calling the `getString()`, `getColor()` or `getSymbol()` methods respectively. All available events should return a valid text representation from the `getString()` method.

If supported the six colored key events (`VK_COLORED_KEY_0` thru `VK_COLORED_KEY_5`) must also be represented by a color, i.e. the `getColor()` method must return a valid `java.awt.Color` object.

Key events may also be represented as a symbol - if the platform does not support a symbolic representation for a given event, then the application is responsible for rendering the symbol itself. The rendering of keys with a commonly known representation should follow the guidelines given here, as defined in the following table.

Event	Implied symbol	Sample
VK_GO_TO_START	Two equilateral triangles, pointing at a line to the left	
VK_REWIND	Two equilateral triangles, pointing to the left	
VK_STOP	A square	
VK_PAUSE	Two vertical lines, side by side	
VK_PLAY	One equilateral triangle, pointing to the right	

VK_FAST_FWD	Two equilateral triangles, pointing to the right	
VK_GO_TO_END	Two equilateral triangles, pointing to a line at the right	
VK_TRACK_PREV	One equilateral triangle, pointing to a line at the left	
VK_TRACK_NEXT	One equilateral triangle, pointing to a line at the right	
VK_RECORD	A circle, normally red	
VK_EJECT_TOGGLE	A line under a wide triangle which points up	
VK_VOLUME_UP	A ramp, increasing to the right, near a plus sign	
VK_VOLUME_DOWN	A ramp, increasing to the right, near a minus sign	
VK_UP	An arrow pointing up	
VK_DOWN	An arrow pointing down	
VK_LEFT	An arrow pointing to the left	

VK_RIGHT An arrow pointing to the right



VK_POWER A circle, broken at the top, with a vertical line in the break



The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

Fields

ER_TYPE_COLOR

```
public static final int ER_TYPE_COLOR
```

The event representation type for the current event is supported as a color.

See Also:

[ER_TYPE_NOT_SUPPORTED](#)

ER_TYPE_NOT_SUPPORTED

```
public static final int ER_TYPE_NOT_SUPPORTED
```

The event representation type for the current event is not supported.

The four ER_TYPE integers describe if an input mechanism is not supported, or is described by a string, color or symbol.

The values of the four ER_TYPE integers are required to be bitwise distinct, and the value of ER_TYPE_NOT_SUPPORTED should be 0.

See Also:

[ER_TYPE_STRING](#), [ER_TYPE_COLOR](#), [ER_TYPE_SYMBOL](#)

ER_TYPE_STRING

```
public static final int ER_TYPE_STRING
```

The event representation type for the current event is supported as a string.

See Also:

`ER_TYPE_NOT_SUPPORTED`

ER_TYPE_SYMBOL

```
public static final int ER_TYPE_SYMBOL
```

The event representation type for the current event is supported as a symbol.

See Also:

`ER_TYPE_NOT_SUPPORTED`

Constructors

HEventRepresentation()

```
protected HEventRepresentation()
```

It is not intended that applications should directly construct `HEventRepresentation` objects.

Creates an `HEventRepresentation` object. See the class description for details of constructor parameters and default values.

This method is protected to allow the platform to override it in a different package scope.

Methods

getColor()

```
public java.awt.Color getColor()
```

This returns the color representation (generally used for colored soft keys) of the current event code.

Returns:

The color representation of the current event code, or `null` if not available.

getString()

```
public java.lang.String getString()
```

Returns the text representation of the current event code.

Returns:

The text representation of the current event code, or `null` if not available.

getSymbol()

```
public java.awt.Image getSymbol()
```

This returns an image-based representation (generally used for symbolic keys) of the current event code.

Note that it is platform specific whether this method will return a valid Image, in particular it is a valid implementation option to always return null. Note that for non-null Images, the size and other Image characteristics are dependent on particular manufacturer implementation.

Returns:

The symbolic representation of the current event code, or null if not available.

getType()

```
public int getType()
```

This returns the type of representation(s) available for the event code which this instance of `HEventRepresentation` represents.

If the event code can be represented in multiple ways, then the returned type will be the sum of the supported types, e.g. an event generated by a key with a particular font representation of an "A" in yellow might return `ER_TYPE_STRING + ER_TYPE_COLOR + ER_TYPE_SYMBOL`. Where the string representation is "A", the color representation is "yellow" and the symbol representation might be a likeness of the "A glyph" from a particular font.

isSupported()

```
public boolean isSupported()
```

This method returns true if the current event is supported by the platform.

setColor(Color)

```
protected void setColor(java.awt.Color aColor)
```

Sets the Color representation for this `HEventRepresentation`. Any previous value is overwritten.

This method is protected to allow the platform to override it in subclasses of `HEventRepresentation`. It is not intended for use by the application and conformant applications shall not use this method.

Parameters:

`aColor` - - the color to be associated with this event.

setString(String)

```
protected void setString(java.lang.String aText)
```

Sets the string representation for this `HEventRepresentation`. Any previous value is overwritten.

This method is protected to allow the platform to override it in subclasses of `HEventRepresentation`. It is not intended for use by the application and conformant applications shall not use this method.

Parameters:

`aText` - - the text string to be associated with this event.

setSymbol(Image)

```
protected void setSymbol(java.awt.Image aSymbol)
```

Sets the symbolic representation for this `HEventRepresentation`. Any previous value is overwritten.

This method is protected to allow the platform to override it in subclasses of `HEventRepresentation`. It is not intended for use by the application and conformant applications shall not use this method.

Parameters:

aSymbol - - the symbol image to be associated with this event.

setType(int)

```
protected void setType(int aType)
```

Sets the type of representation(s) available for the event code which this instance of `HEventRepresentation` represents. If no representation(s) are available then `aType` should be set to `ER_TYPE_NOT_SUPPORTED`. Otherwise the representation should be set to the sum of one or more of the following: `ER_TYPE_STRING`, `ER_TYPE_COLOR`, `ER_TYPE_SYMBOL`.

For example, if both string and color representations are available then the system should call this method with the parameter set to `ER_TYPE_STRING + ER_TYPE_COLOR`.

This method is protected to allow the platform to override it in subclasses of `HEventRepresentation`. It is not intended for use by the application and conformant applications shall not use this method.

Parameters:

aType - the type of representation(s) available for this event

org.havi.ui.event

HFocusEvent

Syntax

```
public class HFocusEvent extends java.awt.event.FocusEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--java.awt.AWTEvent
|
+--java.awt.event.ComponentEvent
|
+--java.awt.event.FocusEvent
|
+--org.havi.ui.event.HFocusEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

An `HFocusEvent` event is used to interact with a component implementing the `HNavigationInputPreferred` interface as follows:

- An `HFocusEvent` event may be sent from the HAVi system to the component to inform the component that it has gained or lost the input focus, or that it should transfer focus to another component.
- An `HFocusEvent` event is sent from the component to all registered `HFocusListener` listeners whenever the component focus status changes or focus is transferred to another component.

Note that because the underlying focus mechanism is based on AWT, focus transfer events do not guarantee that another component will actually get focus, or that the current component will lose focus.

All interoperable HAVi components which expect to receive `HFocusEvent` events must implement the `HNavigationInputPreferred` interface.

Fields

FOCUS_TRANSFER

```
public static final int FOCUS_TRANSFER
```

An event id which indicates that the component should transfer focus to the component identified by the data returned from the `getTransferId()` method.

If a component matching the data cannot be found the component receiving this event should do nothing and not send an event to any registered `HFocusListener` listeners.

HFOCUS_FIRST

```
public static final int HFOCUS_FIRST
```

The first integer id in the range of event ids supported by the `HFocusEvent` class.

HFOCUS_LAST

```
public static final int HFOCUS_LAST
```

The last integer id in the range of event ids supported by the `HFocusEvent` class.

NO_TRANSFER_ID

```
public static final int NO_TRANSFER_ID
```

A constant returned from the `getTransferId()` method if the event id is not `FOCUS_TRANSFER`.

Constructors

HFocusEvent(Component, int)

```
public HFocusEvent(java.awt.Component source, int id)
```

Constructs an `HFocusEvent`.

Parameters:

`source` - The `java.awt.Component` component which originated this event.

`id` - The event id of the `HFocusEvent` generated by the `HNavigable` component. This is the value that will be returned by the event object's `getID` method.

HFocusEvent(Component, int, int)

```
public HFocusEvent(java.awt.Component source, int id, int transfer)
```

Constructs an `HFocusEvent`.

Parameters:

`source` - The `java.awt.Component` component which originated this event.

`id` - The event id of the `HFocusEvent` generated by the `HNavigable` component. This is the value that will be returned by the event object's `getID` method.

`transfer` - a key which maps to the component to transfer focus to, if the `id` parameter has the value `FOCUS_TRANSFER`. If the `id` parameter does not have this value `NO_TRANSFER_ID` is substituted for its value.

Methods

getTransferId()

```
public int getTransferId()
```

Returns a key which maps to the component to transfer focus to.

Returns:

a key which maps to the component to transfer focus to, or `NO_TRANSFER_ID` if the id of this event is not `FOCUS_TRANSFER`.

The return value of this function is used to pass key codes to an `HNavigable` to implement focus transfer for HAVi UI components.

isTemporary()

```
public boolean isTemporary()
```

Returns whether or not this focus change event is a temporary change.

Overrides:

java.awt.event.FocusEvent.isTemporary() in class java.awt.event.FocusEvent

Returns:

an implementation specific value. The HAVi UI does not use temporary focus events and interoperable applications shall not call this method.

org.havi.ui.event

HFocusListener

Syntax

```
public interface HFocusListener extends java.awt.event.FocusListener
```

All Superinterfaces:

java.util.EventListener, java.awt.event.FocusListener

All Known Implementing Classes:

HEventMulticaster

Description

The `HFocusListener` interface enables the reception of `HFocusEvent` events, as generated by objects implementing `HNavigable`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

org.havi.ui.event HItemEvent

Syntax

```
public class HItemEvent extends java.awt.AWTEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--java.awt.AWTEvent
|
+--org.havi.ui.event.HItemEvent
```

All Implemented Interfaces:

```
java.io.Serializable
```

Description

An `HItemEvent` event is used to interact with a component implementing the `HSelectionInputPreferred` interface as follows:

- An `HItemEvent` event may be sent from the HAVi system to the component to change the state of the component, and the selection set held by the component.
- An `HItemEvent` event is sent from the component to all registered `HItemListener` when a change to the component state or selection set occurs.

The `HItemEvent` event class therefore provides support for selecting and clearing individual elements, selecting or clearing all elements and managing the currently focused element, i.e. the item whose selection state is toggled by some user interaction.

All interoperable HAVi components which expect to receive `HItemEvent` events should implement the `HSelectionInputPreferred` interface.

See Also:

```
HListGroup
```

Fields

ITEM_CLEARED

```
public static final int ITEM_CLEARED
```

An item event with this id is sent from the component whenever an item is removed from the selection set of an `HItemValue` component. Note that events of this type are silently ignored if they are sent to the component.

ITEM_END_CHANGE

```
public static final int ITEM_END_CHANGE
```

An item event with this id indicates that the selection of an `HItemValue` component has been finally set. This event is sent to or from the component when the user causes the component to leave selection mode. Note that it is a platform specific implementation option for such components to

leave selection mode automatically e.g. when they lose input focus. In such a case the order in which the `HFocusEvent` and `HItemEvent` are sent is platform specific.

See Also:

`getSelectionMode()`

ITEM_FIRST

```
public static final int ITEM_FIRST
```

The first integer id in the range of event ids supported by the `HItemEvent` class.

ITEM_LAST

```
public static final int ITEM_LAST
```

The last integer id in the range of event ids supported by the `HItemEvent` class.

ITEM_SELECTED

```
public static final int ITEM_SELECTED
```

An item event with this id is sent from the component whenever an item is added to the selection set of an `HItemValue` component. Note that events of this type are silently ignored if they are sent to the component.

ITEM_SELECTION_CLEARED

```
public static final int ITEM_SELECTION_CLEARED
```

An item event with this id is sent to or from the component whenever the entire selection set of an `HItemValue` component is removed.

ITEM_SET_CURRENT

```
public static final int ITEM_SET_CURRENT
```

An item event with this id is sent to or from the component whenever the current item of an `HItemValue` component changes.

ITEM_SET_NEXT

```
public static final int ITEM_SET_NEXT
```

An item event with this id is sent to or from the component whenever the current item of an `HItemValue` component changes to the next item in the group.

ITEM_SET_PREVIOUS

```
public static final int ITEM_SET_PREVIOUS
```

An item event with this id is sent to or from the component whenever the current item of an `HItemValue` component changes to the previous item in the group.

ITEM_START_CHANGE

```
public static final int ITEM_START_CHANGE
```

An item event with this id indicates that the selection of an `HItemValue` component may be about to change. This event is sent to or from the component when the user causes the component to enter selection mode. Note that it is a platform specific implementation option for such components to enter selection mode automatically e.g. when they receive input focus. In such a case the order in which the `HFocusEvent` and `HItemEvent` are sent is platform specific.

See Also:

```
getSelectionMode()
```

ITEM_TOGGLE_SELECTED

```
public static final int ITEM_TOGGLE_SELECTED
```

An item event with this id may be sent to an `HItemValue` component to toggle the selection state of the currently focused item. Note that events of this type are never sent to listeners from the component; instead an event of type `ITEM_SELECTED` or `ITEM_CLEARED` is sent in response to an event with this id, depending on the new state of the currently focused item.

Constructors

`HItemEvent(HItemValue, int, Object)`

```
public HItemEvent(HItemValue source, int id, java.lang.Object item)
```

Constructs an `HItemEvent`.

Parameters:

`source` - The `HItemValue` component whose value or current item has been modified.

`id` - The event id of the `HItemEvent` generated by the `HItemValue` component. This is the value that will be returned by the event object's `getID` method.

`item` - The item which caused the change, or `null` if this information is not available. This information shall be provided if the event id is one of `ITEM_SELECTED` or `ITEM_CLEARED`.

Methods

`getItem()`

```
public java.lang.Object getItem()
```

Retrieve the item which caused this `HItemEvent`. This information is not available for the `ITEM_SELECTION_CLEARED` event id.

Returns:

the item which was selected or cleared, or became the current item, or `null` if this information is not available for this event.

org.havi.ui.event HItemListener

Syntax

```
public interface HItemListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

All Known Implementing Classes:

HEventMulticaster

Description

The `HItemListener` interface enables the reception of `HItemEvent`, as generated by objects implementing `HItemValue`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

Methods

currentItemChanged(HItemEvent)

```
public void currentItemChanged(HItemEvent e)
```

Called when a change to the current item of the `HItemValue` occurs.

Parameters:

`e` - is the `HItemEvent` generated by the object implementing `HItemValue`.

selectionChanged(HItemEvent)

```
public void selectionChanged(HItemEvent e)
```

Called when a change to the set of selected items held by the `HItemValue` occurs.

Parameters:

`e` - is the `HItemEvent` generated by the object implementing `HItemValue`.

org.havi.ui.event HKeyCapabilities

Syntax

```
public class HKeyCapabilities
    java.lang.Object
    |
    +--org.havi.ui.event.HKeyCapabilities
```

Direct Known Subclasses:

[HRcCapabilities](#)

Description

This class is used to describe the (basic) keyboard capabilities of the platform.

This class is not intended to be constructed by applications. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

Constructors

HKeyCapabilities()

```
protected HKeyCapabilities()
```

It is not intended that applications should directly construct [HKeyCapabilities](#) objects.

Creates an [HKeyCapabilities](#) object. See the class description for details of constructor parameters and default values.

This method is protected to allow the platform to override it in a different package scope.

Methods

getInputDeviceSupported()

```
public static boolean getInputDeviceSupported()
```


Determine if keyboard input functionality exists in the system. Note that this functionality may be provided through a "virtual" keyboard.

Returns:

true if keyboard input functionality exists in the system, false otherwise.

See Also:

`getInputDeviceSupported()`

isSupported(int)

```
public static boolean isSupported(int keycode)
```

Queries whether the system keyboard can generate an event of the given type. Note that this method does not distinguish between key codes which can only be generated via a virtual keyboard and key codes generated as a result of "real" key presses.

Parameters:

`keycode` - the keycode to query e.g. `VK_SPACE`

Returns:

true if events with the given key code can (ever) be generated on this system, false otherwise.

See Also:

`isSupported(int)`

org.havi.ui.event HKeyEvent

Syntax

```
public class HKeyEvent extends java.awt.event.KeyEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--java.awt.AWTEvent
|
+--java.awt.event.ComponentEvent
|
+--java.awt.event.InputEvent
|
+--java.awt.event.KeyEvent
|
+--org.havi.ui.event.HKeyEvent
```

Direct Known Subclasses:

[HRcEvent](#)

All Implemented Interfaces:

[java.io.Serializable](#)

Description

An [HKeyEvent](#) event is used to interact with a component implementing the [HKeyboardInputPreferred](#) interface as follows:

- An [HKeyEvent](#) event may be sent from the HAVi system to inform the component about key-input. The source of the input may be either a real or a virtual keyboard.
- An [HKeyEvent](#) event is sent from the component to all registered [HKeyListener](#) whenever the component received input.

Note that the HAVi system should only generate KEY_PRESSED events. Neither KEY_TYPED nor KEY_RELEASED events should be generated. Furthermore, the system should collapse combined events. For example, a usual Java Virtual Machine generates for the letter A three events: KEY_PRESSED for modifier key Shift, KEY_PRESSED for letter 'A' and KEY_TYPED for 'A'. This should be collapsed into one single KEY_PRESSED event with the letter 'A' and the Shift modifier set. This is to simplify the key event handling of applications.

All interoperable HAVi components which expect to receive [HKeyEvent](#) events must either implement the [HKeyboardInputPreferred](#) interface or subclass components providing the `processHKeyEvent(HKeyEvent)` method. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method

None.

See Also:

`processHKeyEvent (HKeyEvent)`

Constructors

HKeyEvent(Component, int, long, int, int)

```
public HKeyEvent(java.awt.Component source, int id, long when, int modifiers, int keyCode)
```

Deprecated.

See explanation in `java.awt.event.KeyEvent`.

Constructs an `HKeyEvent` object with the specified source component, type, modifiers and key.

Parameters:

`source` - the object where the event originated.

`id` - the identifier.

`when` - the time stamp for this event.

`modifiers` - indication of any modification keys that are active for this event.

`keyCode` - the code of the key associated with this event.

HKeyEvent(Component, int, long, int, int, char)

```
public HKeyEvent(java.awt.Component source, int id, long when, int modifiers, int keyCode,
                 char keyChar)
```

Constructs an `HKeyEvent` object with the specified source component, type, modifiers and key.

Parameters:

`source` - the object where the event originated.

`id` - the identifier.

`when` - the time stamp for this event.

`modifiers` - indication of any modification keys that are active for this event.

`keyCode` - the code of the key associated with this event.

`keyChar` - the character representation of the key associated with this event.

org.havi.ui.event HKeyListener

Syntax

```
public interface HKeyListener extends java.awt.event.KeyListener
```

All Superinterfaces:

java.util.EventListener, java.awt.event.KeyListener

All Known Implementing Classes:

HEventMulticaster

Description

The `HKeyListener` interface enables the reception of `HKeyEvent` events.

Note that HAVi compliant systems should never call the methods `keyReleased(KeyEvent)` and `keyTyped(KeyEvent)` of the superinterface on an `HKeyListener`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

org.havi.ui.event

HMouseCapabilities

Syntax

```
public class HMouseCapabilities
    java.lang.Object
    |
    +--org.havi.ui.event.HMouseCapabilities
```

Description

This class is used to describe the (basic) mouse capabilities of the platform.

This class is not intended to be constructed by applications. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HMouseCapabilities()

```
protected HMouseCapabilities()
```

It is not intended that applications should directly construct `HMouseCapabilities` objects.

Creates an `HMouseCapabilities` object. See the class description for details of constructor parameters and default values.

This method is protected to allow the platform to override it in a different package scope.

Methods

getInputDeviceSupported()

```
public static boolean getInputDeviceSupported()
```

Determine if a mouse exists in the system.

Returns:

true if a mouse exists in the system, false otherwise.

org.havi.ui.event HRcCapabilities

Syntax

```
public class HRcCapabilities extends HKeyCapabilities
```

```
java.lang.Object
|
+--HKeyCapabilities
|
+--org.havi.ui.event.HRcCapabilities
```

Description

This class is used to describe the (basic) remote control capabilities of the platform.

This class is not intended to be constructed by applications. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HRcCapabilities()

```
protected HRcCapabilities()
```

It is not intended that applications should directly construct `HRcCapabilities` objects.

Creates an `HRcCapabilities` object. See the class description for details of constructor parameters and default values.

This method is protected to allow the platform to override it in a different package scope.

Methods

getInputDeviceSupported()

```
public static boolean getInputDeviceSupported()
```

Determine if a physical remote control exists in the system.

Returns:

true if a physical remote control exists in the system, false otherwise.

See Also:

`getInputDeviceSupported()`

getRepresentation(int)

```
public static HEventRepresentation getRepresentation(int aCode)
```

Get the `HEventRepresentation` object for a specified key event id.

Parameters:

`aCode` - the key event id for which the `HEventRepresentation` should be returned.

Returns:

an `HEventRepresentation` object for the specified key event id, or null if there is no valid representation available.

isSupported(int)

```
public static boolean isSupported(int keycode)
```

Queries whether the remote control can directly generate an event of the given type. Note that this method will return false for key codes which can only be generated on this system via a virtual keyboard.

Parameters:

`keycode` - the keycode to query e.g. `VK_SPACE`

Returns:

true if events with the given key code can be directly generated on this system via a physical remote control, false otherwise.

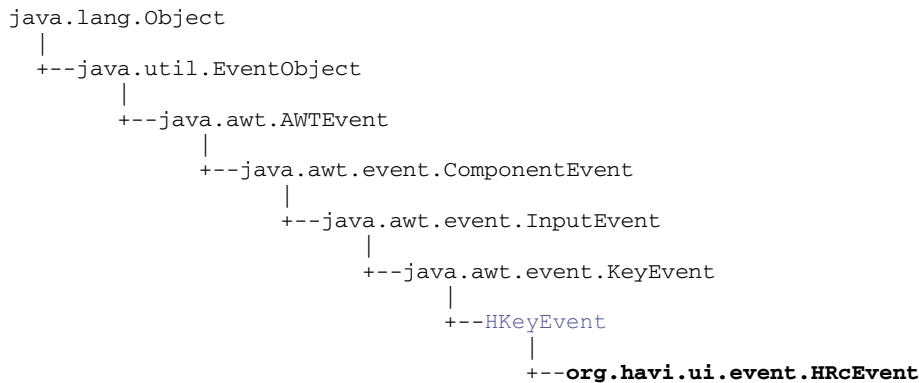
See Also:

`isSupported(int)`

org.havi.ui.event HRcEvent

Syntax

```
public class HRcEvent extends HKeyEvent
```



All Implemented Interfaces:

java.io.Serializable

Description

The remote control event class.

The presence or absence of these keys and their desired representation is provided by the `HRcCapabilities` class.

Note that it is an implementation option if remote control key events are repeated.

Instances of `HRcEvent` are reported through the normal `java.awt` event mechanism. Note that the reception of these events by a `java.awt.Component` is dependent on it having `java.awt.event.KeyEvent` events enabled.

Note that it is an implementation constraint that the `HRcEvent` event range should not intersect with the Java AWT key event range. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Fields

RC_FIRST

```
public static final int RC_FIRST
```

Marks the first integer id for the range of remote control event ids.

RC_LAST

```
public static final int RC_LAST
```

Marks the last integer id for the range of remote control event ids.

VK_BALANCE_LEFT

```
public static final int VK_BALANCE_LEFT
```

The 'balance left' action id - moves the audio balance to the left.

VK_BALANCE_RIGHT

```
public static final int VK_BALANCE_RIGHT
```

The 'balance right' action id - moves the audio balance to the right.

VK_BASS_BOOST_DOWN

```
public static final int VK_BASS_BOOST_DOWN
```

The 'bass boost down' action id - decreases the audio amplifier bass boost.

VK_BASS_BOOST_UP

```
public static final int VK_BASS_BOOST_UP
```

The 'bass boost up' action id - increases the audio amplifier bass boost.

VK_CHANNEL_DOWN

```
public static final int VK_CHANNEL_DOWN
```

The 'channel down' action id.

VK_CHANNEL_UP

```
public static final int VK_CHANNEL_UP
```

The 'channel up' action id.

VK_CLEAR_FAVORITE_0

```
public static final int VK_CLEAR_FAVORITE_0
```

The 'clear favorite 0' action id.

VK_CLEAR_FAVORITE_1

```
public static final int VK_CLEAR_FAVORITE_1
```

The 'clear favorite 1' action id.

VK_CLEAR_FAVORITE_2

```
public static final int VK_CLEAR_FAVORITE_2
```

The 'clear favorite 2' action id.

VK_CLEAR_FAVORITE_3

```
public static final int VK_CLEAR_FAVORITE_3
```

The 'clear favorite 3' action id.

VK_COLORED_KEY_0

```
public static final int VK_COLORED_KEY_0
```

Colored key 0 action id.

Up to six colored soft keys can be included on a remote control. These are optional, and must be identified with a color. If implemented, these keys are to be oriented from left to right, or from top to bottom in ascending order.

The application can determine how many colored keys are implemented, and what colors are to be used, so that the application can match the controls, by using the `getRepresentation` method in the `HRcCapabilities` class.

See Also:

[VK_COLORED_KEY_1](#), [VK_COLORED_KEY_2](#), [VK_COLORED_KEY_3](#), [VK_COLORED_KEY_4](#),
[VK_COLORED_KEY_5](#)

VK_COLORED_KEY_1

```
public static final int VK_COLORED_KEY_1
```

Colored key 1 action id.

See Also:

[VK_COLORED_KEY_0](#)

VK_COLORED_KEY_2

```
public static final int VK_COLORED_KEY_2
```

Colored key 2 action id.

See Also:

[VK_COLORED_KEY_0](#)

VK_COLORED_KEY_3

```
public static final int VK_COLORED_KEY_3
```

Colored key 3 action id.

See Also:

[VK_COLORED_KEY_0](#)

VK_COLORED_KEY_4

```
public static final int VK_COLORED_KEY_4
```

Colored key 4 action id.

See Also:

[VK_COLORED_KEY_0](#)

VK_COLORED_KEY_5

```
public static final int VK_COLORED_KEY_5
```

Colored key 5 action id.

See Also:

[VK_COLORED_KEY_0](#)

VK_DIMMER

```
public static final int VK_DIMMER
```

The 'device dimmer' action id adjusts illumination of the device.

This may be a toggle between two states, or a sequence through multiple states.

VK_DISPLAY_SWAP

```
public static final int VK_DISPLAY_SWAP
```

The 'display swap' action id - swaps displayed video sources.

VK_EJECT_TOGGLE

```
public static final int VK_EJECT_TOGGLE
```

The 'eject / insert media' action id.

VK_FADER_FRONT

```
public static final int VK_FADER_FRONT
```

The 'fader front' action id - moves the audio fader to the front.

VK_FADER_REAR

```
public static final int VK_FADER_REAR
```

The 'fader rear' action id - moves the audio fader to the rear.

VK_FAST_FWD

```
public static final int VK_FAST_FWD
```

The 'fast forward (media)' action id.

VK_GO_TO_END

```
public static final int VK_GO_TO_END
```

The '(send media) to end position' action id.

VK_GO_TO_START

```
public static final int VK_GO_TO_START
```

The 'go (send media) to start position' action id.

VK_GUIDE

```
public static final int VK_GUIDE
```

The 'guide' action id - indicates a user request for a program guide (toggle).

VK_INFO

```
public static final int VK_INFO
```

The 'info' action id - indicates that the user has requested additional information (toggle).

VK_MUTE

```
public static final int VK_MUTE
```

The 'mute' action id - mute audio output

VK_PINP_TOGGLE

```
public static final int VK_PINP_TOGGLE
```

The 'picture in picture toggle' action id - turns picture in picture mode on or off.

VK_PLAY

```
public static final int VK_PLAY
```

The 'play (media)' action id.

VK_PLAY_SPEED_DOWN

```
public static final int VK_PLAY_SPEED_DOWN
```

The 'decrease (media) play speed' action id.

VK_PLAY_SPEED_RESET

```
public static final int VK_PLAY_SPEED_RESET
```

The 'set (media) play speed to normal' action id.

VK_PLAY_SPEED_UP

```
public static final int VK_PLAY_SPEED_UP
```

The 'increase (media) play speed' action id.

VK_POWER

```
public static final int VK_POWER
```

The 'device power' action id turns on or off the delegated device.

VK_RANDOM_TOGGLE

```
public static final int VK_RANDOM_TOGGLE
```

The 'toggle random (media) play' action id.

VK_RECALL_FAVORITE_0

```
public static final int VK_RECALL_FAVORITE_0
```

The 'recall favorite 0' action id.

VK_RECALL_FAVORITE_1

```
public static final int VK_RECALL_FAVORITE_1
```

The 'recall favorite 1' action id.

VK_RECALL_FAVORITE_2

```
public static final int VK_RECALL_FAVORITE_2
```

The 'recall favorite 2' action id.

VK_RECALL_FAVORITE_3

```
public static final int VK_RECALL_FAVORITE_3
```

The 'recall favorite 3' action id.

VK_RECORD

```
public static final int VK_RECORD
```

The 'record (to media)' action id.

VK_RECORD_SPEED_NEXT

```
public static final int VK_RECORD_SPEED_NEXT
```

The 'select next (media) record speed' action id.

VK_REWIND

```
public static final int VK_REWIND
```

The 'rewind (media)' action id.

VK_SCAN_CHANNELS_TOGGLE

```
public static final int VK_SCAN_CHANNELS_TOGGLE
```

The 'scan channels toggle' action id - turns channel scanning on or off.

VK_SCREEN_MODE_NEXT

```
public static final int VK_SCREEN_MODE_NEXT
```

The 'screen mode next' action id - advances the display screen mode.

VK_SPLIT_SCREEN_TOGGLE

```
public static final int VK_SPLIT_SCREEN_TOGGLE
```

The 'split screen toggle' action id - turns split screen on or off.

VK_STOP

```
public static final int VK_STOP
```

The 'stop (media)' action id.

VK_STORE_FAVORITE_0

```
public static final int VK_STORE_FAVORITE_0
```

The 'store current setting as favorite 0' action id.

VK_STORE_FAVORITE_1

```
public static final int VK_STORE_FAVORITE_1
```

The 'store current setting as favorite 1' action id.

VK_STORE_FAVORITE_2

```
public static final int VK_STORE_FAVORITE_2
```

The 'store current setting as favorite 2' action id.

VK_STORE_FAVORITE_3

```
public static final int VK_STORE_FAVORITE_3
```

The 'store current setting as favorite 3' action id.

VK_SUBTITLE

```
public static final int VK_SUBTITLE
```

The 'subtitle' action id - indicates a user request for subtitling (toggle).

VK_SURROUND_MODE_NEXT

```
public static final int VK_SURROUND_MODE_NEXT
```

The 'surround mode next' action id - advances audio amplifier surround mode.

VK_TELETEXT

```
public static final int VK_TELETEXT
```

The 'teletext' action id - indicates a user request for a teletext service (toggle).

VK_TRACK_NEXT

```
public static final int VK_TRACK_NEXT
```

The '(send media) to next track' action id.

VK_TRACK_PREV

```
public static final int VK_TRACK_PREV
```

The '(send media) to previous track' action id.

VK_VIDEO_MODE_NEXT

```
public static final int VK_VIDEO_MODE_NEXT
```

The 'video mode next' action id - advances the display video mode.

VK_VOLUME_DOWN

```
public static final int VK_VOLUME_DOWN
```

The 'volume down' action id - decreases audio amplifier volume.

VK_VOLUME_UP

```
public static final int VK_VOLUME_UP
```

The 'volume up' action id - increases audio amplifier volume.

VK_WINK

```
public static final int VK_WINK
```

The 'device wink' action id is used to indicate that the device should identify itself in some manner, for example, audibly or visually.

Constructors

HRcEvent(Component, int, long, int, int)

```
public HRcEvent(java.awt.Component source, int id, long when, int modifiers, int keyCode)
```

Deprecated.

See explanation in `java.awt.event.KeyEvent`.

Constructs an `HRcEvent` object with the specified source component, type, modifiers and key.

Parameters:

`source` - the object where the event originated.

`id` - the identifier.

`when` - the time stamp for this event.

`modifiers` - indication of any modification keys that are active for this event.

`keyCode` - the code of the key associated with this event.

HRcEvent(Component, int, long, int, int, char)

```
public HRcEvent(java.awt.Component source, int id, long when, int modifiers, int keyCode,
                char keyChar)
```

Constructs an `HRcEvent` object with the specified source component, type, modifiers and key.

Parameters:

`source` - the object where the event originated.

`id` - the identifier.

`when` - the time stamp for this event.

`modifiers` - indication of any modification keys that are active for this event.

`keyCode` - the code of the key associated with this event.

`keyChar` - the character representation of the key associated with this event.

org.havi.ui.event HScreenConfigurationEvent

Syntax

```
public class HScreenConfigurationEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.havi.ui.event.HScreenConfigurationEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is sent to all registered [HScreenConfigurationListener](#) when an [HScreenDevice](#) modifies its configuration. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

[HScreenConfigurationListener](#), [HScreenDevice](#)

Constructors

HScreenConfigurationEvent(Object)

```
public HScreenConfigurationEvent(java.lang.Object source)
```

Construct an [HScreenConfigurationEvent](#)

Parameters:

source - the [HScreenDevice](#) whose configuration changed

org.havi.ui.event

HScreenConfigurationListener

Syntax

```
public interface HScreenConfigurationListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

All Known Implementing Classes:

[HEventMulticaster](#)

Description

This listener is used to monitor when the configuration of an [HScreenDevice](#) is modified. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

[HScreenConfigurationEvent](#), [HScreenDevice](#)

Methods

report(HScreenConfigurationEvent)

```
public void report(HScreenConfigurationEvent gce)
```

This method is called when the configuration of an [HScreenDevice](#) is modified.

org.havi.ui.event HScreenDeviceReleasedEvent

Syntax

```
public class HScreenDeviceReleasedEvent extends org.davic.resources.ResourceStatusEvent
```

```
java.lang.Object
|
|--org.davic.resources.ResourceStatusEvent
|
|   |--org.havi.ui.event.HScreenDeviceReleasedEvent
```

Description

This event informs an application that a device for this [HScreen](#) has been released by an application or other entity in the system. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HScreenDeviceReleasedEvent(Object)

```
public HScreenDeviceReleasedEvent(java.lang.Object source)
```

Creates an [HScreenDeviceReleasedEvent](#) object. See the class description for details of constructor parameters and default values.

Parameters:

`source` - the [HScreenDevice](#) which has been released

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the device that has been released

Overrides:

`org.davic.resources.ResourceStatusEvent.getSource()` in class `org.davic.resources.ResourceStatusEvent`

Returns:

the [HScreenDevice](#) object representing the device that has been released

org.havi.ui.event

HScreenDeviceReservedEvent

Syntax

```
public class HScreenDeviceReservedEvent extends org.davic.resources.ResourceStatusEvent
```

```
java.lang.Object
|
+--org.davic.resources.ResourceStatusEvent
|
+--org.havi.ui.event.HScreenDeviceReservedEvent
```

Description

This event informs that a device on this [HScreen](#) has been reserved by an application or other entity in the system. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
None.				

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
None.			

Constructors

HScreenDeviceReservedEvent(Object)

```
public HScreenDeviceReservedEvent(java.lang.Object source)
```

Creates an [HScreenDeviceReservedEvent](#) object. See the class description for details of constructor parameters and default values.

Parameters:

`source` - the [HScreenDevice](#) representing the device which has been reserved

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the device that has been reserved

Overrides:

`org.davic.resources.ResourceStatusEvent.getSource()` in class `org.davic.resources.ResourceStatusEvent`

Returns:

an [HScreenDevice](#) representing the device that has been reserved

org.havi.ui.event HScreenLocationModifiedEvent

Syntax

```
public class HScreenLocationModifiedEvent extends java.util.EventObject
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--org.havi.ui.event.HScreenLocationModifiedEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

This event is generated by the system when a component is moved on-screen, rather than within a container. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

Constructors

HScreenLocationModifiedEvent(Object)

```
public HScreenLocationModifiedEvent(java.lang.Object source)
```

Creates an `HScreenLocationModifiedEvent` object. See the class description for details of constructor parameters and default values.

Parameters:

`source` - the Component whose on-screen location has been modified.

Methods

getSource()

```
public java.lang.Object getSource()
```

Returns the Component whose on-screen location has been modified.

Overrides:

java.util.EventObject.getSource() in class java.util.EventObject

Returns:

the Component whose on-screen location has been modified.

org.havi.ui.event

HScreenLocationModifiedListener

Syntax

```
public interface HScreenLocationModifiedListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

All Known Implementing Classes:

[HEventMulticaster](#)

Description

This listener is used to monitor when a component, such as an [HVideoComponent](#) on-screen location is modified. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

See Also:

[HScreenLocationModifiedEvent](#), [HVideoComponent](#)

Methods

report(HScreenLocationModifiedEvent)

```
public void report(HScreenLocationModifiedEvent gce)
```

This method is called when the component's on-screen location is modified.

org.havi.ui.event HTextEvent

Syntax

```
public class HTextEvent extends java.awt.AWTEvent
```

```
java.lang.Object
|
+--java.util.EventObject
|
+--java.awt.AWTEvent
|
+--org.havi.ui.event.HTextEvent
```

All Implemented Interfaces:

java.io.Serializable

Description

An `HTextEvent` event is used to interact with a component implementing the `HKeyboardInputPreferred` interface as follows:

- An `HTextEvent` event may be sent from the HAVi system to the component to cause a change to the caret position or editable mode of the component as a result of user interaction. For example, a platform which lacks suitable caret positioning or mode switching keys may choose to generate this using a virtual keyboard user interface.
- An `HTextEvent` event is sent from the component to all registered `HTextListener` when a change to the text content, caret position or editable mode of the component occurs.

All interoperable HAVi components which expect to receive `HTextEvent` events should implement the `HKeyboardInputPreferred` interface. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

Fields

CARET_NEXT_CHAR

```
public static final int CARET_NEXT_CHAR
```


When a text event with this id is sent to a `HTextValue` component, then its caret position should move one character forward. If such an event is sent from a component to `HTextListener`, then it was moved.

CARET_NEXT_LINE

```
public static final int CARET_NEXT_LINE
```

When a text event with this id is sent to a `HTextValue` component, then its caret position should move down one line. If such an event is sent from a component to `HTextListener`, then it was moved. It is widget specific, if the caret remains at the same column or at an approximate horizontal pixel position for non-fixed-width fonts.

CARET_NEXT_PAGE

```
public static final int CARET_NEXT_PAGE
```

When a text event with this id is sent to a `HTextValue` component, then its caret position should move down to the last possible line in the visible window. If the caret position is already on the last visible line then the caret should move down so that the last visible line scrolls up to the top of the visible window. If such an event is sent from a component to `HTextListener`, then it was moved. It is widget specific, if the caret remains at the same column or at an approximate horizontal pixel position for non-fixed-width fonts.

CARET_PREV_CHAR

```
public static final int CARET_PREV_CHAR
```

When a text event with this id is sent to a `HTextValue` component, then its caret position should move one character backward. If such an event is sent from a component to `HTextListener`, then it was moved.

CARET_PREV_LINE

```
public static final int CARET_PREV_LINE
```

When a text event with this id is sent to a `HTextValue` component, then its caret position should move up one line. If such an event is sent from a component to `HTextListener`, then it was moved. It is widget specific, if the caret remains at the same column or at an approximate horizontal pixel position for non-fixed-width fonts.

CARET_PREV_PAGE

```
public static final int CARET_PREV_PAGE
```

When a text event with this id is sent to a `HTextValue` component, then its caret position should move up to the first possible line in the visible window. If the caret position is already on the first visible line then the caret should move down so that the first visible line scrolls down to the bottom of the visible window. If such an event is sent from a component to `HTextListener`, then it was moved. It is widget specific, if the caret remains at the same column or at an approximate horizontal pixel position for non-fixed-width fonts.

TEXT_CARET_CHANGE

```
public static final int TEXT_CARET_CHANGE
```

A text event with this id is sent from the component whenever the caret position of an `HTextValue` component is changed. This event will be sent only if the caret position changed in a manner not notified by the `CARET_NEXT_CHAR`, `CARET_NEXT_LINE`, `CARET_PREV_CHAR`, `CARET_PREV_LINE`, `CARET_NEXT_PAGE`, or `CARET_PREV_PAGE` events.

TEXT_CHANGE

```
public static final int TEXT_CHANGE
```

A text event with this id is sent from the component whenever the textual content of an `HTextValue` component is changed.

TEXT_END_CHANGE

```
public static final int TEXT_END_CHANGE
```

A text event with this id indicates that the textual content of an `HTextValue` component has been finally set. This event is sent to or from the component when the user causes the component to leave its editable mode. Note that it is a platform specific implementation option for such components to leave editable mode automatically e.g. when they lose input focus. In such a case the order in which the `HFocusEvent` and `HTextEvent` are sent is platform specific.

See Also:

```
getEditMode()
```

TEXT_FIRST

```
public static final int TEXT_FIRST
```

The first integer id in the range of event ids supported by the `HTextEvent` class.

TEXT_LAST

```
public static final int TEXT_LAST
```

The last integer id in the range of event ids supported by the `HTextEvent` class.

TEXT_START_CHANGE

```
public static final int TEXT_START_CHANGE
```

A text event with this id indicates that the textual content of an `HTextValue` component may be about to change. This event is sent to or from the component when the user causes the component to enter its editable mode. Note that it is a platform specific implementation option for such components to enter editable mode automatically e.g. when they receive input focus. In such a case the order in which the `HFocusEvent` and `HTextEvent` are sent is platform specific.

See Also:

```
getEditMode()
```

Constructors

HTextEvent(HTextValue, int)

```
public HTextEvent(HTextValue source, int id)
```

Constructs an `HTextEvent` .

Parameters:

`source` - The `HTextValue` component whose value has been modified.

`id` - The event id of the `HTextEvent` generated by the `HTextValue` component. This is the value that will be returned by the event object's `getID` method.

org.havi.ui.event HTextListener

Syntax

```
public interface HTextListener extends java.util.EventListener
```

All Superinterfaces:

java.util.EventListener

All Known Implementing Classes:

HEventMulticaster

Description

The `HTextListener` interface enables the reception of `HTextEvent`, as generated by objects implementing `HTextValue`. The parameters to the constructors are as follows, in cases where parameters are not used, then the constructor should use the default values.

Default parameter values exposed in the constructors

Parameter	Description	Default value	Set method	Get method
-----------	-------------	---------------	------------	------------

None.

Default parameter values not exposed in the constructors

Description	Default value	Set method	Get method
-------------	---------------	------------	------------

None.

Methods

caretMoved(HTextEvent)

```
public void caretMoved(HTextEvent e)
```

Called when the caret position of an `HTextValue` component has moved.

Parameters:

`e` - is the `HTextEvent` generated by the object implementing `HTextValue`.

textChanged(HTextEvent)

```
public void textChanged(HTextEvent e)
```

Called when the textual content of an `HTextValue` component has changed.

Parameters:

`e` - is the `HTextEvent` generated by the object implementing `HTextValue`.

Annex W (normative): DVB-J examples

W.1 DVB-J Application lifecycle implementation example

```

package com.random.myxlet;

/**
 * This pseudocode illustrates the kind of actions that an Xlet should
 * take in response to Xlet state change callbacks. It is primarily meant
 * to illustrate what is to be done in the paused state. An example of
 * the kind of application that might use this kind of resource-management
 * policy is a slide-show application that is used to view images. In this
 * example, the application caches only the current image when in the
 * paused state, but caches more images when in the active state.
 */

import javax.tv.Xlet;
import javax.tv.XletContext;

public class Sample implements Xlet {

    private boolean started = false;        // Latch, set true when first started
    private boolean active = false;        // Condition variable synchronized on this
    private boolean destroyed = false;    // Latch, set true when destroyed
    private XletContext context;

    public void initXlet(XletContext ctx) {
        context = ctx;
    }

    public synchronized void destroyXlet(boolean unconditional) {
        active = false;
    }

    private void manageCache() {
        for (;;) {
            synchronized(this) {
                if (destroyed) {
                    ... free any resources we hold ...;
                    cancel any image loading currently in progress;
                    return;                // Terminates thread
                }
                if (!active) {
                    free all cached images, except the one currently
                    being viewed;
                } else {                    // active
                    if (cached images remain to be loaded && an image load is not in process)
                    {
                        Start an image load. Provide the image loader with a listener that will,
                        when the image loading is complete, notify us and do this.notifyAll().
                    }
                }
            }
            wait();
        }
    }
}

```

A simple example of Xlet lifecycle is a stock ticker application that uses a back channel to retrieve stock quotes, which it displays on the viewer's television.

- a) The application manager retrieves the Xlet's code.
- b) The application manager creates an instance of the XletContext Object and initializes it for the new Xlet.
- c) The application manager initializes the Xlet by calling its `initXlet()` method and passing it the context object.

- d) The Xlet uses the context object to initialize itself and enters the `Paused` state.
- e) The application manager calls the Xlet's `startXlet()` method. The application manager assumes that the Xlet is performing its service.
- f) Upon receiving this signal, the Xlet creates a new thread that opens the back channel to retrieve the stock quotes. The Xlet is now in the `Active` state.
- g) The Xlet begins to show the stock quotes.
- h) Due to circumstances beyond the control of the Xlet, it is no longer able to retrieve updated stock quotes.
- i) The Xlet decides to continue displaying the most recent quotes it has. Note that the Xlet is still in the `Active` state.
- j) After a time, the Xlet is still unable to open the back channel. It decides that the quotes it is displaying are too old to present and that it can no longer perform its service. It chooses to take itself out of the `Active` state. It calls the `paused()` method on `XletContext` to signal this change to the application manager.
- k) Finally, the Xlet decides it no longer has any chance of performing its service, so it decides it should be terminated. It calls the `destroyed()` method on the `XletContext` to signal application manager that it has entered the `Destroyed` state. The Xlet does some final clean up.
- l) The application manager prepares the Xlet for garbage collection.

W.2 Example of exporting an object for inter-application communication

```
public interface MyService extends java.rmi.Remote {
    public String getData() throws java.rmi.RemoteException;
}

public class MyServer extends MyService {

    private static javax.tv.xlet.XletContext ctx;

    public String getData() throws java.rmi.RemoteException {
        return "Hello from " + ctx.getXletProperty("dvb.app.id");
    }

    //
    // Called upon Xlet initialization
    //
    public static void export(XletContext ctx) {
        this.ctx = ctx;
        Remote server = new MyServer();
        org.dvb.io.ixc.IxcRegistry.bind("myserver", server);
    }

    //
    // Try to import the object that we previously exported.
    // Note that this would typically be done from a different
    // Xlet, but importing from yourself works, too.
    // Called when the Xlet is run.
    //
    public static void import(XletContext ctx) {
        String appId = ctx.getXletProperty("dvb.app.id");
        String orgId = ctx.getXletProperty("dvb.org.id");
        Remote obj;
        try {
            obj = org.dvb.io.ixc.IxcRegistry.lookup(
                "/" + appId + "/"
                + orgId + "/myserver");
            MyService r = (MyService) obj;
            System.out.println("Success " + r
                + ", " + r.getData());
        } catch (Exception ex) {
        }
    }
}
```

Annex X (normative): Test support

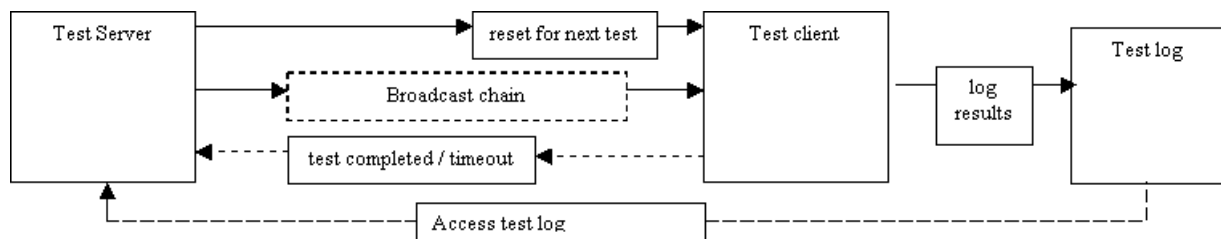
Package org.dvb.test

Description

Broadcast model

In a broadcast-based conformance system, there are effectively three main entities involved in an automated test process:

1. The test server that is used to hold and initiate all of the tests.
2. The test client which runs the tests and logs the results.
3. The broadcast chain that is used to transfer applications and application data from the server to the client.



The communication order is as follows:

1. The test-server uses the "reset for next test" mechanism to set the test client into a known default state, ready to receive the test-application.
2. The test-server uses the "broadcast chain" mechanism to supply the test-application to the test client and to signal that the test-application should be executed.
3. The test-client runs the test-application.
4. The test-application either:
 - finishes within a given timelimit, the result of the test is known and shall be considered to be the value reported by the test application for the purposes of compliance.
 - Optionally, the test-client may signal to the test-server that the test-application has finished executing and that the test-client is ready to be reset in order to receive the next test-application.
 - fails to finish the test-application within a given timeout, the result of the test is unknown and shall be treated as a failure for the purposes of compliance. The test-server may treat the test-client as ready to be reset in order to receive the next application.

[Successive tests are then repeated from stage 1.]

"Reset for next test"

The "reset for next test" path is used by the test server to reset the test client to receive the next test. The reset for next test API is considered to be a private implementation issue between the test-server and test-client and therefore has no public Java API implications. Note that this "communication" needs to take place prior to any application being executed. Note that the precise manner of the reset mechanism is intentionally not specified -- in the worst case, this may involve "power cycling" the test client.

Test log

Communication from the test client to the test log is considered as write-only access. Hence, results from successive tests cannot overwrite results from previous ones. Multiple (intermediate) results may be sent to the test log for any given test. It is recommended that all communication to the test log is synchronous.

See the DVCTest.log method for details of the proposed API and implementation issues.

"Test completed"

The "test completed" path is used by the test client to indicate to the test server that it has completed the previous test and is now able to accept a subsequent one. Note that this communication path is an optimisation, since direct communication from the client to the server is not actually required, e.g. the server might simply "time-out" the client, and then perform a "reset for next test" action. However, this optimisation may be important when large numbers of tests are being performed on a "capable" platform, since e.g. if a 30 second timeout is applied for 1000 test cases which typically run within say 6 seconds, then the timeout implies a typical running time of 500 minutes, i.e. ~4.5 hours --- rather than 100 minutes, i.e. ~1.5 hours.

See the DVCTest.terminate method for details of the proposed API and implementation issues.

Access test log

The mechanism by which the test-log is accessed is not considered in this document, this is a private mechanism, which might include reading a file from flash / RAM. Similarly, the mechanism by which results are recovered from the test log is not considered in this document, e.g. the test-log may actually reside on the test server, e.g. as in the case that results are transmitted over an IP connection.

Class Summary	
Classes	
DVCTest	The DVCTest class allows test applications to log messages during their execution and to indicate their termination condition in a platform independent manner.

org.dvb.test

DVBTest

Syntax

```
public class DVBTest
```

```
java.lang.Object
```

```
|
```

```
+--org.dvb.test.DVBTest
```

Description

The DVBTest class allows test applications to log messages during their execution and to indicate their termination condition in a platform independent manner.

A number of constants are defined in the DVBTest class and are reserved as follows

- Zero and negative values defined within the class are reserved by DVB.
- Positive return values are available for test application specific return values, which must be defined within the procedure for executing the test application as to their precise meaning as regards conformance.

Fields

FAIL

```
public static final int FAIL
```

The application executed and terminated unsuccessfully and has therefore operated in a non-conformant manner.

HUMAN_INTERVENTION

```
public static final int HUMAN_INTERVENTION
```

The application is unable to determine whether it has operated conformantly and therefore requires some human intervention to determine whether conformance has been achieved. Until the application has been checked the result of the application should be considered as non-conformant.

It is envisaged that tests returning this value may be those requiring evaluation of presented content, such as graphics, etc. Such presentation may require (subjective) human evaluation.

OPTION_UNSUPPORTED

```
public static final int OPTION_UNSUPPORTED
```

The platform does not contain the option under test and therefore the test is inapplicable, the test result should not be considered when determining the status of the platform's conformance.

PASS

```
public static final int PASS
```

The application executed and terminated successfully and has therefore operated in a conformant manner.

UNRESOLVED

```
public static final int UNRESOLVED
```

A setup stage necessary to execute the application failed, and hence the result of the application is unknown and therefore should be considered to have operated in a non-conformant manner.

UNTESTED

```
public static final int UNTESTED
```

The application ran successfully, but the particular test was unable to execute. Hence the result of is unknown, and may require human evaluation to determine conformance.

For example, an out of disk space test may not execute within a fixed number of iterations (within a practical amount of time) for devices with large capacity storage, etc.

Methods

log(String, int)

```
public static void log(java.lang.String id, int no)
```

This method has the same behaviour, implementation options and restrictions as log(String, String) - except that it allows an integer value to be logged, rather than a String, which may prove a useful option for automating tests.

Parameters:

`id` - a string identifying the application (thread) that is logging the test result.

`no` - the integer value that the application wishes to be logged.

Throws:

`IOException` - under the same conditions as log(String, String).

log(String, String)

```
public static void log(java.lang.String id, java.lang.String message)
```

This synchronous, blocking, method logs a result (intermediate result) of a test application using write-only access. The method takes both an identifier string, e.g. "Test number 1" and a message to output, e.g. "Now invoking the xletPause method...". The application is not required to open a file or network connection, per se, and the log() method is always available for writing (in principle).

The precise format of the logged message is left deliberately unspecified, implementers may choose to output compressed messages, XML documents, or other formats of their choice (obviously provided that the original information can be recovered). It is an implementation option to include additional information with each logging message, e.g. including:

- version of the specification being implemented
- compiler version and options.
- build-version
- timestamp
- date
- debug info

Messages sent using this method should "atomic", i.e. that they are not interleaved with other messages sent using the methods defined in the DVBTTest class.

Implementation

The precise mechanism(s) by which this method may be implemented are intentionally unspecified, implementation options might include:

- logging the message to a local file system.
- logging the message to a mounted remote file system.
- logging the message to a RAM disk, etc.
- logging the message via an RS-232 (or other serial) connection.
- logging the message to a remote host via some IP / UDP based mechanism, e.g. using a socket-based connection.

Note that the implementation of the log method may use the same or a different mechanism to that used by the terminate method.

The log method does not require any explicit initialisation on the part of the application under test. For example if messages are being stored to a file system, then the application is not required to mount / open any storage file. Similarly, if the messages are being logged via a network connection, then the application is not required to open a connection to the storage host, etc. In principle, the mechanism should always be available to accept messages.

If this method is implemented on top of some buffering mechanism, it is strongly recommended that the buffer be flushed for each occurrence of a message being logged.

Security and implementation options

There is no Java security mechanism that is used to secure the log method.

Note that even if the log method is based on a particular implementation option, it shall be able to operate in spite of that particular implementation option itself being subject to security checks. For example, a log method implemented using the `java.net.Socket` class shall always be able to log a message from a test-application, even if the test-application is unable to directly access the `java.net.Socket` class due to security restrictions, etc.

It is an allowed implementation option to require that the test-client be put into some particular "test-mode" before any test-results are logged. This mechanism is required to reduce any inadvertent interaction due to downloaded applications accessing the test methods.

Authoring guidelines

The log method is not intended to be accessed by downloaded applications directly, it is purely intended for the use of conformance test applications. Authors of downloaded applications should not call this method, since there may be interactions between this method and normal in-field operation of the test-client (MHP platform).

It is an allowed implementation option to require that the test-client be put into some particular "test-mode" before any test-results are logged. This mechanism is required to reduce any inadvertent interaction due to downloaded applications accessing the test methods.

It is an allowed implementation option to have a number of "test-modes" that are appropriate to different elements being conformance tested, for example, it is a valid implementation for a test-client to have a test-mode where results are stored via a serial port, and a separate test-mode where results are stored via a RAM disk. It is allowable for a conformance test to be performed with the test-client in some specific test-mode, e.g. a `java.net` test (using a serial modem) might have its test results logged to a RAM disk, to avoid interaction between test-log messages and the serial protocol.

The mechanism by which a test-client is put into a given test mode is intentionally left unspecified.

Relationship to `java.io`

It is an implementation option to map the implementation of this method onto corresponding write method(s) of appropriate `java.io` classes. These classes may in turn be obtained, e.g. from `java.net.Socket` classes, etc.

Parameters:

`id` - a string identifying the application (thread) that is logging the test result.

message - the message that the application wishes to be logged.

Throws:

`IOException` - if there is any problem in providing synchronous logging to an application. This `IOException` may be due to failure to write to a file system, inability to access a remote socket, etc. the precise causes are deliberately unspecified and are implementation dependent.

prompt(String, int, String)

```
public static void prompt(java.lang.String id, int controlCode, java.lang.String message)
```

This is a method is used to "approximately" synchronise a test-client and test-server, the method blocks until the test-server positively or negatively acknowledges the particular message. The intended use of this method is to remove critical timing issues from conformance tests, e.g. a conformance test to ensure that an Xlet responds to a change in broadcast signalling must first ensure that the Xlet is in a state where it is able to respond to such signalling -- since the time taken for an Xlet to achieve such a state is reliant on aspects outside of the scope of the conformance test itself (delivery bit rate, hardware and CPU capabilities of the test-client, etc.).

Messages sent using this method should "atomic", i.e. that they are not interleaved with other messages sent using the methods defined in the `DVBTest` class.

Implementation

The precise mechanism(s) by which the this method may be implemented are intentionally unspecified. Implementation options for sending the prompt might include:

- logging the controlCode via an RS-232 (or other serial) connection.
- logging the controlCode to a remote host via some IP / UDP based mechanism, e.g. using a socket-based connection.
- displaying the message on-screen for a (human) test operator, e.g. for systems not implementing a return channel capability.

Implementation options for receiving the acknowledgement might include:

- acknowledgement via an RS-232 (or other serial) connection.
- acknowledgement from a remote host via some IP / UDP based mechanism, e.g. using a socket-based connection.
- a (human) test operator manually acknowledging the message, e.g. for systems not implementing a return channel capability.

Parameters:

`id` - a string identifying the application (thread) that is sending the prompt.

`controlCode` - an integer value (unique within a given Xlet) intended for use by some automated test process (corresponding to the readable message).

`message` - a message (unique within a given Xlet) intended to be readable by a (human) test operator (corresponding to the automated controlCode).

Throws:

`IOException` - If there is any problem in receiving a positive acknowledgement from the test-server, then an this shall be thrown. This may be due to a negative acknowledgement from the test-server, or due to other communication based causes -- which are deliberately left unspecified.

terminate(String, int)

```
public static void terminate(java.lang.String id, int terminationCondition)
```

This synchronous, blocking, method logs the termination condition of a test application using write-only access. The method takes both an identifier string, e.g. "Test number 1" and a integer value to output, e.g. `org.dvb.test.DVBTest.PASS`. In addition to logging the termination condition of the test,

invoking this method also indicates that the test application has terminated its operation. Note that termination of operation does not necessarily correspond to the application being in any particular lifecycle state (as defined in the "Application Model" chapter of the MHP specification). The application is not required to open a file or network connection, per se, and the terminate() method is always available for writing (in principle).

The precise format of the termination message is left deliberately unspecified, implementers may choose to output compressed messages, XML documents, or other formats of their choice (obviously provided that the original information can be recovered). It is an implementation option to include additional information with each termination message, e.g. including:

- version of the specification being implemented
- compiler version and options.
- build-version
- timestamp
- date
- debug info

On test-clients whose implementation of the terminate() method supports external communication to its test-server, implementations of this method may optionally indicate to the test-server that the test-client can be reset by its test-server so that another test may be initiated. The precise mechanism by which this communication takes place is not specified it may be via a IP / socket, serial port, etc.

In the case of an test-client that does not support communication to its test-server, or in the case of an unsuccessful (hanging) test, or inability of this method to return (without throwing an exception) the test-server must be prepared to "time out" the application running on the test-client and then reset the test-client.

Implementation

The precise mechanism(s) by which the this method may be implemented are intentionally unspecified, implementation options might include:

- storing the termination condition to a local file system.
- storing the termination condition to a mounted remote file system.
- storing the termination condition to a RAM disk, etc.
- storing the termination condition via an RS-232 (or other serial) connection.
- storing the termination condition to a remote host via some IP / UDP based mechanism, e.g. using a socket-based connection.

Messages sent using this method should "atomic", i.e. that they are not interleaved with other messages sent using the methods defined in the DVCTest class.

Note that the implementation of the terminate method may use the same or a different mechanism to that used by the log method.

The terminate method does not require any explicit initialisation on the part of the application under test. For example if termination conditions are being stored to a file system, then the application is not required to mount / open any storage file. Similarly, if the results are being logged via a network connection, then the application is not required to open a connection to the storage host, etc. In principle, the mechanism should always be available to accept termination messages.

If this method is implemented on top of some buffering mechanism, it is strongly recommended that the buffer be flushed for each occurrence of a message being logged.

Security and implementation options

There is no Java security mechanism that is used to secure the terminate method.

Note that even if the terminate methods is based on a particular implementation option, it shall be able to operate in spite of that particular implementation option itself being subject to security checks. For example, a terminate method implemented using the java.net.Socket class shall always be able to log the termination condition of a test-application, even if the test-application is unable to directly access the java.net.Socket class due to security restrictions, etc.

It is an allowed implementation option to require that the test-client be put into some particular "test-mode" before any test-results are logged. This mechanism is required to reduce any inadvertent interaction due to downloaded applications accessing the test methods.

Authoring guidelines

The terminate method is not intended to be accessed by downloaded applications directly, it is purely intended for the use of conformance test applications. Authors of downloaded applications should not call this method, since there may be interactions between this method and normal in-field operation of the test-client (MHP platform).

It is an allowed implementation option to require that the test-client be put into some particular "test-mode" before any test-results are logged. This mechanism is required to reduce any inadvertent interaction due to downloaded applications accessing the test methods.

It is an allowed implementation option to have a number of "test-modes" that are appropriate to different elements being conformance tested, for example, it is a valid implementation for a test-client to have a test-mode where results are stored via a serial port, and a separate test-mode where results are stored via a RAM disk. It is allowable for a conformance test to be performed with the test-client in some specific test-mode, e.g. a java.net test (using a serial modem) might have its test results logged to a RAM disk, to avoid interaction between test-log messages and the serial protocol.

The mechanism by which a test-client is put into a given test mode is intentionally left unspecified.

Relationship to java.io

It is an implementation option to map the implementation of this method onto corresponding write method(s) of appropriate java.io classes. These classes may in turn be obtained, e.g. from java.net Socket classes, etc.

Parameters:

`id` - a string identifying the application (thread) that is terminating the test.

`terminationCondition` - the termination condition of the test application.

Throws:

`IOException` - thrown if there is any problem in terminating an application. This may be due to failure to write to a file system, inability to access a remote socket, etc. the precise causes are deliberately unspecified.

Annex Y (normative): Inter-application communication API

Package org.dvb.io.ixc

Description

Provides support for inter-application communication.

Class Summary

Classes

`IxcRegistry`

This is the bootstrap mechanism for obtaining references to remote objects residing in other Xlets executing on the same MHP terminal, using a URL-like syntax.

org.dvb.io.ixc IxcRegistry

Syntax

```
public class IxcRegistry
{
    java.lang.Object
    |
    +--org.dvb.io.ixc.IxcRegistry
}
```

Description

This is the bootstrap mechanism for obtaining references to remote objects residing in other Xlets executing on the same MHP terminal, using a URL-like syntax. The identification of a remote object is given using a syntax indicating the organisation ID and application ID:

/organisation_id/application_id/name

organisation_id = the organisation ID of the Xlet, as signalled in the application_identifier record, defined in the MHP specification.

application_id = the application ID of the Xlet, as signalled in the application_identifier record, defined in the MHP specification.

name = the name under which the remote object was exported.

The organisation ID and the application ID shall be encoded as a hexadecimal string, as would be accepted by `java.lang.Integer.parseInt(String s, 16)`.

When RMI is used to communicate over a network, stubs generated by a tool like `rmic` are often required. This is not necessary for inter-xlet communication initiated with `IxcRegistry`. If such stubs are present, they shall be ignored.

Similarly, network RMI objects often extend the class `server.RemoteObject`, in order to get appropriate implementations for `Object.hashCode()`, `Object.equals()`, and `Object.toString()`. Overriding `Object`'s implementation of these methods in this way is not necessary for inter-xlet communication initiated with `IxcRegistry`, although it is not harmful. Note that the class `server.RemoteObject` is not required in all MHP profiles.

Methods

bind(XletContext, String, Remote)

```
public static void bind(javax.tv.xlet.XletContext xc, java.lang.String name,
    java.rmi.Remote obj)
```

Binds a remote object under a given name in the namespace of an Xlet. The name can be any valid non-null String. No hierarchical namespace exists, e.g. the names "foo" and "bar/../foo" are distinct. If the exporting xlet has been destroyed, this method may fail silently.

Parameters:

`xc` - The context of the Xlet exporting the object.

`name` - The name identifying the object.

`obj` - The object being exported

Throws:

`AlreadyBoundException` - if this Xlet has previously exported an object under the given name.

`NullPointerException` - if `xc`, `name` or `obj` is null

list(XletContext)

```
public static java.lang.String[] list(javax.tv.xlet.XletContext xc)
```

Returns an array of string paths objects available in the registry. The array contains a snapshot of the names present in the registry that the current Xlet would be allowed to import using `lxcRegistry.lookup`.

Parameters:

`xc` - The context of the current Xlet.

Returns:

A non-null array of strings containing a snapshot of the path names of all objects available to the caller in this registry.

See Also:

`lookup(XletContext, String)`

lookup(XletContext, String)

```
public static java.rmi.Remote lookup(javax.tv.xlet.XletContext xc, java.lang.String path)
```

Returns a remote object previously exported by an Xlet that has not been destroyed. The identification of a remote object is given using a syntax indicating the organisation ID and application ID:

`/organisation_id/application_id/name`

`organisation_id` = the organisation ID of the Xlet, as signalled in the `application_identifier` record.

`application_id` = the application ID of the Xlet, as signalled in the `application_identifier` record.

`name` = the name under which the remote object was exported.

The organisation ID and the application ID shall be encoded as a hexadecimal string, as would be accepted by `java.lang.Integer.parseInt(String s, 16)`. If the caller is not authorized to import a given object due to the security policy, then this API will behave as though the object had not been exported, that is, a `NotBoundException` shall be thrown.

Parameters:

`xc` - The context of the current Xlet (that is, the Xlet importing the object).

`path` - A file pathname-like string identifying the Xlet and the name of the object to be imported.

Returns:

A remote object

Throws:

`NotBoundException` - If the name is not currently bound.

`RemoteException` - If a remote stub class cannot be generated for the object being imported.

`java.lang.IllegalArgumentException` - If the name is not formatted in the syntax given above.

`NullPointerException` - if `path` is null

rebind(XletContext, String, Remote)

```
public static void rebind(javax.tv.xlet.XletContext xc, java.lang.String name,  
                        java.rmi.Remote obj)
```

Rebind the name to a new object in the context of an Xlet; replaces any existing binding. The name can be any valid non-null String. No hierarchical namespace exists, e.g. the names "foo" and "bar/../foo" are distinct. If the exporting xlet has been destroyed, this method may fail silently.

Parameters:

- `xc` - The context of the Xlet that exported the object.
- `name` - The name identifying the object.
- `obj` - The object being exported

Throws:

`NullPointerException` - if `xc`, `name` or `obj` is null

unbind(XletContext, String)

```
public static void unbind(javax.tv.xlet.XletContext xc, java.lang.String name)
```

Unbind the name.

Parameters:

- `xc` - The context of the Xlet that exported the object to be unbound.
- `name` - The name identifying the object.

Throws:

`NotBoundException` - if this is not currently any object exported by this Xlet under the given name.

`NullPointerException` - if `xc` or `name` is null

Annex Z (informative): Services, Service Contexts and Applications in an MHP Environment

Z.1 Introduction

This document describes the concepts that link the various parts of an MHP execution environment so that it can display a complete MHP service, including media and applications. This is really an overview to the MHP application lifecycle model, but does include some additional information.

We assume some familiarity with MHP and the JavaTV specification.

Z.2 Basic concepts

The unit for the presentation and execution of content in the MHP specification is the service. A service in MHP represents a group of pieces of content which are intended to be presented together to the end-user. In this version of the specification, the service is the contents of a broadcast DVB service, including audio/video streams, data streams and all the service information, applications and application signalling that is being broadcast. The current service will largely be responsible for determining what media and applications are presented to the user.

Every service that gets presented by an MHP platform is presented within a service context. These form one of the foundations for the runtime environment and the execution model. A service context is an "environment" in which a service gets presented - it defines the boundaries of the service (letting the platform and applications identify which of the pieces of content that are being presented make up a given service). It also enables that service to be addressed and controlled as a single entity. A DVB-J application can call the select method on a service context (represented by `javax.tv.service.selection.ServiceContext`) and the platform will stop presenting all of the content that makes up the current service being presented by that service context and start presenting the content that makes up the new service. In this case, "content" may include one or more applications.

A service context has some major differences from a DVB-J Xlet context. It is not necessary to have one service context for every possible service that can or will get presented - one service context is needed for every service that can be presented simultaneously, but that is all. Also, a service context is not destroyed when the service within it is stopped, unlike the Xlet context for a DVB-J application. The service context exists until an application or the platform explicitly destroys it. In normal operational mode, the built-in navigator or EPG for an MHP system will create one single service context when it starts and never destroy that. MHP applications will run in that service context.

Z.3 Presenting a service in MHP

From the MHP point of view, the content of a service can be one of two types - media or applications. Media is the simplest case and is described first.

Z.3.1 Presenting the media components of a service

If there are several different streams of media that may get presented (such as several different video streams) then the platform uses a variety of methods to tell which streams should be used. These include user preferences and platform defaults, but will also include using service information to determine which streams get presented to the user.

For a DVB-J application, a JMF Player object is created for any media that gets presented as part of the service. These players are directly linked to the service context, and the service context can be queried to find out which JMF Players are linked with it. It is also possible for applications to create JMF Player objects directly without linkage to the applications service context.

Z.3.2 Presenting the application components of a service

Applications are handled in a slightly different way. The lifecycle of all applications in an MHP environment is controlled by an application manager, a software entity that forms part of the MHP runtime environment. It takes its instructions on which applications to start and stop from the user, but also from information that is included in the MHP broadcast (called an "AIT", can logically be considered an extension to MPEG's PMT) and the free resources in the platform.

The information carried in the AIT (Application Information Table) not only says which applications are available, but also provides some instructions to the application manager about whether an application should be started automatically or whether an application should be killed automatically. The application manager monitors this information for changes, and creates, starts or kills applications as appropriate.

Every DVB-J application executes within an Xlet context. This is a similar concept to the applet context that a Java applet executes in, and it provides the Xlet with a link to its environment, both for accessing system properties and for telling the environment that the Xlet has changed its own state.

Since every Xlet executes as part of a DVB service, there is also a link between the Xlet and its associated service. This link is the class `javax.tv.service.selection.ServiceContextFactory`. Using methods on this class, an Xlet can lookup its service context from its xlet context. From the service context, an Xlet can discover which service it is currently running as part of. It can also register for events to be told when the service being presented in its service context changes.

The application manager must maintain a list of all the applications in a system, so that it knows which ones are currently executing. It must also know (directly or indirectly) which applications are associated with which service context, so that if the service being presented in that service context changes due to a new service being selected, it can kill the

applications that are not signalled in the new service. When a service is selected in a service context, the following steps happen in approximately this order:

- a) The platform examines the MPEG PMT for the service that has been selected (tuning first if necessary) and works out which media streams are to be presented.
- b) Any media streams currently playing are stopped and any new media streams that need to be presented are started. Any JMF players presenting the old content are stopped and destroyed, and players for the new content are created and started if necessary.
- c) The platform monitors the application information table for the new service to find out which applications should be running. Any applications that are currently running but which are not signalled in the application information table of the new service (or which are signalled as killed) are killed and the Xlet contexts of DVB-J applications associated with the old service are destroyed.
- d) For any applications which are signalled as autostart and are not currently running, the following steps are taken:
 - The platform attaches to the object carousel signalled in the application information table
 - The platform attempts to load the main application file as signalled in the application information table
 - For a DVB-J application, the platform creates an instance of the main class using the default constructor, creates an XletContext object for the application and calls the `Xlet.initXlet()` method on the newly loaded class, passing the XletContext object as a parameter. Once this call is complete, the platform calls the `Xlet.startXlet()` method.

If several applications are signalled as autostart, the platform will load and start every one in the same way. Each DVB-J application will have a different Xlet context and will execute independently, although they are all associated with the same service context.

Z.4 Multiple service contexts in an MHP platform

The MHP specification allows the platform to have any number of service contexts, although the platform may choose to limit the number it can produce, possibly even to one. Each service context can present a different service, completely independently of the other service contexts. Operations carried out on one service context will not affect another (unless they cause tuning which prevents the contents of a service in another service context from being presented). It is even possible to display the same service in several service contexts simultaneously - this may not be very useful, but it is allowed. This may result in several instances of the same application running in at the same time in different service contexts. In practice, this is most likely to happen in future MHP terminals with multiple independent video output channels.

Z.5 How does the platform know which services are available?

In order to select a new service, an application (or the platform) has to know three things about the service it wants to start: the original network ID, the transport stream ID and the service ID for the service in question. In the case of an application, those values may be hard-wired into the application by the developer, but this not required. The application can find out about a service in the same way that the platform can - using service information.

The platform can not know the details of every available service when it started for the first time, and so it must use another method to find out about what services it can receive. A set-top box may do the following to find this out, for instance:

- a) Scan the input (satellite, cable or some other input) to find out which transport streams are available and the physical parameters it needs to tune to them successfully.
- b) For every transport stream:
 - Tune to it
 - Use the service information API to access the service description table (SDT) and network information table (NIT) for that transport stream.
 - Use these tables to find what services are in the transport stream and the values needed to select those services
 - In the case of the platform performing an initial scan, write this information to non-volatile memory
- c) When the application has found the service it wants (or in the case of the platform performing a scan, once every transport stream has been scanned in this way), a service can be selected.

At this point, the platform has all the information it needs to start presenting services to the user. It is important to realise that this is not the only way of finding this information - other ways may be possible, depending on the MHP implementation.

Index

A

- a - of org.havi.ui.HEventMulticaster 705
- abort() - of org.dvb.dsmcc.DSMCCObject 471
- accept(AppID) - of org.dvb.application.AppsDatabaseFilter 574
- accept(AppID) - of org.dvb.application.CurrentServiceFilter 578
- ACTIONED_FOCUSED_STATE - of org.havi.ui.HState 927
- ACTIONED_STATE - of org.havi.ui.HState 927
- ACTIONED_STATE_BIT - of org.havi.ui.HState 927
- actionPerformed(ActionEvent) - of org.havi.ui.HEventMulticaster 705
- ActiveFormatDescriptionChangedEvent - of org.dvb.media 416
- ActiveFormatDescriptionChangedEvent(Object, int) - of org.dvb.media.ActiveFormatDescriptionChangedEvent 416
- add(HActionListener, HActionListener) - of org.havi.ui.HEventMulticaster 706
- add(HAdjustmentListener, HAdjustmentListener) - of org.havi.ui.HEventMulticaster 706
- add(HBackgroundImageListener, HBackgroundImageListener) - of org.havi.ui.HEventMulticaster 706
- add(HFocusListener, HFocusListener) - of org.havi.ui.HEventMulticaster 706
- add(HItemListener, HItemListener) - of org.havi.ui.HEventMulticaster 706
- add(HKeyListener, HKeyListener) - of org.havi.ui.HEventMulticaster 706
- add(HScreenConfigurationListener, HScreenConfigurationListener) - of org.havi.ui.HEventMulticaster 707
- add(HScreenConfigurationListener, HScreenConfigurationListener, HScreenConfigTemplate) - of org.havi.ui.HEventMulticaster 707
- add(HScreenLocationModifiedListener, HScreenLocationModifiedListener) - of org.havi.ui.HEventMulticaster 707
- add(HTextListener, HTextListener) - of org.havi.ui.HEventMulticaster 707
- add(HToggleButton) - of org.havi.ui.HToggleGroup 993
- add(int, String) - of org.dvb.user.Preference 321
- add(ResourceStatusListener, ResourceStatusListener) - of org.havi.ui.HEventMulticaster 707
- add(String) - of org.dvb.user.Preference 321
- add(String[]) - of org.dvb.user.Preference 321
- add(WindowListener, WindowListener) - of org.havi.ui.HEventMulticaster 708
- ADD_INDEX_END - of org.havi.ui.HListGroup 787
- addAdjustmentListener(HAdjustmentListener) - of org.havi.ui.HAdjustmentValue 650
- addAdjustmentListener(HAdjustmentListener) - of org.havi.ui.HRangeValue 852
- addAfter(Component, Component) - of org.havi.ui.HComponentOrdering 685
- addAfter(Component, Component) - of org.havi.ui.HContainer 692
- addAfter(Component, Component) - of org.havi.ui.HScene 862
- addAllArrowKeys() - of org.dvb.event.UserEventRepository 307
- addAllColourKeys() - of org.dvb.event.UserEventRepository 307
- addAllNumericKeys() - of org.dvb.event.UserEventRepository 307
- addAppStateChangeListener(AppStateChangeListener) - of org.dvb.application.AppProxy 561
- addBefore(Component, Component) - of org.havi.ui.HComponentOrdering 685
- addBefore(Component, Component) - of org.havi.ui.HContainer 693
- addBefore(Component, Component) - of org.havi.ui.HScene 863
- addBouquetMonitoringListener(SIMonitoringListener, int) - of org.dvb.si.SIDatabase 348
- addConnectionListener(ConnectionListener) - of org.dvb.net.rc.ConnectionRCInterface 535
- addEventPresentFollowingMonitoringListener(SIMonitoringListener, int, int, int) - of org.dvb.si.SIDatabase 348
- addEventScheduleMonitoringListener(SIMonitoringListener, int, int, int, Date, Date) - of org.dvb.si.SIDatabase 349
- addExclusiveAccessToAWTEvent(ResourceClient, UserEventRepository) - of org.dvb.event.EventManager 297

addActionListener(HActionListener) - of org.havi.ui.HActionable 641
 addActionListener(HActionListener) - of org.havi.ui.HGraphicButton 737
 addActionListener(HActionListener) - of org.havi.ui.HTextButton 965
 addActionListener(HActionListener) - of org.havi.ui.HToggleButton 985
 addInternal(EventListener, EventListener) - of org.havi.ui.HEventMulticaster 708
 addItem(HListElement, int) - of org.havi.ui.HListGroup 788
 addItemListener(HItemListener) - of org.havi.ui.HItemValue 778
 addItemListener(HItemListener) - of org.havi.ui.HListGroup 789
 addItem(HListElement[], int) - of org.havi.ui.HListGroup 789
 addKey(int) - of org.dvb.event.UserEventRepository 307
 addListener(AppsDatabaseEventListener) - of org.dvb.application.AppsDatabase 567
 addNetworkMonitoringListener(SIMonitoringListener, int) - of org.dvb.si.SIDatabase 350
 addNPTListener(NPTListener) - of org.dvb.dsmcc.DSMCCStream 477
 addObjectChangeEventEventListener(ObjectChangeEventEventListener) - of org.dvb.dsmcc.DSMCCObject 472
 addOnScreenLocationModifiedListener(HScreenLocationModifiedListener) - of org.havi.ui.HVideoComponent 1001
 addPMTServiceMonitoringListener(SIMonitoringListener, int, int, int) - of org.dvb.si.SIDatabase 350
 addResourceStatusEventListener(ResourceStatusListener) - of org.dvb.event.EventManager 297
 addResourceStatusEventListener(ResourceStatusListener) - of org.dvb.net.rc.RCInterfaceManager 544
 addResourceStatusEventListener(ResourceStatusListener) - of org.havi.ui.HScreenDevice 894
 addScreenConfigurationListener(HScreenConfigurationListener) - of org.havi.ui.HScreenDevice 894
 addScreenConfigurationListener(HScreenConfigurationListener, HScreenConfigTemplate) - of org.havi.ui.HScreenDevice 894
 addServiceMonitoringListener(SIMonitoringListener, int, int) - of org.dvb.si.SIDatabase 351
 addShortcut(int, HActionable) - of org.havi.ui.HScene 863
 addSubtitleListener(SubtitleListener) - of org.dvb.media.SubtitlingEventControl 440
 addTextOverflowListener(TextOverflowListener) - of org.dvb.ui.DVBTextLayoutManager 617
 addUserEvent(UserEvent) - of org.dvb.event.UserEventRepository 307
 addUserEventListener(UserEventListener, ResourceClient, UserEventRepository) - of org.dvb.event.EventManager 298
 addUserEventListener(UserEventListener, UserEventRepository) - of org.dvb.event.EventManager 298
 addUserPreferenceChangeListener(UserPreferenceChangeListener) - of org.dvb.user.UserPreferenceManager 326
 addVideoFormatListener(VideoFormatListener) - of org.dvb.media.VideoFormatControl 444
 addWindowListener(WindowListener) - of org.havi.ui.HScene 864
 ADJUST_BUTTON_LESS - of org.havi.ui.HAdjustableLook 645
 ADJUST_BUTTON_MORE - of org.havi.ui.HAdjustableLook 645
 ADJUST_END_CHANGE - of org.havi.ui.event.HAdjustmentEvent 1038
 ADJUST_FIRST - of org.havi.ui.event.HAdjustmentEvent 1039
 ADJUST_LAST - of org.havi.ui.event.HAdjustmentEvent 1039
 ADJUST_LESS - of org.havi.ui.event.HAdjustmentEvent 1039
 ADJUST_MORE - of org.havi.ui.event.HAdjustmentEvent 1039
 ADJUST_NONE - of org.havi.ui.HAdjustableLook 645
 ADJUST_PAGE_LESS - of org.havi.ui.event.HAdjustmentEvent 1039
 ADJUST_PAGE_MORE - of org.havi.ui.HAdjustableLook 645
 ADJUST_PAGE_MORE - of org.havi.ui.event.HAdjustmentEvent 1039
 ADJUST_PAGE_MORE - of org.havi.ui.HAdjustableLook 645
 ADJUST_START_CHANGE - of org.havi.ui.event.HAdjustmentEvent 1040
 ADJUST_THUMB - of org.havi.ui.HAdjustableLook 646
 ADJUSTMENT_VALUE_CHANGE - of org.havi.ui.HVisible 1018
 AFD_14_9 - of org.dvb.media.VideoFormatControl 441
 AFD_14_9_TOP - of org.dvb.media.VideoFormatControl 441
 AFD_16_9 - of org.dvb.media.VideoFormatControl 441
 AFD_16_9_SP_14_9 - of org.dvb.media.VideoFormatControl 441
 AFD_16_9_SP_4_3 - of org.dvb.media.VideoFormatControl 441

AFD_16_9_TOP - of org.dvb.media.VideoFormatControl 442
 AFD_4_3 - of org.dvb.media.VideoFormatControl 442
 AFD_4_3_SP_14_9 - of org.dvb.media.VideoFormatControl 442
 AFD_GT_16_9 - of org.dvb.media.VideoFormatControl 442
 AFD_NOT_PRESENT - of org.dvb.media.VideoFormatControl 442
 AFD_SAME - of org.dvb.media.VideoFormatControl 442
 ALL_STATES - of org.havi.ui.HState 927
 ALPHABETIC_PRESENTATION_FORMS_A - of org.havi.ui.HFontCapabilities 723
 ANIMATE_CONTENT_CHANGE - of org.havi.ui.HVisible 1018
 APP_ADDED - of org.dvb.application.AppsDatabaseEvent 570
 APP_CHANGED - of org.dvb.application.AppsDatabaseEvent 570
 APP_DELETED - of org.dvb.application.AppsDatabaseEvent 570
 AppAttributes - of org.dvb.application 552
 AppIcon - of org.dvb.application 557
 AppIcon() - of org.dvb.application.AppIcon 557
 AppID - of org.dvb.application 558
 AppID(int, int) - of org.dvb.application.AppID 558
 AppProxy - of org.dvb.application 560
 AppsControlPermission - of org.dvb.application 564
 AppsControlPermission() - of org.dvb.application.AppsControlPermission 564
 AppsControlPermission(String, String) - of org.dvb.application.AppsControlPermission 564
 AppsDatabase - of org.dvb.application 566
 AppsDatabaseEvent - of org.dvb.application 570
 AppsDatabaseEvent(int, AppID, Object) - of org.dvb.application.AppsDatabaseEvent 571
 AppsDatabaseEventListener - of org.dvb.application 572
 AppsDatabaseFilter - of org.dvb.application 574
 AppsDatabaseFilter() - of org.dvb.application.AppsDatabaseFilter 574
 AppStateChangeEvent - of org.dvb.application 575
 AppStateChangeEvent(AppID, int, int, Object, boolean) - of org.dvb.application.AppStateChangeEvent 575
 AppStateChangeEventListener - of org.dvb.application 577
 ARABIC_EXTENDED - of org.havi.ui.HFontCapabilities 723
 ARABIC_PRESENTATION_FORMS_A - of org.havi.ui.HFontCapabilities 723
 ARABIC_PRESENTATION_FORMS_B - of org.havi.ui.HFontCapabilities 723
 ARMENIAN - of org.havi.ui.HFontCapabilities 723
 ARROWS - of org.havi.ui.HFontCapabilities 724
 ASPECT_RATIO_16_9 - of org.dvb.media.VideoFormatControl 442
 ASPECT_RATIO_2_21_1 - of org.dvb.media.VideoFormatControl 442
 ASPECT_RATIO_4_3 - of org.dvb.media.VideoFormatControl 442
 ASPECT_RATIO_UNKNOWN - of org.dvb.media.VideoFormatControl 442
 AspectRatioChangedEvent - of org.dvb.media 417
 AspectRatioChangedEvent(Object, int) - of org.dvb.media.AspectRatioChangedEvent 417
 asynchronousLoad(AsynchronousLoadingEventListener) - of org.dvb.dsmcc.DSMCCObject 472
 AsynchronousLoadingEvent - of org.dvb.dsmcc 467
 AsynchronousLoadingEvent(DSMCCObject) - of org.dvb.dsmcc.AsynchronousLoadingEvent 467
 AsynchronousLoadingEventListener - of org.dvb.dsmcc 468
 attach(byte[]) - of org.dvb.dsmcc.ServiceDomain 511
 attach(Locator) - of org.dvb.dsmcc.ServiceDomain 511
 attach(Locator, int) - of org.dvb.dsmcc.ServiceDomain 511

B

b - of org.havi.ui.HEventMulticaster 705
 BACKGROUND_FILL - of org.havi.ui.HScene 861
 BACKGROUND_FILL - of org.havi.ui.HVisible 1018
 BACKGROUNDIMAGE_FILE_NOT_FOUND - of org.havi.ui.event.HBackgroundImageEvent 1042

BACKGROUNDIMAGE_FIRST - of org.havi.ui.event.HBackgroundImageEvent 1042
 BACKGROUNDIMAGE_INVALID - of org.havi.ui.event.HBackgroundImageEvent 1042
 BACKGROUNDIMAGE_IOERROR - of org.havi.ui.event.HBackgroundImageEvent 1043
 BACKGROUNDIMAGE_LAST - of org.havi.ui.event.HBackgroundImageEvent 1043
 BACKGROUNDIMAGE_LOADED - of org.havi.ui.event.HBackgroundImageEvent 1043
 BackgroundVideoPresentationControl - of org.dvb.media 418
 BASIC_ARABIC - of org.havi.ui.HFontCapabilities 724
 BASIC_GEORGIAN - of org.havi.ui.HFontCapabilities 724
 BASIC_GREEK - of org.havi.ui.HFontCapabilities 724
 BASIC_HEBREW - of org.havi.ui.HFontCapabilities 724
 BASIC_LATIN - of org.havi.ui.HFontCapabilities 724
 BENGALI - of org.havi.ui.HFontCapabilities 724
 bind(XletContext, String, Remote) - of org.dvb.io.ixc.IxcRegistry 1102
 BLOCK_ELEMENTS - of org.havi.ui.HFontCapabilities 724
 BOPOMOFO - of org.havi.ui.HFontCapabilities 725
 BOUQUET - of org.dvb.si.SIMonitoringType 381
 BOUQUET_NAME - of org.dvb.si.DescriptorTag 335
 BOX_DRAWING - of org.havi.ui.HFontCapabilities 725
 brighter() - of org.dvb.ui.DVBColor 607
 BUSINESS_GRAPHICS - of org.havi.ui.HImageHints 772

C

CA_FAILURE - of org.dvb.media.PresentationChangedEvent 429
 CA_IDENTIFIER - of org.dvb.si.DescriptorTag 335
 CA_RETURNED - of org.dvb.media.PresentationChangedEvent 429
 CABLE_DELIVERY_SYSTEM - of org.dvb.si.DescriptorTag 335
 CAException - of org.dvb.media 419
 CAException() - of org.dvb.media.CAException 419
 CAException(String) - of org.dvb.media.CAException 419
 cancelRequest() - of org.dvb.si.SIRequest 388
 CAPermission - of org.dvb.net.ca 587
 CAPermission(String) - of org.dvb.net.ca.CAPermission 587
 CAPermission(String, String) - of org.dvb.net.ca.CAPermission 588
 CARET_NEXT_CHAR - of org.havi.ui.event.HTextEvent 1084
 CARET_NEXT_LINE - of org.havi.ui.event.HTextEvent 1085
 CARET_NEXT_PAGE - of org.havi.ui.event.HTextEvent 1085
 CARET_POSITION_CHANGE - of org.havi.ui.HVisible 1018
 CARET_PREV_CHAR - of org.havi.ui.event.HTextEvent 1085
 CARET_PREV_LINE - of org.havi.ui.event.HTextEvent 1085
 CARET_PREV_PAGE - of org.havi.ui.event.HTextEvent 1085
 caretMoved(HTextEvent) - of org.havi.ui.event.HTextListener 1088
 caretMoved(HTextEvent) - of org.havi.ui.HEventMulticaster 708
 caretNextCharacter() - of org.havi.ui.HSinglelineEntry 909
 caretNextLine() - of org.havi.ui.HMultilineEntry 819
 caretPreviousCharacter() - of org.havi.ui.HSinglelineEntry 909
 caretPreviousLine() - of org.havi.ui.HMultilineEntry 819
 CARTOON - of org.havi.ui.HImageHints 772
 CACStopEvent - of org.dvb.media 420
 CACStopEvent(Controller) - of org.dvb.media.CACStopEvent 420
 CACStopEvent(Controller, MediaLocator) - of org.dvb.media.CACStopEvent 420
 CHANGEABLE_SINGLE_COLOR - of org.havi.ui.HBackgroundConfigTemplate 670
 CJK_COMPATIBILITY - of org.havi.ui.HFontCapabilities 725
 CJK_COMPATIBILITY_FORMS - of org.havi.ui.HFontCapabilities 725
 CJK_COMPATIBILITY_IDEOGRAPHS - of org.havi.ui.HFontCapabilities 725

CJK_MISCELLANEOUS - of org.havi.ui.HFontCapabilities 725
 CJK_SYMBOLS_AND_PUNCTUATION - of org.havi.ui.HFontCapabilities 725
 CJK_UNIFIED_IDEOGRAPHS - of org.havi.ui.HFontCapabilities 725
 CLEAR - of org.dvb.ui.DVBAlphaComposite 595
 Clear - of org.dvb.ui.DVBAlphaComposite 594
 clearSelection() - of org.havi.ui.HListGroup 789
 close() - of org.davic.net.ca.MMIOObject 227
 COMBINING_DIACRITICAL_MARKS - of org.havi.ui.HFontCapabilities 726
 COMBINING_DIACRITICAL_MARKS_FOR_SYMBOLS - of org.havi.ui.HFontCapabilities 726
 COMBINING_HALF_MARKS - of org.havi.ui.HFontCapabilities 726
 COMPONENT - of org.dvb.si.DescriptorTag 335
 connect() - of org.dvb.media.DripFeedDataSource 424
 connect() - of org.dvb.net.rc.ConnectionRCInterface 535
 connectionChanged(ConnectionRCEvent) - of org.dvb.net.rc.ConnectionListener 531
 ConnectionEstablishedEvent - of org.dvb.net.rc 529
 ConnectionEstablishedEvent(Object) - of org.dvb.net.rc.ConnectionEstablishedEvent 529
 ConnectionFailedEvent - of org.dvb.net.rc 530
 ConnectionFailedEvent(Object) - of org.dvb.net.rc.ConnectionFailedEvent 530
 ConnectionListener - of org.dvb.net.rc 531
 ConnectionParameters - of org.dvb.net.rc 532
 ConnectionParameters(String, String, String) - of org.dvb.net.rc.ConnectionParameters 532
 ConnectionParameters(String, String, String, InetAddress[]) - of org.dvb.net.rc.ConnectionParameters 532
 ConnectionRCEvent - of org.dvb.net.rc 534
 ConnectionRCEvent(Object) - of org.dvb.net.rc.ConnectionRCEvent 534
 ConnectionRCInterface - of org.dvb.net.rc 535
 ConnectionTerminatedEvent - of org.dvb.net.rc 539
 ConnectionTerminatedEvent(Object) - of org.dvb.net.rc.ConnectionTerminatedEvent 539
 CONTENT - of org.dvb.si.DescriptorTag 335
 CONTENT_CHANGE - of org.havi.ui.HVisible 1019
 CONTROL_PICTURES - of org.havi.ui.HFontCapabilities 726
 convertSIStringToJavaString(byte[], int, int, boolean) - of org.dvb.si.SIUtil 411
 convertTo(HScreenConfiguration, Point) - of org.havi.ui.HScreenConfiguration 891
 COUNTRY_AVAILABILITY - of org.dvb.si.DescriptorTag 335
 createFont(String, int, int) - of org.dvb.ui.FontFactory 623
 createGraphics() - of org.dvb.ui.DVBBufferedImage 600
 CURRENCY_SYMBOLS - of org.havi.ui.HFontCapabilities 726
 currentItemChanged(HItemEvent) - of org.havi.ui.event.HItemListener 1059
 currentItemChanged(HItemEvent) - of org.havi.ui.HEventMulticaster 708
 CurrentServiceFilter - of org.dvb.application 578
 CurrentServiceFilter() - of org.dvb.application.CurrentServiceFilter 578
 CYRILLIC - of org.havi.ui.HFontCapabilities 726

D

D_D2_MAC - of org.dvb.si.SIServiceType 400
 DAR_16_9 - of org.dvb.media.VideoFormatControl 443
 DAR_4_3 - of org.dvb.media.VideoFormatControl 443
 darker() - of org.dvb.ui.DVBColor 608
 data - of org.havi.ui.HChangeData 681
 DATA_BROADCAST - of org.dvb.si.DescriptorTag 336
 DATA_BROADCAST - of org.dvb.si.SIServiceType 400
 DatagramSocketBufferControl - of org.dvb.net 526
 DEFAULT_ICON_HEIGHT - of org.havi.ui.HListGroup 787
 DEFAULT_ICON_WIDTH - of org.havi.ui.HListGroup 787
 DEFAULT_LABEL_HEIGHT - of org.havi.ui.HListGroup 787

DEFAULT_LABEL_WIDTH - of org.havi.ui.HListGroup 788
deleteNextChar() - of org.havi.ui.HSinglelineEntry 909
deletePreviousChar() - of org.havi.ui.HSinglelineEntry 910
Descriptor - of org.dvb.si 333
DescriptorTag - of org.dvb.si 335
DESTROYED - of org.dvb.application.AppProxy 560
detach() - of org.dvb.dsmcc.ServiceDomain 512
DEVANAGARI - of org.havi.ui.HFontCapabilities 726
DFC_PLATFORM - of org.dvb.media.VideoFormatControl 443
DFC_PROCESSING_CCO - of org.dvb.media.VideoFormatControl 443
DFC_PROCESSING_FULL - of org.dvb.media.VideoFormatControl 443
DFC_PROCESSING_LB_14_9 - of org.dvb.media.VideoFormatControl 443
DFC_PROCESSING_LB_16_9 - of org.dvb.media.VideoFormatControl 443
DFC_PROCESSING_LB_2_21_1_ON_16_9 - of org.dvb.media.VideoFormatControl 443
DFC_PROCESSING_LB_2_21_1_ON_4_3 - of org.dvb.media.VideoFormatControl 444
DFC_PROCESSING_NONE - of org.dvb.media.VideoFormatControl 444
DFC_PROCESSING_PAN_SCAN - of org.dvb.media.VideoFormatControl 444
DFC_PROCESSING_UNKNOWN - of org.dvb.media.VideoFormatControl 444
DFCChangedEvent - of org.dvb.media 422
DFCChangedEvent(Object, int) - of org.dvb.media.DFCChangedEvent 422
DIGITAL_RADIO_SOUND - of org.dvb.si.SIServiceType 400
DIGITAL_TELEVISION - of org.dvb.si.SIServiceType 400
DINGBATS - of org.havi.ui.HFontCapabilities 726
DISABLED_ACTIONED_FOCUSED_STATE - of org.havi.ui.HState 928
DISABLED_ACTIONED_STATE - of org.havi.ui.HState 928
DISABLED_FOCUSED_STATE - of org.havi.ui.HState 928
DISABLED_STATE - of org.havi.ui.HState 928
DISABLED_STATE_BIT - of org.havi.ui.HState 928
disconnect() - of org.dvb.media.DripFeedDataSource 424
disconnect() - of org.dvb.net.rc.ConnectionRCInterface 535
displayImage(HBackgroundImage) - of org.havi.ui.HStillImageBackgroundConfiguration 950
displayImage(HBackgroundImage, HScreenRectangle) - of org.havi.ui.HStillImageBackgroundConfiguration 950
dispose() - of org.dvb.ui.DVBBufferedImage 600
dispose() - of org.havi.ui.HScene 864
dispose() - of org.havi.ui.HSound 923
dispose(Color) - of org.havi.ui.HGraphicsConfiguration 753
dispose(HScene) - of org.havi.ui.HSceneFactory 873
DONT_CARE - of org.havi.ui.HScreenConfigTemplate 886
downloadFont(Font) - of org.havi.ui.HFontCapabilities 732
DripFeedDataSource - of org.dvb.media 423
DripFeedDataSource() - of org.dvb.media.DripFeedDataSource 423
DripFeedPermission - of org.dvb.media 426
DripFeedPermission(String) - of org.dvb.media.DripFeedPermission 426
DripFeedPermission(String, String) - of org.dvb.media.DripFeedPermission 426
DSMCCEException - of org.dvb.dsmcc 469
DSMCCEException() - of org.dvb.dsmcc.DSMCCEException 469
DSMCCEException(String) - of org.dvb.dsmcc.DSMCCEException 469
DSMCCObject - of org.dvb.dsmcc 470
DSMCCObject(DSMCCObject, String) - of org.dvb.dsmcc.DSMCCObject 471
DSMCCObject(String) - of org.dvb.dsmcc.DSMCCObject 471
DSMCCObject(String, String) - of org.dvb.dsmcc.DSMCCObject 471
DSMCCStream - of org.dvb.dsmcc 476
DSMCCStream(DSMCCObject) - of org.dvb.dsmcc.DSMCCStream 476
DSMCCStream(String) - of org.dvb.dsmcc.DSMCCStream 476

DSMCCStream(String, String) - of org.dvb.dsmcc.DSMCCStream 477
 DSMCCStreamEvent - of org.dvb.dsmcc 480
 DSMCCStreamEvent(DSMCCObject) - of org.dvb.dsmcc.DSMCCStreamEvent 480
 DSMCCStreamEvent(String) - of org.dvb.dsmcc.DSMCCStreamEvent 480
 DSMCCStreamEvent(String, String) - of org.dvb.dsmcc.DSMCCStreamEvent 480
 DST_IN - of org.dvb.ui.DVBAlphaComposite 595
 DST_OUT - of org.dvb.ui.DVBAlphaComposite 595
 DST_OVER - of org.dvb.ui.DVBAlphaComposite 595
 DstIn - of org.dvb.ui.DVBAlphaComposite 595
 DstOut - of org.dvb.ui.DVBAlphaComposite 596
 DstOver - of org.dvb.ui.DVBAlphaComposite 596
 DVB_HTML_application - of org.dvb.application.AppAttributes 552
 DVB_J_application - of org.dvb.application.AppAttributes 552
 DVBAAlphaComposite - of org.dvb.ui 594
 DVBBufferedImage - of org.dvb.ui 599
 DVBBufferedImage(int, int) - of org.dvb.ui.DVBBufferedImage 600
 DVBBufferedImage(int, int, int) - of org.dvb.ui.DVBBufferedImage 600
 DVBClassLoader - of org.dvb.lang 291
 DVBClassLoader(URL[]) - of org.dvb.lang.DVBClassLoader 291
 DVBClassLoader(URL[], ClassLoader) - of org.dvb.lang.DVBClassLoader 291
 DVBColor - of org.dvb.ui 606
 DVBColor(Color) - of org.dvb.ui.DVBColor 606
 DVBColor(float, float, float, float) - of org.dvb.ui.DVBColor 606
 DVBColor(int, boolean) - of org.dvb.ui.DVBColor 607
 DVBColor(int, int, int, int) - of org.dvb.ui.DVBColor 607
 DVBGraphics - of org.dvb.ui 610
 DVBGraphics() - of org.dvb.ui.DVBGraphics 610
 DVBHTMLProxy - of org.dvb.application 579
 DVBJProxy - of org.dvb.application 581
 DvbNetworkInterfaceSIUtil - of org.dvb.net.tuning 590
 DVBRasterFormatException - of org.dvb.ui 614
 DVBRasterFormatException(String) - of org.dvb.ui.DVBRasterFormatException 614
 DVCTest - of org.dvb.test 1094
 DVCTestLayoutManager - of org.dvb.ui 615
 DVCTestLayoutManager() - of org.dvb.ui.DVCTestLayoutManager 617
 DVCTestLayoutManager(int, int, int, int, boolean, int, int, int) - of org.dvb.ui.DVCTestLayoutManager 617

E

ECHO_CHAR_CHANGE - of org.havi.ui.HVisible 1019
 echoCharIsSet() - of org.havi.ui.HSinglelineEntry 910
 EDIT_MODE_CHANGE - of org.havi.ui.HVisible 1019
 enableShortcuts(boolean) - of org.havi.ui.HScene 864
 ENCLOSED_ALPHANUMERICS - of org.havi.ui.HFontCapabilities 727
 ENCLOSED_CJK_LETTERS_AND_MONTHS - of org.havi.ui.HFontCapabilities 727
 entryAdded(AppsDatabaseEvent) - of org.dvb.application.AppsDatabaseEventListener 572
 entryChanged(AppsDatabaseEvent) - of org.dvb.application.AppsDatabaseEventListener 572
 entryRemoved(AppsDatabaseEvent) - of org.dvb.application.AppsDatabaseEventListener 572
 equals(Object) - of org.dvb.application.AppsControlPermission 564
 equals(Object) - of org.dvb.ui.DVBAlphaComposite 597
 equals(Object) - of org.dvb.ui.DVBColor 608
 ER_TYPE_COLOR - of org.havi.ui.event.HEventRepresentation 1048
 ER_TYPE_NOT_SUPPORTED - of org.havi.ui.event.HEventRepresentation 1048
 ER_TYPE_STRING - of org.havi.ui.event.HEventRepresentation 1048
 ER_TYPE_SYMBOL - of org.havi.ui.event.HEventRepresentation 1049

EventManager - of org.dvb.event 297
 EXTENDED_EVENT - of org.dvb.si.DescriptorTag 336

F

Facility - of org.dvb.user 318
 Facility(String, String) - of org.dvb.user.Facility 318
 Facility(String, String[]) - of org.dvb.user.Facility 318
 FAIL - of org.dvb.test.DVBTest 1094
 feed(byte[]) - of org.dvb.media.DripFeedDataSource 424
 FileAccessPermissions - of org.dvb.io.persistent 311
 FileAccessPermissions(boolean, boolean, boolean, boolean, boolean, boolean) - of org.dvb.io.persistent.File-
 AccessPermissions 311
 FileAttributes - of org.dvb.io.persistent 313
 findClass(String) - of org.dvb.lang.DVBClassLoader 292
 FIRST_CHANGE - of org.havi.ui.HVisible 1019
 FIRST_STATE - of org.havi.ui.HState 928
 FLICKER_FILTERING - of org.havi.ui.HScreenConfigTemplate 886
 flush() - of org.dvb.ui.DVBBufferedImage 601
 flush() - of org.havi.ui.HBackgroundImage 679
 FM_RADIO - of org.dvb.si.SIServiceType 400
 FOCUS_TRANSFER - of org.havi.ui.event.HFocusEvent 1052
 FOCUSED_STATE - of org.havi.ui.HState 929
 FOCUSED_STATE_BIT - of org.havi.ui.HState 929
 focusGained(FocusEvent) - of org.havi.ui.HEventMulticaster 709
 focusLost(FocusEvent) - of org.havi.ui.HEventMulticaster 709
 fontAccessible(Font) - of org.havi.ui.HFontCapabilities 732
 FontFactory - of org.dvb.ui 622
 FontFactory() - of org.dvb.ui.FontFactory 622
 FontFactory(URL) - of org.dvb.ui.FontFactory 622
 FontFormatException - of org.dvb.ui 624
 FontFormatException() - of org.dvb.ui.FontFormatException 624
 FontFormatException(String) - of org.dvb.ui.FontFormatException 624
 FontNotAvailableException - of org.dvb.ui 625
 FontNotAvailableException() - of org.dvb.ui.FontNotAvailableException 625
 FontNotAvailableException(String) - of org.dvb.ui.FontNotAvailableException 625
 FREQUENCY_LIST - of org.dvb.si.DescriptorTag 336
 FROM_CACHE - of org.dvb.dsmcc.DSMCCObject 470
 FROM_CACHE_ONLY - of org.dvb.si.SIInformation 370
 FROM_CACHE_OR_STREAM - of org.dvb.dsmcc.DSMCCObject 470
 FROM_CACHE_OR_STREAM - of org.dvb.si.SIInformation 370
 FROM_STREAM_ONLY - of org.dvb.dsmcc.DSMCCObject 471
 FROM_STREAM_ONLY - of org.dvb.si.SIInformation 370
 fromActual() - of org.dvb.si.SIInformation 371

G

GENERAL_PUNCTUATION - of org.havi.ui.HFontCapabilities 727
 GeneralPreference - of org.dvb.user 319
 GeneralPreference(String) - of org.dvb.user.GeneralPreference 319
 GEOMETRICAL_SHAPES - of org.havi.ui.HFontCapabilities 727
 GEORGIAN_EXTENDED - of org.havi.ui.HFontCapabilities 727
 getActionCommand() - of org.havi.ui.event.HActionEvent 1035
 getActionCommand() - of org.havi.ui.HActionable 641
 getActionCommand() - of org.havi.ui.HGraphicButton 737

getActionCommand() - of org.havi.ui.HTextButton 965
 getActionCommand() - of org.havi.ui.HToggleButton 985
 getActions() - of org.dvb.application.AppsControlPermission 565
 getActionSound() - of org.havi.ui.HActionable 641
 getActionSound() - of org.havi.ui.HGraphicButton 737
 getActionSound() - of org.havi.ui.HTextButton 965
 getActionSound() - of org.havi.ui.HToggleButton 985
 getActiveFormatDefinition() - of org.dvb.media.VideoFormatControl 444
 getActiveVideoArea() - of org.dvb.media.VideoPresentationControl 449
 getActiveVideoAreaOnScreen() - of org.dvb.media.VideoPresentationControl 449
 getAdjustmentSound() - of org.havi.ui.HAdjustmentValue 651
 getAdjustmentSound() - of org.havi.ui.HRangeValue 853
 getAdjustMode() - of org.havi.ui.HAdjustmentInputPreferred 647
 getAdjustMode() - of org.havi.ui.HRangeValue 853
 getAID() - of org.dvb.application.AppID 558
 getAllFonts() - of org.havi.ui.HGraphicsConfiguration 753
 getAllShortcutKeycodes() - of org.havi.ui.HScene 864
 getAlpha() - of org.dvb.ui.DVBAlphaComposite 598
 getAlpha() - of org.dvb.ui.DVBColor 608
 getAnimateContent(int) - of org.havi.ui.HVisible 1024
 getAppAttributes(AppID) - of org.dvb.application.AppsDatabase 567
 getAppAttributes(AppsDatabaseFilter) - of org.dvb.application.AppsDatabase 567
 getAppData() - of org.dvb.si.SIRetrievalEvent 390
 getAppIcon() - of org.dvb.application.AppAttributes 552
 getAppID() - of org.dvb.application.AppsDatabaseEvent 571
 getAppID() - of org.dvb.application.AppStateChangeEvent 576
 getAppIDs(AppsDatabaseFilter) - of org.dvb.application.AppsDatabase 568
 getAppProxy(AppID) - of org.dvb.application.AppsDatabase 568
 getAppsDatabase() - of org.dvb.application.AppsDatabase 568
 getAspectRatio() - of org.dvb.media.VideoFormatControl 444
 getAvailableCompositeRules() - of org.dvb.ui.DVBGraphics 611
 getBackgroundImage() - of org.havi.ui.HScene 864
 getBackgroundMode() - of org.havi.ui.HScene 865
 getBackgroundMode() - of org.havi.ui.HVisible 1024
 getBehavior() - of org.havi.ui.HStaticRange 941
 getBestColorMatch(Color) - of org.dvb.ui.DVBGraphics 611
 getBestConfiguration(HBackgroundConfigTemplate) - of org.havi.ui.HBackgroundDevice 675
 getBestConfiguration(HBackgroundConfigTemplate[]) - of org.havi.ui.HBackgroundDevice 675
 getBestConfiguration(HBackgroundConfigTemplate[]) - of org.havi.ui.HScreen 880
 getBestConfiguration(HGraphicsConfigTemplate) - of org.havi.ui.HGraphicsDevice 758
 getBestConfiguration(HGraphicsConfigTemplate[]) - of org.havi.ui.HGraphicsDevice 758
 getBestConfiguration(HGraphicsConfigTemplate[]) - of org.havi.ui.HScreen 881
 getBestConfiguration(HVideoConfigTemplate) - of org.havi.ui.HVideoDevice 1008
 getBestConfiguration(HVideoConfigTemplate[]) - of org.havi.ui.HScreen 881
 getBestConfiguration(HVideoConfigTemplate[]) - of org.havi.ui.HVideoDevice 1008
 getBestScene(HSceneTemplate) - of org.havi.ui.HSceneFactory 873
 getBestSceneTemplate(HSceneTemplate) - of org.havi.ui.HSceneFactory 874
 getBlockIncrement() - of org.havi.ui.HAdjustmentValue 651
 getBlockIncrement() - of org.havi.ui.HRangeValue 853
 getBouquetID() - of org.dvb.si.SIBouquet 344
 getBouquetID() - of org.dvb.si.SIMonitoringEvent 378
 getBouquetID() - of org.dvb.si.SITransportStreamBAT 408
 getByteAt(int) - of org.dvb.si.Descriptor 333
 getCaretCharPosition() - of org.havi.ui.HSinglelineEntry 910
 getCaretCharPositionForLine(HVisible, int) - of org.havi.ui.HMultilineEntryLook 821

getCaretPositionNextLine(HVisible) - of org.havi.ui.HMultilineEntryLook 821
 getCaretPositionPreviousLine(HVisible) - of org.havi.ui.HMultilineEntryLook 821
 getCarouselId() - of org.dvb.dsmcc.ServiceXFRReference 517
 getClient() - of org.dvb.event.RepositoryDescriptor 301
 getClient() - of org.dvb.net.rc.ConnectionRCInterface 536
 getClient() - of org.havi.ui.HScreenDevice 894
 getClipRegion() - of org.dvb.media.VideoPresentationControl 449
 getClipRegion() - of org.dvb.media.VideoTransformation 453
 getClosestMatch(VideoTransformation) - of org.dvb.media.BackgroundVideoPresentationControl 418
 getCode() - of org.dvb.event.UserEvent 303
 getCoherentScreenConfigurations(HScreenConfigTemplate[]) - of org.havi.ui.HScreen 882
 getColor() - of org.dvb.ui.DVBGraphics 611
 getColor() - of org.havi.ui.event.HEventRepresentation 1049
 getColor() - of org.havi.ui.HBackgroundConfiguration 673
 getCompatibleImage(Image, HImageHints) - of org.havi.ui.HGraphicsConfiguration 753
 getComponentHScreenRectangle(Component) - of org.havi.ui.HGraphicsConfiguration 754
 getComponentTag() - of org.dvb.si.PMTElementaryStream 339
 getConfigTemplate() - of org.havi.ui.HBackgroundConfiguration 673
 getConfigTemplate() - of org.havi.ui.HEmulatedGraphicsConfiguration 701
 getConfigTemplate() - of org.havi.ui.HGraphicsConfiguration 754
 getConfigTemplate() - of org.havi.ui.HVideoConfiguration 1006
 getConfigurations() - of org.havi.ui.HBackgroundDevice 676
 getConfigurations() - of org.havi.ui.HGraphicsDevice 759
 getConfigurations() - of org.havi.ui.HVideoDevice 1009
 getConnectedTime() - of org.dvb.net.rc.ConnectionRCInterface 536
 getContent() - of org.dvb.si.Descriptor 333
 getContent(int) - of org.havi.ui.HVisible 1024
 getContentLength() - of org.dvb.si.Descriptor 333
 getContentNibbles() - of org.dvb.si.SIEvent 364
 getContentType() - of org.dvb.media.DripFeedDataSource 424
 getControl(String) - of org.dvb.media.DripFeedDataSource 424
 getControls() - of org.dvb.media.DripFeedDataSource 425
 getCurrent() - of org.havi.ui.HToggleGroup 993
 getCurrentConfiguration() - of org.havi.ui.HBackgroundDevice 676
 getCurrentConfiguration() - of org.havi.ui.HGraphicsDevice 759
 getCurrentConfiguration() - of org.havi.ui.HVideoDevice 1009
 getCurrentIndex() - of org.havi.ui.HListGroup 789
 getCurrentItem() - of org.havi.ui.HListGroup 790
 getCurrentTarget() - of org.dvb.net.rc.ConnectionRCInterface 536
 getDataRate() - of org.dvb.net.rc.RCInterface 543
 getDataSource() - of org.dvb.si.SIInformation 371
 getDecoderFormatConversion() - of org.dvb.media.VideoFormatControl 445
 getDefaultConfiguration() - of org.havi.ui.HBackgroundDevice 676
 getDefaultConfiguration() - of org.havi.ui.HGraphicsDevice 759
 getDefaultConfiguration() - of org.havi.ui.HVideoDevice 1009
 getDefaultHBackgroundDevice() - of org.havi.ui.HScreen 882
 getDefaultHGraphicsDevice() - of org.havi.ui.HScreen 883
 getDefaultHScene() - of org.havi.ui.HSceneFactory 874
 getDefaultHScene(HScreen) - of org.havi.ui.HSceneFactory 874
 getDefaultHScreen() - of org.havi.ui.HScreen 883
 getDefaultHVideoDevice() - of org.havi.ui.HScreen 883
 getDefaultLook() - of org.havi.ui.HAnimation 665
 getDefaultLook() - of org.havi.ui.HGraphicButton 737
 getDefaultLook() - of org.havi.ui.HIcon 763
 getDefaultLook() - of org.havi.ui.HListGroup 790

getDefaultLook() - of org.havi.ui.HMultilineEntry 819
getDefaultLook() - of org.havi.ui.HRange 840
getDefaultLook() - of org.havi.ui.HRangeValue 853
getDefaultLook() - of org.havi.ui.HSinglelineEntry 910
getDefaultLook() - of org.havi.ui.HStaticAnimation 932
getDefaultLook() - of org.havi.ui.HStaticIcon 938
getDefaultLook() - of org.havi.ui.HStaticRange 942
getDefaultLook() - of org.havi.ui.HStaticText 948
getDefaultLook() - of org.havi.ui.HText 958
getDefaultLook() - of org.havi.ui.HTextButton 966
getDefaultLook() - of org.havi.ui.HToggleButton 985
getDefaultSize() - of org.havi.ui.HVisible 1025
getDelay() - of org.havi.ui.HAnimateEffect 654
getDelay() - of org.havi.ui.HFlatEffectMatte 717
getDelay() - of org.havi.ui.HImageEffectMatte 768
getDelay() - of org.havi.ui.HStaticAnimation 932
getDenominator() - of org.dvb.dsmcc.NPTRate 501
getDescriptorTags() - of org.dvb.si.SIBouquet 344
getDescriptorTags() - of org.dvb.si.SIInformation 371
getDescriptorTags() - of org.dvb.si.SINetwork 382
getDevice() - of org.havi.ui.HBackgroundConfiguration 673
getDevice() - of org.havi.ui.HGraphicsConfiguration 754
getDevice() - of org.havi.ui.HVideoConfiguration 1006
getDisplayAspectRatio() - of org.dvb.media.VideoFormatControl 445
getDNSServer() - of org.dvb.net.rc.ConnectionParameters 532
getDuration() - of org.dvb.dsmcc.DSMCCStream 477
getDuration() - of org.dvb.media.DripFeedDataSource 425
getDuration() - of org.dvb.si.SIEvent 364
getDVBComposite() - of org.dvb.ui.DVBGraphics 612
getDvbLocator() - of org.dvb.si.PMTElementaryStream 339
getDvbLocator() - of org.dvb.si.PMTService 341
getDvbLocator() - of org.dvb.si.SIEvent 364
getDvbLocator() - of org.dvb.si.SIService 394
getDvbLocator() - of org.dvb.si.SITransportStream 406
getEchoChar() - of org.havi.ui.HSinglelineEntry 910
getEditMode() - of org.havi.ui.HKeyboardInputPreferred 781
getEditMode() - of org.havi.ui.HSinglelineEntry 910
getEITPresentFollowingFlag() - of org.dvb.si.SIService 394
getEITScheduleFlag() - of org.dvb.si.SIService 394
getElementaryPID() - of org.dvb.si.PMTElementaryStream 339
getElementaryStreams() - of org.davic.mpeg.NotAuthorizedException 217
getElementInsets() - of org.havi.ui.HListGroupLook 801
getEmulation() - of org.havi.ui.HEmulatedGraphicsConfiguration 701
getEndTime() - of org.dvb.si.SIMonitoringEvent 378
getEventData() - of org.dvb.dsmcc.StreamEvent 519
getEventId() - of org.dvb.application.AppsDatabaseEvent 571
getEventId() - of org.dvb.dsmcc.StreamEvent 520
getEventID() - of org.dvb.si.SIEvent 365
getEventList() - of org.dvb.dsmcc.DSMCCStreamEvent 481
getEventName() - of org.dvb.dsmcc.StreamEvent 520
getEventNPT() - of org.dvb.dsmcc.StreamEvent 520
getExpirationDate() - of org.dvb.io.persistent.FileAttributes 313
getFamily() - of org.dvb.event.UserEvent 303
getFavourites() - of org.dvb.user.Preference 321
getFileAttributes(File) - of org.dvb.io.persistent.FileAttributes 313

getFirstNPT() - of org.dvb.dsmcc.NPTDiscontinuityEvent 498
getFlickerFilter() - of org.havi.ui.HScreenConfiguration 891
getFocusOwner() - of org.havi.ui.HScene 865
getForcedSelection() - of org.havi.ui.HToggleGroup 993
getFreeCAMode() - of org.dvb.si.SIEvent 365
getFreeCAMode() - of org.dvb.si.SIService 394
getFromState() - of org.dvb.application.AppStateChangeEvent 576
getFullScreenScene(HGraphicsDevice) - of org.havi.ui.HSceneFactory 875
getGainFocusSound() - of org.havi.ui.HAnimation 665
getGainFocusSound() - of org.havi.ui.HGraphicButton 737
getGainFocusSound() - of org.havi.ui.HIcon 763
getGainFocusSound() - of org.havi.ui.HListGroup 790
getGainFocusSound() - of org.havi.ui.HNavigable 828
getGainFocusSound() - of org.havi.ui.HRange 841
getGainFocusSound() - of org.havi.ui.HRangeValue 853
getGainFocusSound() - of org.havi.ui.HSinglelineEntry 911
getGainFocusSound() - of org.havi.ui.HText 958
getGainFocusSound() - of org.havi.ui.HTextButton 966
getGainFocusSound() - of org.havi.ui.HToggleButton 986
getGraphicContent(int) - of org.havi.ui.HVisible 1025
getGraphics() - of org.dvb.ui.DVBBufferedImage 601
getHBackgroundDevices() - of org.havi.ui.HScreen 883
getHeight() - of org.dvb.ui.DVBBufferedImage 601
getHeight() - of org.havi.ui.HBackgroundImage 679
getHeight(ImageObserver) - of org.dvb.ui.DVBBufferedImage 601
getHGraphicsDevices() - of org.havi.ui.HScreen 883
getHorizontalAlign() - of org.dvb.ui.DVBTextLayoutManager 617
getHorizontalAlignment() - of org.havi.ui.HVisible 1025
getHorizontalScalingFactors() - of org.dvb.media.VideoPresentationControl 450
getHorizontalTabSpacing() - of org.dvb.ui.DVBTextLayoutManager 617
getHScreens() - of org.havi.ui.HScreen 883
getHVideoDevices() - of org.havi.ui.HScreen 884
getIcon() - of org.havi.ui.HListElement 784
getIconFlags() - of org.dvb.application.AppIcon 557
getIconSize() - of org.havi.ui.HListGroup 790
getID() - of org.havi.ui.event.HBackgroundImageEvent 1043
getIdentifier() - of org.dvb.application.AppAttributes 552
getIDstring() - of org.havi.ui.HScreenDevice 895
getImage() - of org.dvb.ui.DVBBufferedImage 601
getImplementation() - of org.havi.ui.HEmulatedGraphicsConfiguration 701
getIndex(HListElement) - of org.havi.ui.HListGroup 790
getInputDeviceSupported() - of org.havi.ui.event.HKeyCapabilities 1060
getInputDeviceSupported() - of org.havi.ui.event.HMouseCapabilities 1065
getInputDeviceSupported() - of org.havi.ui.event.HRcCapabilities 1066
getInputVideoSize() - of org.dvb.media.VideoPresentationControl 450
getInsets() - of org.dvb.ui.DVBTextLayoutManager 618
getInsets(HVisible) - of org.havi.ui.HAnimateLook 658
getInsets(HVisible) - of org.havi.ui.HGraphicLook 744
getInsets(HVisible) - of org.havi.ui.HListGroupLook 801
getInsets(HVisible) - of org.havi.ui.HLook 808
getInsets(HVisible) - of org.havi.ui.HMultilineEntryLook 822
getInsets(HVisible) - of org.havi.ui.HRangeLook 846
getInsets(HVisible) - of org.havi.ui.HSinglelineEntryLook 919
getInsets(HVisible) - of org.havi.ui.HTextLook 975
getInstance() - of org.dvb.event.EventManager 298

getInstance() - of org.dvb.net.rc.RCInterfaceManager 544
 getInstance() - of org.dvb.user.UserPreferenceManager 326
 getInstance() - of org.havi.ui.HSceneFactory 875
 getInstance(int) - of org.dvb.ui.DVBAlphaComposite 598
 getInstance(int, float) - of org.dvb.ui.DVBAlphaComposite 598
 getInteractionState() - of org.havi.ui.HVisible 1025
 getInterface(InetAddress) - of org.dvb.net.rc.RCInterfaceManager 544
 getInterface(Socket) - of org.dvb.net.rc.RCInterfaceManager 545
 getInterface(URLConnection) - of org.dvb.net.rc.RCInterfaceManager 545
 getInterfaces() - of org.dvb.net.rc.RCInterfaceManager 545
 getInterlaced() - of org.havi.ui.HScreenConfiguration 892
 getIsServiceBound() - of org.dvb.application.AppAttributes 553
 getItem() - of org.havi.ui.event.HItemEvent 1058
 getItem(int) - of org.havi.ui.HListGroup 791
 getKeyChar() - of org.dvb.event.UserEvent 303
 getLabel() - of org.havi.ui.HListElement 784
 getLabelSize() - of org.havi.ui.HListGroup 791
 getLastNPT() - of org.dvb.dsmcc.NPTDiscontinuityEvent 498
 getLetterSpace() - of org.dvb.ui.DVBTextLayoutManager 618
 getLevel1ContentNibbles() - of org.dvb.si.SIEvent 365
 getLineOrientation() - of org.dvb.ui.DVBTextLayoutManager 618
 getLineSpace() - of org.dvb.ui.DVBTextLayoutManager 618
 getListContent() - of org.havi.ui.HListGroup 791
 getLocator() - of org.dvb.application.AppIcon 557
 getLocator() - of org.dvb.dsmcc.ServiceDomain 512
 getLocator() - of org.dvb.dsmcc.ServiceXFRReference 518
 getLook() - of org.havi.ui.HVisible 1026
 getLookData(Object) - of org.havi.ui.HVisible 1026
 getLoseFocusSound() - of org.havi.ui.HAnimation 665
 getLoseFocusSound() - of org.havi.ui.HGraphicButton 738
 getLoseFocusSound() - of org.havi.ui.HIcon 764
 getLoseFocusSound() - of org.havi.ui.HListGroup 791
 getLoseFocusSound() - of org.havi.ui.HNavigable 828
 getLoseFocusSound() - of org.havi.ui.HRange 841
 getLoseFocusSound() - of org.havi.ui.HRangeValue 854
 getLoseFocusSound() - of org.havi.ui.HSinglelineEntry 911
 getLoseFocusSound() - of org.havi.ui.HText 959
 getLoseFocusSound() - of org.havi.ui.HTextButton 966
 getLoseFocusSound() - of org.havi.ui.HToggleButton 986
 getMatte() - of org.havi.ui.HComponent 683
 getMatte() - of org.havi.ui.HContainer 693
 getMatte() - of org.havi.ui.HMatteLayer 815
 getMatteData() - of org.havi.ui.HFlatEffectMatte 717
 getMatteData() - of org.havi.ui.HFlatMatte 722
 getMatteData() - of org.havi.ui.HImageEffectMatte 768
 getMatteData() - of org.havi.ui.HImageMatte 775
 getMaxCharsPerLine() - of org.havi.ui.HSinglelineEntry 911
 getMaximumSize() - of org.havi.ui.HVisible 1026
 getMaximumSize(HVisible) - of org.havi.ui.HAnimateLook 658
 getMaximumSize(HVisible) - of org.havi.ui.HGraphicLook 744
 getMaximumSize(HVisible) - of org.havi.ui.HListGroupLook 802
 getMaximumSize(HVisible) - of org.havi.ui.HLook 808
 getMaximumSize(HVisible) - of org.havi.ui.HMultilineEntryLook 822
 getMaximumSize(HVisible) - of org.havi.ui.HRangeLook 846
 getMaximumSize(HVisible) - of org.havi.ui.HSinglelineEntryLook 919

getMaximumSize(HVisible) - of org.havi.ui.HTextLook 975
getMaxValue() - of org.havi.ui.HStaticRange 942
getMinimumSize() - of org.havi.ui.HVisible 1026
getMinimumSize(HVisible) - of org.havi.ui.HAnimateLook 659
getMinimumSize(HVisible) - of org.havi.ui.HGraphicLook 745
getMinimumSize(HVisible) - of org.havi.ui.HListGroupLook 802
getMinimumSize(HVisible) - of org.havi.ui.HLook 809
getMinimumSize(HVisible) - of org.havi.ui.HMultilineEntryLook 822
getMinimumSize(HVisible) - of org.havi.ui.HRangeLook 846
getMinimumSize(HVisible) - of org.havi.ui.HSinglelineEntryLook 919
getMinimumSize(HVisible) - of org.havi.ui.HTextLook 976
getMinValue() - of org.havi.ui.HStaticRange 942
getModifiers() - of org.dvb.event.UserEvent 303
getModifiers() - of org.havi.ui.event.HActionEvent 1036
getMostFavourite() - of org.dvb.user.Preference 321
getMountPoint() - of org.dvb.dsmcc.ServiceDomain 512
getMove(int) - of org.havi.ui.HAnimation 665
getMove(int) - of org.havi.ui.HGraphicButton 738
getMove(int) - of org.havi.ui.HIcon 764
getMove(int) - of org.havi.ui.HListGroup 791
getMove(int) - of org.havi.ui.HNavigable 828
getMove(int) - of org.havi.ui.HRange 841
getMove(int) - of org.havi.ui.HRangeValue 854
getMove(int) - of org.havi.ui.HSinglelineEntry 911
getMove(int) - of org.havi.ui.HText 959
getMove(int) - of org.havi.ui.HTextButton 966
getMove(int) - of org.havi.ui.HToggleButton 986
getMultiSelection() - of org.havi.ui.HListGroup 792
getName() - of org.dvb.application.AppAttributes 553
getName() - of org.dvb.event.RepositoryDescriptor 301
getName() - of org.dvb.si.SIBouquet 344
getName() - of org.dvb.si.SIEvent 365
getName() - of org.dvb.si.SINetwork 382
getName() - of org.dvb.si.SIService 395
getName() - of org.dvb.user.Preference 321
getName() - of org.dvb.user.UserPreferenceChangeEvent 324
getName(String) - of org.dvb.application.AppAttributes 553
getNames() - of org.dvb.application.AppAttributes 553
getNavigationKeys() - of org.havi.ui.HAnimation 666
getNavigationKeys() - of org.havi.ui.HGraphicButton 738
getNavigationKeys() - of org.havi.ui.HIcon 764
getNavigationKeys() - of org.havi.ui.HListGroup 792
getNavigationKeys() - of org.havi.ui.HNavigationInputPreferred 831
getNavigationKeys() - of org.havi.ui.HRange 841
getNavigationKeys() - of org.havi.ui.HRangeValue 854
getNavigationKeys() - of org.havi.ui.HSinglelineEntry 912
getNavigationKeys() - of org.havi.ui.HText 959
getNavigationKeys() - of org.havi.ui.HTextButton 967
getNavigationKeys() - of org.havi.ui.HToggleButton 986
getNetworkID() - of org.dvb.si.SIMonitoringEvent 378
getNetworkID() - of org.dvb.si.SINetwork 383
getNetworkID() - of org.dvb.si.SITransportStreamNIT 410
getNetworkInterface(SIDatabase) - of org.dvb.net.tuning.DvbNetworkInterfaceSIUtil 590
getNewDFC() - of org.dvb.media.DFCChangedEvent 422
getNewFormat() - of org.dvb.media.ActiveFormatDescriptionChangedEvent 416

getNewRatio() - of org.dvb.media.AspectRatioChangedEvent 417
 getNewVersionNumber() - of org.dvb.dsmcc.ObjectChangeEvent 505
 getNPT() - of org.dvb.dsmcc.DSMCCStream 477
 getNPTRate() - of org.dvb.dsmcc.DSMCCStream 478
 getNSAPAddress() - of org.dvb.dsmcc.ServiceDomain 512
 getNSAPAddress() - of org.dvb.dsmcc.ServiceXFRReference 518
 getNumerator() - of org.dvb.dsmcc.NPTRate 501
 getNumItems() - of org.havi.ui.HListGroup 792
 getNumSelected() - of org.havi.ui.HListGroup 792
 getNumVisible(HVisible) - of org.havi.ui.HListGroupLook 803
 getOffset() - of org.havi.ui.HImageMatte 775
 getOffset(HScreenConfiguration) - of org.havi.ui.HScreenConfiguration 892
 getOffset(int) - of org.havi.ui.HImageEffectMatte 768
 getOID() - of org.dvb.application.AppID 558
 getOrientation() - of org.havi.ui.HListGroup 792
 getOrientation() - of org.havi.ui.HOrientable 835
 getOrientation() - of org.havi.ui.HStaticRange 942
 getOriginalNetworkID() - of org.dvb.si.PMTElementaryStream 340
 getOriginalNetworkID() - of org.dvb.si.PMTService 341
 getOriginalNetworkID() - of org.dvb.si.SIEvent 365
 getOriginalNetworkID() - of org.dvb.si.SIMonitoringEvent 378
 getOriginalNetworkID() - of org.dvb.si.SIService 395
 getOriginalNetworkID() - of org.dvb.si.SITransportStream 406
 getPassword() - of org.dvb.net.rc.ConnectionParameters 533
 getPathName() - of org.dvb.dsmcc.ServiceXFRReference 518
 getPcrPid() - of org.dvb.si.PMTService 341
 getPermissions() - of org.dvb.io.persistent.FileAttributes 314
 getPixelAspectRatio() - of org.havi.ui.HScreenConfiguration 892
 getPixelCoordinatesHScreenRectangle(HScreenRectangle, Container) - of org.havi.ui.HGraphicsConfigura-
 tion 754
 getPixelCoordinatesHScreenRectangle(Rectangle) - of org.havi.ui.HScene 865
 getPixelResolution() - of org.havi.ui.HScreenConfiguration 892
 getPlayMode() - of org.havi.ui.HAnimateEffect 654
 getPlayMode() - of org.havi.ui.HFlatEffectMatte 717
 getPlayMode() - of org.havi.ui.HImageEffectMatte 769
 getPlayMode() - of org.havi.ui.HStaticAnimation 933
 getPosition() - of org.havi.ui.HAnimateEffect 654
 getPosition() - of org.havi.ui.HFlatEffectMatte 718
 getPosition() - of org.havi.ui.HImageEffectMatte 769
 getPosition() - of org.havi.ui.HStaticAnimation 933
 getPosition(String) - of org.dvb.user.Preference 322
 getPositioningCapability() - of org.dvb.media.VideoPresentationControl 450
 getPreferenceObject(int) - of org.havi.ui.HGraphicsConfigTemplate 749
 getPreferenceObject(int) - of org.havi.ui.HSceneTemplate 878
 getPreferenceObject(int) - of org.havi.ui.HScreenConfigTemplate 889
 getPreferenceObject(int) - of org.havi.ui.HVideoConfigTemplate 1003
 getPreferencePriority(int) - of org.havi.ui.HBackgroundConfigTemplate 670
 getPreferencePriority(int) - of org.havi.ui.HGraphicsConfigTemplate 750
 getPreferencePriority(int) - of org.havi.ui.HSceneTemplate 879
 getPreferencePriority(int) - of org.havi.ui.HScreenConfigTemplate 889
 getPreferencePriority(int) - of org.havi.ui.HVideoConfigTemplate 1003
 getPreferredSize() - of org.havi.ui.HVisible 1027
 getPreferredSize(HVisible) - of org.havi.ui.HAnimateLook 659
 getPreferredSize(HVisible) - of org.havi.ui.HGraphicLook 745
 getPreferredSize(HVisible) - of org.havi.ui.HListGroupLook 803

getPreferredSize(HVisible) - of org.havi.ui.HLook 809
getPreferredSize(HVisible) - of org.havi.ui.HMultilineEntryLook 823
getPreferredSize(HVisible) - of org.havi.ui.HRangeLook 847
getPreferredSize(HVisible) - of org.havi.ui.HSinglelineEntryLook 920
getPreferredSize(HVisible) - of org.havi.ui.HTextLook 976
getPriority() - of org.dvb.application.AppAttributes 554
getPriority() - of org.dvb.io.persistent.FileAttributes 314
getProfiles() - of org.dvb.application.AppAttributes 554
getProperty(String) - of org.dvb.application.AppAttributes 554
getProperty(String, ImageObserver) - of org.dvb.ui.DVBBufferedImage 602
getProviderName() - of org.dvb.si.SIService 395
getPunchThroughToBackgroundColor(Color, int) - of org.havi.ui.HGraphicsConfiguration 755
getPunchThroughToBackgroundColor(Color, int, HVideoDevice) - of org.havi.ui.HGraphicsConfiguration 755
getPunchThroughToBackgroundColor(int) - of org.havi.ui.HGraphicsConfiguration 756
getPunchThroughToBackgroundColor(int, HVideoDevice) - of org.havi.ui.HGraphicsConfiguration 756
getRate() - of org.dvb.dsmcc.NPTRateChangeEvent 502
getReason() - of org.dvb.media.PresentationChangedEvent 430
getReason(int) - of org.davic.mpeg.NotAuthorizedException 218
getReceiveBufferSize(DatagramSocket) - of org.dvb.net.DatagramSocketBufferControl 526
getRenderMode() - of org.havi.ui.HScene 865
getRepeatCount() - of org.havi.ui.HAnimateEffect 654
getRepeatCount() - of org.havi.ui.HFlatEffectMatte 718
getRepeatCount() - of org.havi.ui.HImageEffectMatte 769
getRepeatCount() - of org.havi.ui.HStaticAnimation 933
getRepresentation(int) - of org.havi.ui.event.HRcCapabilities 1067
getResizeMode() - of org.havi.ui.HVisible 1027
getResult() - of org.dvb.si.SISuccessfulRetrieveEvent 402
getRGB() - of org.dvb.ui.DVBColor 608
getRGB(int, int) - of org.dvb.ui.DVBBufferedImage 602
getRGB(int, int, int, int, int[], int, int) - of org.dvb.ui.DVBBufferedImage 603
getRule() - of org.dvb.ui.DVBAlphaComposite 598
getRunningStatus() - of org.dvb.si.SIEvent 365
getRunningStatus() - of org.dvb.si.SIService 395
getScalingFactors() - of org.dvb.media.VideoTransformation 454
getSceneTemplate() - of org.havi.ui.HScene 865
getScreenArea() - of org.havi.ui.HScreenConfiguration 892
getScreenAspectRatio() - of org.havi.ui.HScreenDevice 895
getScrollPosition() - of org.havi.ui.HListGroup 792
getSelection() - of org.havi.ui.HListGroup 793
getSelectionIndices() - of org.havi.ui.HListGroup 793
getSelectionMode() - of org.havi.ui.HListGroup 793
getSelectionMode() - of org.havi.ui.HSelectionInputPreferred 904
getSelectionSound() - of org.havi.ui.HItemValue 779
getSelectionSound() - of org.havi.ui.HListGroup 793
getService() - of org.davic.mpeg.NotAuthorizedException 218
getServiceID() - of org.dvb.si.PMTElementaryStream 340
getServiceID() - of org.dvb.si.PMTService 341
getServiceID() - of org.dvb.si.SIEvent 366
getServiceID() - of org.dvb.si.SIMonitoringEvent 378
getServiceID() - of org.dvb.si.SIService 395
getServiceLocator() - of org.dvb.application.AppAttributes 555
getServiceXFR() - of org.dvb.dsmcc.ServiceXFRErrorEvent 514
getServiceXFR() - of org.dvb.dsmcc.ServiceXFRException 516
getSetupTimeEstimate() - of org.dvb.net.rc.ConnectionRCInterface 536

getShortBouquetName() - of org.dvb.si.SIBouquet 345
getShortcutComponent(int) - of org.havi.ui.HScene 865
getShortcutKeycode(HActionable) - of org.havi.ui.HScene 866
getShortDescription() - of org.dvb.si.SIEvent 366
getShortEventName() - of org.dvb.si.SIEvent 366
getShortNetworkName() - of org.dvb.si.SINetwork 383
getShortProviderName() - of org.dvb.si.SIService 395
getShortServiceName() - of org.dvb.si.SIService 396
getSIDatabase() - of org.dvb.si.SIDatabase 351
getSIDatabase() - of org.dvb.si.SIInformation 371
getSIDatabase(NetworkInterface) - of org.dvb.net.tuning.DvbNetworkInterfaceSIUtil 590
getSigners() - of org.dvb.dsmcc.DSMCCObject 472
getSIInformationType() - of org.dvb.si.SIMonitoringEvent 378
getSIServiceLocators() - of org.dvb.si.SIBouquet 345
getSIServiceType() - of org.dvb.si.SIService 396
getSoftLineBreakPositions(HVisible) - of org.havi.ui.HMultilineEntryLook 824
getSource() - of org.davic.mpeg.sections.TimeOutEvent 220
getSource() - of org.dvb.dsmcc.AsynchronousLoadingEvent 467
getSource() - of org.dvb.dsmcc.InvalidFormatEvent 486
getSource() - of org.dvb.dsmcc.InvalidPathnameEvent 488
getSource() - of org.dvb.dsmcc.LoadingAbortedEvent 490
getSource() - of org.dvb.dsmcc.MPEGDeliveryErrorEvent 491
getSource() - of org.dvb.dsmcc.NotEntitledEvent 493
getSource() - of org.dvb.dsmcc.NPTRateChangeEvent 502
getSource() - of org.dvb.dsmcc.NPTStatusEvent 504
getSource() - of org.dvb.dsmcc.ObjectChangeEvent 505
getSource() - of org.dvb.dsmcc.ServerDeliveryErrorEvent 508
getSource() - of org.dvb.dsmcc.ServiceXFRErrorEvent 514
getSource() - of org.dvb.dsmcc.StreamEvent 520
getSource() - of org.dvb.dsmcc.SuccessEvent 522
getSource() - of org.dvb.media.SubtitleAvailableEvent 435
getSource() - of org.dvb.media.SubtitleNotAvailableEvent 437
getSource() - of org.dvb.media.SubtitleNotSelectedEvent 438
getSource() - of org.dvb.media.SubtitleSelectedEvent 439
getSource() - of org.dvb.net.rc.RCInterfaceReleasedEvent 546
getSource() - of org.dvb.net.rc.RCInterfaceReservedEvent 547
getSource() - of org.dvb.si.SIMonitoringEvent 379
getSource() - of org.dvb.si.SIRetrievalEvent 391
getSource() - of org.dvb.ui.DVBBufferedImage 603
getSource() - of org.havi.ui.event.HBackgroundImageEvent 1043
getSource() - of org.havi.ui.event.HScreenDeviceReleasedEvent 1079
getSource() - of org.havi.ui.event.HScreenDeviceReservedEvent 1080
getSource() - of org.havi.ui.event.HScreenLocationModifiedEvent 1082
getStartCorner() - of org.dvb.ui.DVBTextLayoutManager 618
getStartTime() - of org.dvb.si.SIEvent 366
getStartTime() - of org.dvb.si.SIMonitoringEvent 379
getState() - of org.dvb.application.AppProxy 561
getStream() - of org.dvb.media.CAStopEvent 421
getStream() - of org.dvb.media.NoComponentSelectedEvent 428
getStream() - of org.dvb.media.PresentationChangedEvent 430
getStream() - of org.dvb.media.ServiceRemovedEvent 432
getStream() - of org.dvb.media.StopByResourceLossEvent 434
getStreamLocator() - of org.dvb.dsmcc.DSMCCStream 478
getStreams() - of org.dvb.media.DripFeedDataSource 425
getStreamType() - of org.dvb.si.PMTElementaryStream 340

getString() - of org.havi.ui.event.HEventRepresentation 1049
getSubimage(int, int, int, int) - of org.dvb.ui.DVBBufferedImage 603
getSupportedCharacterRanges(Font) - of org.havi.ui.HFontCapabilities 733
getSwitchableState() - of org.havi.ui.HSwitchable 954
getSwitchableState() - of org.havi.ui.HToggleButton 987
getSymbol() - of org.havi.ui.event.HEventRepresentation 1049
getTag() - of org.dvb.si.Descriptor 334
getTarget() - of org.dvb.net.rc.ConnectionParameters 533
getTextContent(int) - of org.havi.ui.HSinglelineEntry 912
getTextContent(int) - of org.havi.ui.HVisible 1027
getTextLayoutManager() - of org.havi.ui.HVisible 1027
getTextualServiceIdentifiers() - of org.dvb.si.SIService 396
getTextualServiceIdentifiers() - of org.dvb.si.TextualServiceIdentifierQuery 412
getTextWrapping() - of org.dvb.ui.DVBTextLayoutManager 618
getThumbMaxOffset() - of org.havi.ui.HStaticRange 942
getThumbMinOffset() - of org.havi.ui.HStaticRange 942
getToggleGroup() - of org.havi.ui.HToggleButton 987
getToState() - of org.dvb.application.AppStateChangeEvent 576
getTotalVideoArea() - of org.dvb.media.VideoPresentationControl 450
getTotalVideoAreaOnScreen() - of org.dvb.media.VideoPresentationControl 450
getTransferId() - of org.havi.ui.event.HFocusEvent 1053
getTransportStreamID() - of org.dvb.si.PMTElementaryStream 340
getTransportStreamID() - of org.dvb.si.PMTService 342
getTransportStreamID() - of org.dvb.si.SIEvent 366
getTransportStreamID() - of org.dvb.si.SIMonitoringEvent 379
getTransportStreamID() - of org.dvb.si.SIService 396
getTransportStreamID() - of org.dvb.si.SITransportStream 406
getType() - of org.davic.mpeg.NotAuthorizedException 218
getType() - of org.dvb.application.AppAttributes 555
getType() - of org.dvb.event.UserEvent 304
getType() - of org.dvb.net.rc.RCInterface 543
getType() - of org.dvb.ui.DVBGraphics 612
getType() - of org.havi.ui.event.HEventRepresentation 1050
getType() - of org.havi.ui.HImageHints 773
getType() - of org.havi.ui.HKeyboardInputPreferred 781
getType() - of org.havi.ui.HSinglelineEntry 912
getUnitIncrement() - of org.havi.ui.HAdjustmentValue 651
getUnitIncrement() - of org.havi.ui.HRangeValue 854
getUnsetActionSound() - of org.havi.ui.HSwitchable 954
getUnsetActionSound() - of org.havi.ui.HToggleButton 987
getUpdateTime() - of org.dvb.si.SIInformation 372
getURL() - of org.dvb.dsmcc.DSMCCObject 472
getURL(Locator) - of org.dvb.dsmcc.ServiceDomain 512
getUserEvent() - of org.dvb.event.UserEventRepository 307
getUsername() - of org.dvb.net.rc.ConnectionParameters 533
getUTCTime() - of org.dvb.si.SITime 405
getValidInput() - of org.havi.ui.HKeyboardInputPreferred 781
getValidInput() - of org.havi.ui.HSinglelineEntry 912
getValue() - of org.havi.ui.HStaticRange 943
getVersions(String) - of org.dvb.application.AppAttributes 555
getVerticalAlign() - of org.dvb.ui.DVBTextLayoutManager 619
getVerticalAlignment() - of org.havi.ui.HVisible 1028
getVerticalScalingFactors() - of org.dvb.media.VideoPresentationControl 451
getVideoController() - of org.havi.ui.HVideoDevice 1010
getVideoDevice() - of org.havi.ui.HVideoComponent 1001

getVideoPosition() - of org.dvb.media.VideoTransformation 454
 getVideoSize() - of org.dvb.media.VideoPresentationControl 451
 getVideoSource() - of org.havi.ui.HVideoDevice 1010
 getVideoTransformation() - of org.dvb.media.BackgroundVideoPresentationControl 418
 getVideoTransformation(int) - of org.dvb.media.VideoFormatControl 445
 getVisibleSoftLineBreakPositions(HVisible) - of org.havi.ui.HMultilineEntryLook 824
 getWidth() - of org.dvb.ui.DVBBufferedImage 604
 getWidth() - of org.havi.ui.HBackgroundImage 679
 getWidth(ImageObserver) - of org.dvb.ui.DVBBufferedImage 604
 GRAPHIC_CONTENT_CHANGE - of org.havi.ui.HVisible 1019
 GRAPHICS_CONFIGURATION - of org.havi.ui.HSceneTemplate 877
 GRAPHICS_MIXING - of org.havi.ui.HVideoConfigTemplate 1002
 GREEK_EXTENDED - of org.havi.ui.HFontCapabilities 727
 GREEK_SYMBOLS_AND_COPTIC - of org.havi.ui.HFontCapabilities 727
 group() - of org.havi.ui.HContainer 693
 GUJARATI - of org.havi.ui.HFontCapabilities 727
 GURMUKHI - of org.havi.ui.HFontCapabilities 728

H

HActionable - of org.havi.ui 639
 HActionEvent - of org.havi.ui.event 1035
 HActionEvent(HActionable, int, String) - of org.havi.ui.event.HActionEvent 1035
 HActionInputPreferred - of org.havi.ui 643
 HActionListener - of org.havi.ui.event 1037
 HAdjustableLook - of org.havi.ui 644
 HAdjustmentEvent - of org.havi.ui.event 1038
 HAdjustmentEvent(HAdjustmentValue, int) - of org.havi.ui.event.HAdjustmentEvent 1040
 HAdjustmentInputPreferred - of org.havi.ui 647
 HAdjustmentListener - of org.havi.ui.event 1041
 HAdjustmentValue - of org.havi.ui 649
 HALFWIDTH_AND_FULLWIDTH_FORMS - of org.havi.ui.HFontCapabilities 728
 HALIGN_CENTER - of org.havi.ui.HVisible 1019
 HALIGN_JUSTIFY - of org.havi.ui.HVisible 1019
 HALIGN_LEFT - of org.havi.ui.HVisible 1020
 HALIGN_RIGHT - of org.havi.ui.HVisible 1020
 HANGUL - of org.havi.ui.HFontCapabilities 728
 HANGUL_COMPATIBILITY_JAMO - of org.havi.ui.HFontCapabilities 728
 HANGUL_JAMO - of org.havi.ui.HFontCapabilities 728
 HANGUL_SUPPLEMENTARY_A - of org.havi.ui.HFontCapabilities 728
 HANGUL_SUPPLEMENTARY_B - of org.havi.ui.HFontCapabilities 728
 HAnimateEffect - of org.havi.ui 653
 HAnimateLook - of org.havi.ui 657
 HAnimateLook() - of org.havi.ui.HAnimateLook 658
 HAnimation - of org.havi.ui 662
 HAnimation() - of org.havi.ui.HAnimation 664
 HAnimation(Image[], Image[], int, int, int) - of org.havi.ui.HAnimation 664
 HAnimation(Image[], Image[], int, int, int, int, int, int, int) - of org.havi.ui.HAnimation 664
 HAnimation(Image[], int, int, int) - of org.havi.ui.HAnimation 665
 HAnimation(Image[], int, int, int, int, int, int, int) - of org.havi.ui.HAnimation 665
 hasFailed() - of org.dvb.application.AppStateChangeEvent 576
 hashCode() - of org.dvb.application.AppsControlPermission 565
 hasReadApplicationAccessRight() - of org.dvb.io.persistent.FileAccessPermissions 311
 hasReadOrganisationAccessRight() - of org.dvb.io.persistent.FileAccessPermissions 311
 hasReadWorldAccessRight() - of org.dvb.io.persistent.FileAccessPermissions 312

hasValue() - of org.dvb.user.Preference 322
 hasWriteApplicationAccessRight() - of org.dvb.io.persistent.FileAccessPermissions 312
 hasWriteOrganisationAccessRight() - of org.dvb.io.persistent.FileAccessPermissions 312
 hasWriteWorldAccessRight() - of org.dvb.io.persistent.FileAccessPermissions 312
 HAVI_IMPLEMENTATION_NAME - of org.havi.ui.HVersion 998
 HAVI_IMPLEMENTATION_VENDOR - of org.havi.ui.HVersion 998
 HAVI_IMPLEMENTATION_VERSION - of org.havi.ui.HVersion 998
 HAVI_SPECIFICATION_NAME - of org.havi.ui.HVersion 998
 HAVI_SPECIFICATION_VENDOR - of org.havi.ui.HVersion 998
 HAVI_SPECIFICATION_VERSION - of org.havi.ui.HVersion 999
 HBackgroundConfigTemplate - of org.havi.ui 669
 HBackgroundConfigTemplate() - of org.havi.ui.HBackgroundConfigTemplate 670
 HBackgroundConfiguration - of org.havi.ui 672
 HBackgroundConfiguration() - of org.havi.ui.HBackgroundConfiguration 672
 HBackgroundDevice - of org.havi.ui 674
 HBackgroundDevice() - of org.havi.ui.HBackgroundDevice 674
 HBackgroundImage - of org.havi.ui 678
 HBackgroundImage(byte[]) - of org.havi.ui.HBackgroundImage 678
 HBackgroundImage(String) - of org.havi.ui.HBackgroundImage 678
 HBackgroundImage(URL) - of org.havi.ui.HBackgroundImage 679
 HBackgroundImageEvent - of org.havi.ui.event 1042
 HBackgroundImageEvent(Object, int) - of org.havi.ui.event.HBackgroundImageEvent 1043
 HBackgroundImageListener - of org.havi.ui.event 1045
 HChangeData - of org.havi.ui 681
 HChangeData(int, Object) - of org.havi.ui.HChangeData 681
 HComponent - of org.havi.ui 682
 HComponent() - of org.havi.ui.HComponent 683
 HComponent(int, int, int, int) - of org.havi.ui.HComponent 683
 HComponentOrdering - of org.havi.ui 685
 HConfigurationException - of org.havi.ui 689
 HConfigurationException() - of org.havi.ui.HConfigurationException 689
 HConfigurationException(String) - of org.havi.ui.HConfigurationException 689
 HContainer - of org.havi.ui 691
 HContainer() - of org.havi.ui.HContainer 692
 HContainer(int, int, int, int) - of org.havi.ui.HContainer 692
 HDefaultTextLayoutManager - of org.havi.ui 698
 HDefaultTextLayoutManager() - of org.havi.ui.HDefaultTextLayoutManager 699
 HEBREW_EXTENDED - of org.havi.ui.HFontCapabilities 728
 height - of org.havi.ui.HScreenDimension 898
 height - of org.havi.ui.HScreenRectangle 902
 HEmulatedGraphicsConfiguration - of org.havi.ui 700
 HEmulatedGraphicsConfiguration() - of org.havi.ui.HEmulatedGraphicsConfiguration 700
 HEmulatedGraphicsDevice - of org.havi.ui 702
 HEmulatedGraphicsDevice() - of org.havi.ui.HEmulatedGraphicsDevice 702
 HEventMulticaster - of org.havi.ui 704
 HEventMulticaster(EventListener, EventListener) - of org.havi.ui.HEventMulticaster 705
 HEventRepresentation - of org.havi.ui.event 1046
 HEventRepresentation() - of org.havi.ui.event.HEventRepresentation 1049
 HFlatEffectMatte - of org.havi.ui 716
 HFlatEffectMatte() - of org.havi.ui.HFlatEffectMatte 717
 HFlatEffectMatte(float[]) - of org.havi.ui.HFlatEffectMatte 717
 HFlatMatte - of org.havi.ui 721
 HFlatMatte() - of org.havi.ui.HFlatMatte 721
 HFlatMatte(float) - of org.havi.ui.HFlatMatte 721
 HFOCUS_FIRST - of org.havi.ui.event.HFocusEvent 1052

HFOCUS_LAST - of org.havi.ui.event.HFocusEvent 1053
 HFocusEvent - of org.havi.ui.event 1052
 HFocusEvent(Component, int) - of org.havi.ui.event.HFocusEvent 1053
 HFocusEvent(Component, int, int) - of org.havi.ui.event.HFocusEvent 1053
 HFocusListener - of org.havi.ui.event 1055
 HFontCapabilities - of org.havi.ui 723
 HFontCapabilities() - of org.havi.ui.HFontCapabilities 732
 HGraphicButton - of org.havi.ui 734
 HGraphicButton() - of org.havi.ui.HGraphicButton 736
 HGraphicButton(Image) - of org.havi.ui.HGraphicButton 736
 HGraphicButton(Image, Image, Image) - of org.havi.ui.HGraphicButton 736
 HGraphicButton(Image, Image, Image, int, int, int, int) - of org.havi.ui.HGraphicButton 736
 HGraphicButton(Image, int, int, int, int) - of org.havi.ui.HGraphicButton 736
 HGraphicLook - of org.havi.ui 743
 HGraphicLook() - of org.havi.ui.HGraphicLook 744
 HGraphicsConfigTemplate - of org.havi.ui 748
 HGraphicsConfigTemplate() - of org.havi.ui.HGraphicsConfigTemplate 749
 HGraphicsConfiguration - of org.havi.ui 752
 HGraphicsConfiguration() - of org.havi.ui.HGraphicsConfiguration 752
 HGraphicsDevice - of org.havi.ui 757
 HGraphicsDevice() - of org.havi.ui.HGraphicsDevice 757
 HIcon - of org.havi.ui 761
 HIcon() - of org.havi.ui.HIcon 763
 HIcon(Image) - of org.havi.ui.HIcon 763
 HIcon(Image, Image, int, int, int, int) - of org.havi.ui.HIcon 763
 HIcon(Image, int, int, int, int) - of org.havi.ui.HIcon 763
 HImageEffectMatte - of org.havi.ui 767
 HImageEffectMatte() - of org.havi.ui.HImageEffectMatte 768
 HImageEffectMatte(Image[]) - of org.havi.ui.HImageEffectMatte 768
 HImageHints - of org.havi.ui 772
 HImageHints() - of org.havi.ui.HImageHints 773
 HImageMatte - of org.havi.ui 774
 HImageMatte() - of org.havi.ui.HImageMatte 774
 HImageMatte(Image) - of org.havi.ui.HImageMatte 774
 hint - of org.havi.ui.HChangeData 681
 HInvalidLookException - of org.havi.ui 776
 HInvalidLookException() - of org.havi.ui.HInvalidLookException 776
 HInvalidLookException(String) - of org.havi.ui.HInvalidLookException 776
 HIRAGANA - of org.havi.ui.HFontCapabilities 729
 HItemEvent - of org.havi.ui.event 1056
 HItemEvent(HItemValue, int, Object) - of org.havi.ui.event.HItemEvent 1058
 HItemListener - of org.havi.ui.event 1059
 HItemValue - of org.havi.ui 777
 hitTest(HAdjustmentValue, Point) - of org.havi.ui.HAdjustableLook 646
 hitTest(HAdjustmentValue, Point) - of org.havi.ui.HListGroupLook 804
 hitTest(HAdjustmentValue, Point) - of org.havi.ui.HRangeLook 848
 HKeyboardInputPreferred - of org.havi.ui 780
 HKeyCapabilities - of org.havi.ui.event 1060
 HKeyCapabilities() - of org.havi.ui.event.HKeyCapabilities 1060
 HKeyEvent - of org.havi.ui.event 1062
 HKeyEvent(Component, int, long, int, int) - of org.havi.ui.event.HKeyEvent 1063
 HKeyEvent(Component, int, long, int, int, char) - of org.havi.ui.event.HKeyEvent 1063
 HKeyListener - of org.havi.ui.event 1064
 HListElement - of org.havi.ui 783
 HListElement(Image, String) - of org.havi.ui.HListElement 783

HListElement(String) - of org.havi.ui.HListElement 784
HListGroup - of org.havi.ui 785
HListGroup() - of org.havi.ui.HListGroup 788
HListGroup(HListElement[]) - of org.havi.ui.HListGroup 788
HListGroup(HListElement[], int, int, int, int) - of org.havi.ui.HListGroup 788
HListGroupLook - of org.havi.ui 800
HListGroupLook() - of org.havi.ui.HListGroupLook 801
HLook - of org.havi.ui 806
HMatte - of org.havi.ui 812
HMatteException - of org.havi.ui 813
HMatteException() - of org.havi.ui.HMatteException 813
HMatteException(String) - of org.havi.ui.HMatteException 814
HMatteLayer - of org.havi.ui 815
HMouseCapabilities - of org.havi.ui.event 1065
HMouseCapabilities() - of org.havi.ui.event.HMouseCapabilities 1065
HMultilineEntry - of org.havi.ui 816
HMultilineEntry() - of org.havi.ui.HMultilineEntry 818
HMultilineEntry(int) - of org.havi.ui.HMultilineEntry 818
HMultilineEntry(int, int, int, int, int) - of org.havi.ui.HMultilineEntry 818
HMultilineEntry(String, int, Font, Color) - of org.havi.ui.HMultilineEntry 818
HMultilineEntry(String, int, int, int, int, int, Font, Color) - of org.havi.ui.HMultilineEntry 818
HMultilineEntryLook - of org.havi.ui 820
HMultilineEntryLook() - of org.havi.ui.HMultilineEntryLook 820
HNavigable - of org.havi.ui 826
HNavigationInputPreferred - of org.havi.ui 831
HNoInputPreferred - of org.havi.ui 833
HOrientable - of org.havi.ui 834
HORIZONTAL_CENTER - of org.dvb.ui.DVBTextLayoutManager 615
HORIZONTAL_END_ALIGN - of org.dvb.ui.DVBTextLayoutManager 615
HORIZONTAL_START_ALIGN - of org.dvb.ui.DVBTextLayoutManager 615
HPermissionDeniedException - of org.havi.ui 836
HPermissionDeniedException() - of org.havi.ui.HPermissionDeniedException 836
HPermissionDeniedException(String) - of org.havi.ui.HPermissionDeniedException 837
HRange - of org.havi.ui 838
HRange() - of org.havi.ui.HRange 840
HRange(int, int, int, int) - of org.havi.ui.HRange 840
HRange(int, int, int, int, int, int, int, int) - of org.havi.ui.HRange 840
HRangeLook - of org.havi.ui 845
HRangeLook() - of org.havi.ui.HRangeLook 845
HRangeValue - of org.havi.ui 850
HRangeValue() - of org.havi.ui.HRangeValue 852
HRangeValue(int, int, int, int) - of org.havi.ui.HRangeValue 852
HRangeValue(int, int, int, int, int, int, int, int) - of org.havi.ui.HRangeValue 852
HRcCapabilities - of org.havi.ui.event 1066
HRcCapabilities() - of org.havi.ui.event.HRcCapabilities 1066
HRcEvent - of org.havi.ui.event 1068
HRcEvent(Component, int, long, int, int) - of org.havi.ui.event.HRcEvent 1075
HRcEvent(Component, int, long, int, int, char) - of org.havi.ui.event.HRcEvent 1076
HScene - of org.havi.ui 859
HScene() - of org.havi.ui.HScene 862
HSceneFactory - of org.havi.ui 872
HSceneTemplate - of org.havi.ui 876
HSceneTemplate() - of org.havi.ui.HSceneTemplate 878
HScreen - of org.havi.ui 880
HScreenConfigTemplate - of org.havi.ui 885

HScreenConfigTemplate() - of org.havi.ui.HScreenConfigTemplate 889
 HScreenConfiguration - of org.havi.ui 891
 HScreenConfigurationEvent - of org.havi.ui.event 1077
 HScreenConfigurationEvent(Object) - of org.havi.ui.event.HScreenConfigurationEvent 1077
 HScreenConfigurationListener - of org.havi.ui.event 1078
 HScreenDevice - of org.havi.ui 893
 HScreenDeviceReleasedEvent - of org.havi.ui.event 1079
 HScreenDeviceReleasedEvent(Object) - of org.havi.ui.event.HScreenDeviceReleasedEvent 1079
 HScreenDeviceReservedEvent - of org.havi.ui.event 1080
 HScreenDeviceReservedEvent(Object) - of org.havi.ui.event.HScreenDeviceReservedEvent 1080
 HScreenDimension - of org.havi.ui 897
 HScreenDimension(float, float) - of org.havi.ui.HScreenDimension 898
 HScreenLocationModifiedEvent - of org.havi.ui.event 1081
 HScreenLocationModifiedEvent(Object) - of org.havi.ui.event.HScreenLocationModifiedEvent 1081
 HScreenLocationModifiedListener - of org.havi.ui.event 1083
 HScreenPoint - of org.havi.ui 899
 HScreenPoint(float, float) - of org.havi.ui.HScreenPoint 900
 HScreenRectangle - of org.havi.ui 901
 HScreenRectangle(float, float, float, float) - of org.havi.ui.HScreenRectangle 902
 HSelectionInputPreferred - of org.havi.ui 904
 HSinglelineEntry - of org.havi.ui 906
 HSinglelineEntry() - of org.havi.ui.HSinglelineEntry 908
 HSinglelineEntry(int) - of org.havi.ui.HSinglelineEntry 909
 HSinglelineEntry(int, int, int, int, int) - of org.havi.ui.HSinglelineEntry 909
 HSinglelineEntry(String, int, Font, Color) - of org.havi.ui.HSinglelineEntry 909
 HSinglelineEntry(String, int, int, int, int, int, Font, Color) - of org.havi.ui.HSinglelineEntry 909
 HSinglelineEntryLook - of org.havi.ui 918
 HSinglelineEntryLook() - of org.havi.ui.HSinglelineEntryLook 918
 HSound - of org.havi.ui 923
 HSound() - of org.havi.ui.HSound 923
 HState - of org.havi.ui 926
 HStaticAnimation - of org.havi.ui 930
 HStaticAnimation() - of org.havi.ui.HStaticAnimation 932
 HStaticAnimation(Image[], int, int, int) - of org.havi.ui.HStaticAnimation 932
 HStaticAnimation(Image[], int, int, int, int, int, int, int) - of org.havi.ui.HStaticAnimation 932
 HStaticIcon - of org.havi.ui 936
 HStaticIcon() - of org.havi.ui.HStaticIcon 937
 HStaticIcon(Image) - of org.havi.ui.HStaticIcon 937
 HStaticIcon(Image, int, int, int, int) - of org.havi.ui.HStaticIcon 938
 HStaticRange - of org.havi.ui 939
 HStaticRange() - of org.havi.ui.HStaticRange 941
 HStaticRange(int, int, int, int) - of org.havi.ui.HStaticRange 941
 HStaticRange(int, int, int, int, int, int, int, int) - of org.havi.ui.HStaticRange 941
 HStaticText - of org.havi.ui 945
 HStaticText() - of org.havi.ui.HStaticText 947
 HStaticText(String) - of org.havi.ui.HStaticText 947
 HStaticText(String, Font, Color, Color, HTextLayoutManager) - of org.havi.ui.HStaticText 947
 HStaticText(String, int, int, int, int) - of org.havi.ui.HStaticText 947
 HStaticText(String, int, int, int, int, Font, Color, Color, HTextLayoutManager) - of org.havi.ui.HStaticText 947
 HStillImageBackgroundConfiguration - of org.havi.ui 949
 HStillImageBackgroundConfiguration() - of org.havi.ui.HStillImageBackgroundConfiguration 949
 HSwitchable - of org.havi.ui 952
 HText - of org.havi.ui 955
 HText() - of org.havi.ui.HText 957

HText(String) - of org.havi.ui.HText 957
HText(String, Font, Color, Color, HTextLayoutManager) - of org.havi.ui.HText 957
HText(String, int, int, int, int) - of org.havi.ui.HText 957
HText(String, int, int, int, int, Font, Color, Color, HTextLayoutManager) - of org.havi.ui.HText 958
HText(String, String) - of org.havi.ui.HText 958
HText(String, String, Font, Color, Color, HTextLayoutManager) - of org.havi.ui.HText 958
HText(String, String, int, int, int, int) - of org.havi.ui.HText 958
HText(String, String, int, int, int, int, Font, Color, Color, HTextLayoutManager) - of org.havi.ui.HText 958
HTextButton - of org.havi.ui 962
HTextButton() - of org.havi.ui.HTextButton 964
HTextButton(String) - of org.havi.ui.HTextButton 964
HTextButton(String, Font, Color, Color, HTextLayoutManager) - of org.havi.ui.HTextButton 964
HTextButton(String, int, int, int, int) - of org.havi.ui.HTextButton 965
HTextButton(String, int, int, int, int, Font, Color, Color, HTextLayoutManager) - of org.havi.ui.HTextButton 965
HTextEvent - of org.havi.ui.event 1084
HTextEvent(HTextValue, int) - of org.havi.ui.event.HTextEvent 1087
HTextLayoutManager - of org.havi.ui 971
HTextListener - of org.havi.ui.event 1088
HTextLook - of org.havi.ui 974
HTextLook() - of org.havi.ui.HTextLook 975
HTextValue - of org.havi.ui 979
HToggleButton - of org.havi.ui 981
HToggleButton() - of org.havi.ui.HToggleButton 983
HToggleButton(Image) - of org.havi.ui.HToggleButton 983
HToggleButton(Image, boolean, HToggleGroup) - of org.havi.ui.HToggleButton 983
HToggleButton(Image, Image, Image, Image, boolean) - of org.havi.ui.HToggleButton 984
HToggleButton(Image, Image, Image, Image, boolean, HToggleGroup) - of org.havi.ui.HToggleButton 984
HToggleButton(Image, Image, Image, Image, int, int, int, int, boolean) - of org.havi.ui.HToggleButton 984
HToggleButton(Image, Image, Image, Image, int, int, int, int, boolean, HToggleGroup) - of org.havi.ui.HToggleButton 984
HToggleButton(Image, int, int, int, int) - of org.havi.ui.HToggleButton 984
HToggleButton(Image, int, int, int, int, boolean) - of org.havi.ui.HToggleButton 984
HToggleButton(Image, int, int, int, int, boolean, HToggleGroup) - of org.havi.ui.HToggleButton 984
HToggleGroup - of org.havi.ui 992
HToggleGroup() - of org.havi.ui.HToggleGroup 993
HUIException - of org.havi.ui 996
HUIException() - of org.havi.ui.HUIException 996
HUIException(String) - of org.havi.ui.HUIException 997
HUMAN_INTERVENTION - of org.dvb.test.DVBTest 1094
HVersion - of org.havi.ui 998
HVideoComponent - of org.havi.ui 1000
HVideoComponent() - of org.havi.ui.HVideoComponent 1000
HVideoConfigTemplate - of org.havi.ui 1002
HVideoConfigTemplate() - of org.havi.ui.HVideoConfigTemplate 1003
HVideoConfiguration - of org.havi.ui 1005
HVideoConfiguration() - of org.havi.ui.HVideoConfiguration 1005
HVideoDevice - of org.havi.ui 1007
HVideoDevice() - of org.havi.ui.HVideoDevice 1008
HVisible - of org.havi.ui 1012
HVisible() - of org.havi.ui.HVisible 1023
HVisible(HLook) - of org.havi.ui.HVisible 1024
HVisible(HLook, int, int, int, int) - of org.havi.ui.HVisible 1024

I

IllegalObjectTypeException - of org.dvb.dsmcc 483
 IllegalObjectTypeException() - of org.dvb.dsmcc.IllegalObjectTypeException 483
 IllegalObjectTypeException(String) - of org.dvb.dsmcc.IllegalObjectTypeException 483
 IllegalProfileParameterException - of org.dvb.application 583
 IllegalProfileParameterException() - of org.dvb.application.IllegalProfileParameterException 583
 IllegalProfileParameterException(String) - of org.dvb.application.IllegalProfileParameterException 583
 IMAGE_CENTER - of org.havi.ui.HScene 861
 IMAGE_NONE - of org.havi.ui.HScene 861
 IMAGE_SCALING_SUPPORT - of org.havi.ui.HGraphicsConfigTemplate 748
 IMAGE_STRETCH - of org.havi.ui.HScene 861
 IMAGE_TILE - of org.havi.ui.HScene 862
 imageLoaded(HBackgroundImageEvent) - of org.havi.ui.event.HBackgroundImageListener 1045
 imageLoaded(HBackgroundImageEvent) - of org.havi.ui.HEventMulticaster 709
 imageLoadFailed(HBackgroundImageEvent) - of org.havi.ui.event.HBackgroundImageListener 1045
 imageLoadFailed(HBackgroundImageEvent) - of org.havi.ui.HEventMulticaster 709
 implies(Permission) - of org.dvb.application.AppsControlPermission 565
 IncompleteTargetException - of org.dvb.net.rc 540
 IncompleteTargetException() - of org.dvb.net.rc.IncompleteTargetException 540
 IncompleteTargetException(String) - of org.dvb.net.rc.IncompleteTargetException 540
 init() - of org.dvb.application.DVBProxy 581
 INPUT_ALPHA - of org.havi.ui.HKeyboardInputPreferred 780
 INPUT_ALPHANUMERIC - of org.havi.ui.HKeyboardInputPreferred 780
 INPUT_ANY - of org.havi.ui.HKeyboardInputPreferred 780
 INPUT_CUSTOMIZED - of org.havi.ui.HKeyboardInputPreferred 781
 INPUT_NUMERIC - of org.havi.ui.HKeyboardInputPreferred 781
 insertChar(char) - of org.havi.ui.HSinglelineEntry 913
 InsufficientResourcesException - of org.dvb.dsmcc 484
 InsufficientResourcesException() - of org.dvb.dsmcc.InsufficientResourcesException 484
 InsufficientResourcesException(String) - of org.dvb.dsmcc.InsufficientResourcesException 484
 INTERLACED_DISPLAY - of org.havi.ui.HScreenConfigTemplate 886
 InvalidAddressException - of org.dvb.dsmcc 485
 InvalidAddressException() - of org.dvb.dsmcc.InvalidAddressException 485
 InvalidAddressException(String) - of org.dvb.dsmcc.InvalidAddressException 485
 InvalidFormatEvent - of org.dvb.dsmcc 486
 InvalidFormatEvent(DSMCCObject) - of org.dvb.dsmcc.InvalidFormatEvent 486
 InvalidFormatException - of org.dvb.dsmcc 487
 InvalidFormatException() - of org.dvb.dsmcc.InvalidFormatException 487
 InvalidFormatException(String) - of org.dvb.dsmcc.InvalidFormatException 487
 InvalidLocatorException - of org.davic.net 222
 InvalidLocatorException() - of org.davic.net.InvalidLocatorException 222
 InvalidLocatorException(String) - of org.davic.net.InvalidLocatorException 222
 InvalidPathnameEvent - of org.dvb.dsmcc 488
 InvalidPathnameEvent(DSMCCObject) - of org.dvb.dsmcc.InvalidPathnameEvent 488
 InvalidPathNameException - of org.dvb.dsmcc 489
 InvalidPathNameException() - of org.dvb.dsmcc.InvalidPathNameException 489
 InvalidPathNameException(String) - of org.dvb.dsmcc.InvalidPathNameException 489
 IPA_EXTENSIONS - of org.havi.ui.HFontCapabilities 729
 isAltDown() - of org.dvb.event.UserEvent 304
 isAnimated() - of org.havi.ui.HAnimateEffect 655
 isAnimated() - of org.havi.ui.HFlatEffectMatte 718
 isAnimated() - of org.havi.ui.HImageEffectMatte 769
 isAnimated() - of org.havi.ui.HStaticAnimation 933
 isAttached() - of org.dvb.dsmcc.ServiceDomain 513

isAudio() - of org.dvb.dsmcc.DSMCCStream 478
isAvailableInCache() - of org.dvb.si.SIRequest 388
isCharAvailable(Font, char) - of org.havi.ui.HFontCapabilities 733
isConfigSupported(HBackgroundConfiguration) - of org.havi.ui.HBackgroundConfigTemplate 671
isConfigSupported(HGraphicsConfiguration) - of org.havi.ui.HGraphicsConfigTemplate 750
isConfigSupported(HVideoConfiguration) - of org.havi.ui.HVideoConfigTemplate 1004
isConnected() - of org.dvb.net.rc.ConnectionRCInterface 536
isControlDown() - of org.dvb.event.UserEvent 304
isData() - of org.dvb.dsmcc.DSMCCStream 478
isDoubleBuffered() - of org.havi.ui.HComponent 683
isDoubleBuffered() - of org.havi.ui.HContainer 693
isDoubleBuffered() - of org.havi.ui.HScene 866
isEnabled() - of org.havi.ui.HToggleGroup 993
isEnabledShortcuts() - of org.havi.ui.HScene 866
isFocusTraversable() - of org.havi.ui.HVisible 1028
isGrouped() - of org.havi.ui.HContainer 694
isItemSelected(int) - of org.havi.ui.HListGroup 793
isLoading() - of org.dvb.dsmcc.DSMCCObject 473
isMetaDown() - of org.dvb.event.UserEvent 304
isMPEGProgram() - of org.dvb.dsmcc.DSMCCStream 478
isNetworkConnectionAvailable() - of org.dvb.dsmcc.ServiceDomain 513
isObjectKindKnown() - of org.dvb.dsmcc.DSMCCObject 473
isOpaque() - of org.dvb.ui.TestOpacity 626
isOpaque() - of org.havi.ui.HComponent 683
isOpaque() - of org.havi.ui.HContainer 694
isOpaque() - of org.havi.ui.HScene 866
isOpaque() - of org.havi.ui.HVisible 1028
isOpaque(HVisible) - of org.havi.ui.HAnimateLook 660
isOpaque(HVisible) - of org.havi.ui.HGraphicLook 746
isOpaque(HVisible) - of org.havi.ui.HListGroupLook 804
isOpaque(HVisible) - of org.havi.ui.HLook 810
isOpaque(HVisible) - of org.havi.ui.HMultilineEntryLook 824
isOpaque(HVisible) - of org.havi.ui.HRangeLook 848
isOpaque(HVisible) - of org.havi.ui.HSinglelineEntryLook 921
isOpaque(HVisible) - of org.havi.ui.HTextLook 977
isPanAndScan() - of org.dvb.media.VideoTransformation 454
isSelected() - of org.havi.ui.HAnimation 666
isSelected() - of org.havi.ui.HGraphicButton 738
isSelected() - of org.havi.ui.HIcon 764
isSelected() - of org.havi.ui.HListGroup 794
isSelected() - of org.havi.ui.HNavigable 828
isSelected() - of org.havi.ui.HRange 841
isSelected() - of org.havi.ui.HRangeValue 855
isSelected() - of org.havi.ui.HSinglelineEntry 913
isSelected() - of org.havi.ui.HText 959
isSelected() - of org.havi.ui.HTextButton 967
isSelected() - of org.havi.ui.HToggleButton 987
isShiftDown() - of org.dvb.event.UserEvent 304
isStartable() - of org.dvb.application.AppAttributes 555
isStream() - of org.dvb.dsmcc.DSMCCObject 473
isStreamEvent() - of org.dvb.dsmcc.DSMCCObject 473
isSupported() - of org.havi.ui.event.HEventRepresentation 1050
isSupported(int) - of org.havi.ui.event.HKeyCapabilities 1061
isSupported(int) - of org.havi.ui.event.HRcCapabilities 1067
isTemporary() - of org.havi.ui.event.HFocusEvent 1054

isVideo() - of org.dvb.dsmcc.DSMCCStream 478
 isVisible() - of org.havi.ui.HScene 867
 ITEM_CLEARED - of org.havi.ui.event.HItemEvent 1056
 ITEM_END_CHANGE - of org.havi.ui.event.HItemEvent 1056
 ITEM_FIRST - of org.havi.ui.event.HItemEvent 1057
 ITEM_LAST - of org.havi.ui.event.HItemEvent 1057
 ITEM_NOT_FOUND - of org.havi.ui.HListGroup 788
 ITEM_SELECTED - of org.havi.ui.event.HItemEvent 1057
 ITEM_SELECTION_CLEARED - of org.havi.ui.event.HItemEvent 1057
 ITEM_SET_CURRENT - of org.havi.ui.event.HItemEvent 1057
 ITEM_SET_NEXT - of org.havi.ui.event.HItemEvent 1057
 ITEM_SET_PREVIOUS - of org.havi.ui.event.HItemEvent 1057
 ITEM_START_CHANGE - of org.havi.ui.event.HItemEvent 1057
 ITEM_TOGGLE_SELECTED - of org.havi.ui.event.HItemEvent 1058
 ITEM_VALUE_CHANGE - of org.havi.ui.HVisible 1020
 IxcRegistry - of org.dvb.io.ixc 1102

K

KANNADA - of org.havi.ui.HFontCapabilities 729
 KATAKANA - of org.havi.ui.HFontCapabilities 729
 keyPressed(KeyEvent) - of org.havi.ui.HEventMulticaster 709
 keyReleased(KeyEvent) - of org.havi.ui.HEventMulticaster 710
 keyTyped(KeyEvent) - of org.havi.ui.HEventMulticaster 710

L

LanguageNotAvailableException - of org.dvb.application 584
 LanguageNotAvailableException() - of org.dvb.application.LanguageNotAvailableException 584
 LanguageNotAvailableException(String) - of org.dvb.application.LanguageNotAvailableException 584
 LAO - of org.havi.ui.HFontCapabilities 729
 LARGEST_PIXEL_DIMENSION - of org.havi.ui.HSceneTemplate 877
 LAST_CHANGE - of org.havi.ui.HVisible 1020
 LAST_STATE - of org.havi.ui.HState 929
 LATIN_1_SUPPLEMENT - of org.havi.ui.HFontCapabilities 729
 LATIN_EXTENDED_A - of org.havi.ui.HFontCapabilities 729
 LATIN_EXTENDED_ADDITIONAL - of org.havi.ui.HFontCapabilities 729
 LATIN_EXTENDED_B - of org.havi.ui.HFontCapabilities 730
 LETTERLIKE_SYMBOLS - of org.havi.ui.HFontCapabilities 730
 LINE_ART - of org.havi.ui.HImageHints 772
 LINE_ORIENTATION_HORIZONTAL - of org.dvb.ui.DVBTextLayoutManager 615
 LINE_ORIENTATION_VERTICAL - of org.dvb.ui.DVBTextLayoutManager 616
 LINKAGE - of org.dvb.si.DescriptorTag 336
 list(XletContext) - of org.dvb.io.ixc.IxcRegistry 1103
 LIST_CONTENT_CHANGE - of org.havi.ui.HVisible 1020
 LIST_ICONSIZING_CHANGE - of org.havi.ui.HVisible 1020
 LIST_LABELSIZING_CHANGE - of org.havi.ui.HVisible 1020
 LIST_MULTISELECTION_CHANGE - of org.havi.ui.HVisible 1021
 LIST_SCROLLPOSITION_CHANGE - of org.havi.ui.HVisible 1021
 load() - of org.dvb.application.DVBProxy 581
 load(HBackgroundImageListener) - of org.havi.ui.HBackgroundImage 680
 load(String) - of org.havi.ui.HSound 923
 load(URL) - of org.havi.ui.HSound 924
 loadDirectoryEntry(AsynchronousLoadingEventListener) - of org.dvb.dsmcc.DSMCCObject 473
 LOADED - of org.dvb.application.DVBProxy 581

LoadingAbortedEvent - of org.dvb.dsmcc 490
 LoadingAbortedEvent(DSMCCObject) - of org.dvb.dsmcc.LoadingAbortedEvent 490
 LOCAL_TIME_OFFSET - of org.dvb.si.DescriptorTag 336
 log(String, int) - of org.dvb.test.DVBTest 1095
 log(String, String) - of org.dvb.test.DVBTest 1095
 lookup(XletContext, String) - of org.dvb.io.ixc.IxcRegistry 1103
 loop() - of org.havi.ui.HSound 924

M

MALAYALAM - of org.havi.ui.HFontCapabilities 730
 MATHEMATICAL_OPERATORS - of org.havi.ui.HFontCapabilities 730
 MATTE_SUPPORT - of org.havi.ui.HGraphicsConfigTemplate 748
 MHP_APPLICATION - of org.dvb.si.SIServiceType 400
 MIN_MAX_CHANGE - of org.havi.ui.HVisible 1021
 MISCELLANEOUS_SYMBOLS - of org.havi.ui.HFontCapabilities 730
 MISCELLANEOUS_TECHNICAL - of org.havi.ui.HFontCapabilities 730
 MMIOobject - of org.davic.net.ca 227
 MOSAIC - of org.dvb.si.DescriptorTag 336
 MOSAIC - of org.dvb.si.SIServiceType 401
 MPEG1_AUDIO - of org.dvb.si.PMTStreamType 343
 MPEG1_VIDEO - of org.dvb.si.PMTStreamType 343
 MPEG2_AUDIO - of org.dvb.si.PMTStreamType 343
 MPEG2_VIDEO - of org.dvb.si.PMTStreamType 343
 MPEGDeliveryErrorEvent - of org.dvb.dsmcc 491
 MPEGDeliveryErrorEvent(DSMCCObject) - of org.dvb.dsmcc.MPEGDeliveryErrorEvent 491
 MPEGDeliveryException - of org.dvb.dsmcc 492
 MPEGDeliveryException() - of org.dvb.dsmcc.MPEGDeliveryException 492
 MPEGDeliveryException(String) - of org.dvb.dsmcc.MPEGDeliveryException 492
 MULTILINGUAL_BOUQUET_NAME - of org.dvb.si.DescriptorTag 336
 MULTILINGUAL_COMPONENT - of org.dvb.si.DescriptorTag 336
 MULTILINGUAL_NETWORK_NAME - of org.dvb.si.DescriptorTag 336
 MULTILINGUAL_SERVICE_NAME - of org.dvb.si.DescriptorTag 336

N

NATURAL_IMAGE - of org.havi.ui.HImageHints 773
 NETWORK - of org.dvb.si.SIMonitoringType 381
 NETWORK_NAME - of org.dvb.si.DescriptorTag 337
 NEW_DATABASE - of org.dvb.application.AppsDatabaseEvent 571
 newDatabase(AppsDatabaseEvent) - of org.dvb.application.AppsDatabaseEventListener 573
 newInstance(URL[]) - of org.dvb.lang.DVBClassLoader 292
 newInstance(URL[], ClassLoader) - of org.dvb.lang.DVBClassLoader 292
 NO_BACKGROUND_FILL - of org.havi.ui.HScene 862
 NO_BACKGROUND_FILL - of org.havi.ui.HVisible 1021
 NO_DEFAULT_HEIGHT - of org.havi.ui.HVisible 1021
 NO_DEFAULT_SIZE - of org.havi.ui.HVisible 1021
 NO_DEFAULT_WIDTH - of org.havi.ui.HVisible 1021
 NO_TRANSFER_ID - of org.havi.ui.event.HFocusEvent 1053
 NoComponentSelectedEvent - of org.dvb.media 427
 NoComponentSelectedEvent(Controller) - of org.dvb.media.NoComponentSelectedEvent 427
 NoComponentSelectedEvent(Controller, MediaLocator) - of org.dvb.media.NoComponentSelectedEvent 427
 NoFreeCapacityException - of org.davic.net.ca 226
 NoFreeCapacityException() - of org.davic.net.ca.NoFreeCapacityException 226
 NoFreeCapacityException(String) - of org.davic.net.ca.NoFreeCapacityException 226

NORMAL_STATE - of org.havi.ui.HState 929
 NOT_CONTRIBUTING - of org.havi.ui.HVideoDevice 1007
 NOT_LOADED - of org.dvb.application.AppProxy 560
 NOT_RUNNING - of org.dvb.si.SIRunningStatus 393
 NotAuthorizedException - of org.davic.mpeg 217
 NotAuthorizedException() - of org.davic.mpeg.NotAuthorizedException 217
 NotAuthorizedException(String) - of org.davic.mpeg.NotAuthorizedException 217
 NotAuthorizedMediaException(ElementaryStream[], int[]) - of org.davic.media.NotAuthorizedMediaException 221
 NotAuthorizedMediaException(Service, int) - of org.davic.media.NotAuthorizedMediaException 221
 NotEntitledEvent - of org.dvb.dsmcc 493
 NotEntitledEvent(DSMCCObject) - of org.dvb.dsmcc.NotEntitledEvent 493
 NotEntitledException - of org.dvb.dsmcc 494
 NotEntitledException() - of org.dvb.dsmcc.NotEntitledException 494
 NotEntitledException(String) - of org.dvb.dsmcc.NotEntitledException 494
 NothingToAbortException - of org.dvb.dsmcc 495
 NothingToAbortException() - of org.dvb.dsmcc.NothingToAbortException 495
 NothingToAbortException(String) - of org.dvb.dsmcc.NothingToAbortException 495
 notifyTextOverflow(String, HVisible, boolean, boolean) - com.nokia.mhp.ui.TextOverflowListener.notifyTextOverflow(java.lang.String, org.havi.ui.HVisible, boolean, boolean) 272
 notifyTextOverflow(String, HVisible, boolean, boolean) - of org.dvb.ui.TextOverflowListener 627
 NotLoadedException - of org.dvb.dsmcc 496
 NotLoadedException() - of org.dvb.dsmcc.NotLoadedException 496
 NotLoadedException(String) - of org.dvb.dsmcc.NotLoadedException 496
 NPTDiscontinuityEvent - of org.dvb.dsmcc 497
 NPTDiscontinuityEvent(DSMCCStream, long, long) - of org.dvb.dsmcc.NPTDiscontinuityEvent 497
 NPTListener - of org.dvb.dsmcc 499
 NPTPresentEvent - of org.dvb.dsmcc 500
 NPTPresentEvent(DSMCCStream) - of org.dvb.dsmcc.NPTPresentEvent 500
 NPTRate - of org.dvb.dsmcc 501
 NPTRateChangeEvent - of org.dvb.dsmcc 502
 NPTRateChangeEvent(DSMCCStream, NPTRate) - of org.dvb.dsmcc.NPTRateChangeEvent 502
 NPTRemovedEvent - of org.dvb.dsmcc 503
 NPTRemovedEvent(DSMCCStream) - of org.dvb.dsmcc.NPTRemovedEvent 503
 NPTStatusEvent - of org.dvb.dsmcc 504
 NPTStatusEvent(DSMCCStream) - of org.dvb.dsmcc.NPTStatusEvent 504
 NTSC - of org.dvb.si.SIServiceType 401
 NUMBER_FORMS - of org.havi.ui.HFontCapabilities 730
 numberOfRemainingObjects() - of org.dvb.si.SIIterator 375
 NVOD_REFERENCE - of org.dvb.si.DescriptorTag 337
 NVOD_REFERENCE - of org.dvb.si.SIServiceType 401
 NVOD_TIME_SHIFTED - of org.dvb.si.SIServiceType 401

O

ObjectChangeEvent - of org.dvb.dsmcc 505
 ObjectChangeEvent(DSMCCObject, int) - of org.dvb.dsmcc.ObjectChangeEvent 505
 ObjectChangeListener - of org.dvb.dsmcc 507
 OPTICAL_CHARACTER_RECOGNITION - of org.havi.ui.HFontCapabilities 730
 OPTION_UNSUPPORTED - of org.dvb.test.DVBTest 1094
 org.davic.net - package 222
 org.dvb.application - package 551
 org.dvb.dsmcc - package 465
 org.dvb.event - package 296
 org.dvb.io.ixc - package 1101

org.dvb.io.persistent - package 310
 org.dvb.lang - package 290
 org.dvb.media - package 414
 org.dvb.net - package 525
 org.dvb.net.ca - package 586
 org.dvb.net.rc - package 528
 org.dvb.net.tuning - package 589
 org.dvb.si - package 330
 org.dvb.test - package 1092
 org.dvb.ui - package 593
 org.dvb.user - package 317
 org.havi.ui - package 634
 org.havi.ui.event - package 1033
 ORIENT_BOTTOM_TO_TOP - of org.havi.ui.HOrientable 834
 ORIENT_LEFT_TO_RIGHT - of org.havi.ui.HOrientable 834
 ORIENT_RIGHT_TO_LEFT - of org.havi.ui.HOrientable 834
 ORIENT_TOP_TO_BOTTOM - of org.havi.ui.HOrientable 834
 ORIENTATION_CHANGE - of org.havi.ui.HVisible 1022
 ORIYA - of org.havi.ui.HFontCapabilities 731
 OverallRepository - of org.dvb.event 300
 OverallRepository() - of org.dvb.event.OverallRepository 300

P

paint(Graphics) - of org.havi.ui.HScene 867
 paint(Graphics) - of org.havi.ui.HVisible 1028
 PAL - of org.dvb.si.SIServiceType 401
 PARENTAL_RATING - of org.dvb.si.DescriptorTag 337
 PARTIAL_TRANSPORT_STREAM - of org.dvb.si.DescriptorTag 337
 PASS - of org.dvb.test.DVBTest 1094
 pause() - of org.dvb.application.AppProxy 561
 PAUSED - of org.dvb.application.AppProxy 561
 PAUSING - of org.dvb.si.SIRunningStatus 393
 PermissionDeniedException - of org.dvb.net.rc 541
 PermissionDeniedException() - of org.dvb.net.rc.PermissionDeniedException 541
 PermissionDeniedException(String) - of org.dvb.net.rc.PermissionDeniedException 541
 PIXEL_ASPECT_RATIO - of org.havi.ui.HScreenConfigTemplate 886
 PIXEL_RESOLUTION - of org.havi.ui.HScreenConfigTemplate 886
 play() - of org.havi.ui.HSound 924
 PLAY_ALTERNATING - of org.havi.ui.HAnimateEffect 653
 PLAY_REPEATING - of org.havi.ui.HAnimateEffect 653
 PMT_SERVICE - of org.dvb.si.SIMonitoringType 381
 PMTElementaryStream - of org.dvb.si 339
 PMTService - of org.dvb.si 341
 PMTStreamType - of org.dvb.si 343
 pop(Component) - of org.havi.ui.HComponentOrdering 686
 pop(Component) - of org.havi.ui.HContainer 694
 pop(Component) - of org.havi.ui.HScene 867
 popInFrontOf(Component, Component) - of org.havi.ui.HComponentOrdering 686
 popInFrontOf(Component, Component) - of org.havi.ui.HContainer 695
 popInFrontOf(Component, Component) - of org.havi.ui.HScene 867
 popToFront(Component) - of org.havi.ui.HComponentOrdering 686
 popToFront(Component) - of org.havi.ui.HContainer 695
 popToFront(Component) - of org.havi.ui.HScene 868
 POS_CAP_FULL - of org.dvb.media.VideoPresentationControl 448

POS_CAP_FULL_EVEN_LINES - of org.dvb.media.VideoPresentationControl 448
 POS_CAP_FULL_EVEN_LINES_IF_ENTIRE_VIDEO_ON_SCREEN - of org.dvb.media.VideoPresentationControl 448
 POS_CAP_FULL_IF_ENTIRE_VIDEO_ON_SCREEN - of org.dvb.media.VideoPresentationControl 449
 POS_CAP_OTHER - of org.dvb.media.VideoPresentationControl 449
 postMonitoringEvent(SIMonitoringEvent) - of org.dvb.si.SIMonitoringListener 380
 postRetrievalEvent(SIRetrievalEvent) - of org.dvb.si.SIRetrievalListener 392
 Preference - of org.dvb.user 320
 Preference() - of org.dvb.user.Preference 320
 Preference(String, String) - of org.dvb.user.Preference 320
 Preference(String, String[]) - of org.dvb.user.Preference 320
 PREFERRED - of org.havi.ui.HSceneTemplate 877
 PREFERRED - of org.havi.ui.HScreenConfigTemplate 886
 PREFERRED_NOT - of org.havi.ui.HScreenConfigTemplate 887
 prefetch() - of org.dvb.application.DVBHTMLProxy 579
 prefetch(DSMCCObject, String, byte) - of org.dvb.dsmcc.DSMCCObject 473
 prefetch(String, byte) - of org.dvb.dsmcc.DSMCCObject 474
 PRESENT_FOLLOWING_EVENT - of org.dvb.si.SIMonitoringType 381
 PresentationChangedEvent - of org.dvb.media 429
 PresentationChangedEvent(Controller, MediaLocator, int) - of org.dvb.media.PresentationChangedEvent 430
 PRIORITY_HIGH - of org.dvb.io.persistent.FileAttributes 313
 PRIORITY_LOW - of org.dvb.io.persistent.FileAttributes 313
 PRIORITY_MEDIUM - of org.dvb.io.persistent.FileAttributes 313
 PRIVATE_DATA_SPECIFIER - of org.dvb.si.DescriptorTag 337
 PRIVATE_USE_AREA - of org.havi.ui.HFontCapabilities 731
 processEvent(AWTEvent) - of org.havi.ui.HComponent 684
 processHActionEvent(HActionEvent) - of org.havi.ui.HActionInputPreferred 643
 processHActionEvent(HActionEvent) - of org.havi.ui.HGraphicButton 739
 processHActionEvent(HActionEvent) - of org.havi.ui.HTextButton 967
 processHActionEvent(HActionEvent) - of org.havi.ui.HToggleButton 987
 processHAdjustmentEvent(HAdjustmentEvent) - of org.havi.ui.HAdjustmentInputPreferred 647
 processHAdjustmentEvent(HAdjustmentEvent) - of org.havi.ui.HRangeValue 855
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HAnimation 666
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HGraphicButton 739
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HIcon 764
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HListGroup 794
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HNavigationInputPreferred 832
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HRange 842
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HRangeValue 855
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HSinglelineEntry 913
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HText 960
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HTextButton 967
 processHFocusEvent(HFocusEvent) - of org.havi.ui.HToggleButton 988
 processHItemEvent(HItemEvent) - of org.havi.ui.HListGroup 794
 processHItemEvent(HItemEvent) - of org.havi.ui.HSelectionInputPreferred 904
 processHKeyEvent(HKeyEvent) - of org.havi.ui.HKeyboardInputPreferred 782
 processHKeyEvent(HKeyEvent) - of org.havi.ui.HSinglelineEntry 913
 processHTextEvent(HTextEvent) - of org.havi.ui.HKeyboardInputPreferred 782
 processHTextEvent(HTextEvent) - of org.havi.ui.HSinglelineEntry 913
 processWindowEvent(WindowEvent) - of org.havi.ui.HScene 868
 prompt(String, int, String) - of org.dvb.test.DVBTest 1097
 push(Component) - of org.havi.ui.HComponentOrdering 687
 push(Component) - of org.havi.ui.HContainer 695
 push(Component) - of org.havi.ui.HScene 868
 pushBehind(Component, Component) - of org.havi.ui.HComponentOrdering 687

pushBehind(Component, Component) - of org.havi.ui.HContainer 696
 pushBehind(Component, Component) - of org.havi.ui.HScene 869
 pushToBack(Component) - of org.havi.ui.HComponentOrdering 687
 pushToBack(Component) - of org.havi.ui.HContainer 696
 pushToBack(Component) - of org.havi.ui.HScene 869

R

RC_FIRST - of org.havi.ui.event.HRcEvent 1069
 RC_LAST - of org.havi.ui.event.HRcEvent 1069
 RCInterface - of org.dvb.net.rc 542
 RCInterfaceManager - of org.dvb.net.rc 544
 RCInterfaceReleasedEvent - of org.dvb.net.rc 546
 RCInterfaceReleasedEvent(Object) - of org.dvb.net.rc.RCInterfaceReleasedEvent 546
 RCInterfaceReservedEvent - of org.dvb.net.rc 547
 RCInterfaceReservedEvent(Object) - of org.dvb.net.rc.RCInterfaceReservedEvent 547
 RCPermission - of org.dvb.net.rc 548
 RCPermission(String) - of org.dvb.net.rc.RCPermission 548
 RCPermission(String, String) - of org.dvb.net.rc.RCPermission 549
 read(Preference) - of org.dvb.user.UserPreferenceManager 326
 read(Preference, Facility) - of org.dvb.user.UserPreferenceManager 326
 rebind(XletContext, String, Remote) - of org.dvb.io.ixc.IxcRegistry 1104
 receiveEvent(AsynchronousLoadingEvent) - of org.dvb.dsmcc.AsynchronousLoadingEventListener 468
 receiveNPTStatusEvent(NPTStatusEvent) - of org.dvb.dsmcc.NPTListener 499
 receiveObjectChangeEvent(ObjectChangeEvent) - of org.dvb.dsmcc.ObjectChangeEventListener 507
 receiveRateChangedEvent(NPTRateChangeEvent) - of org.dvb.dsmcc.NPTListener 499
 receiveStreamEvent(StreamEvent) - of org.dvb.dsmcc.StreamEventListener 521
 receiveUserPreferenceChangeEvent(UserPreferenceChangeEvent) - of org.dvb.user.UserPreferenceChangeListener 325
 receiveVideoFormatEvent(VideoFormatEvent) - of org.dvb.media.VideoFormatListener 447
 release() - of org.dvb.net.rc.ConnectionRCInterface 537
 releaseDevice() - of org.havi.ui.HScreenDevice 895
 remove(EventListener) - of org.havi.ui.HEventMulticaster 710
 remove(HActionListener, HActionListener) - of org.havi.ui.HEventMulticaster 710
 remove(HAdjustmentListener, HAdjustmentListener) - of org.havi.ui.HEventMulticaster 710
 remove(HBackgroundImageListener, HBackgroundImageListener) - of org.havi.ui.HEventMulticaster 711
 remove(HFocusListener, HFocusListener) - of org.havi.ui.HEventMulticaster 711
 remove(HItemListener, HItemListener) - of org.havi.ui.HEventMulticaster 711
 remove(HKeyListener, HKeyListener) - of org.havi.ui.HEventMulticaster 711
 remove(HScreenConfigurationListener, HScreenConfigurationListener) - of org.havi.ui.HEventMulticaster 711
 remove(HScreenLocationModifiedListener, HScreenLocationModifiedListener) - of org.havi.ui.HEventMulticaster 712
 remove(HTextListener, HTextListener) - of org.havi.ui.HEventMulticaster 712
 remove(HToggleButton) - of org.havi.ui.HToggleGroup 994
 remove(ResourceStatusListener, ResourceStatusListener) - of org.havi.ui.HEventMulticaster 712
 remove(String) - of org.dvb.user.Preference 322
 remove(WindowListener, WindowListener) - of org.havi.ui.HEventMulticaster 712
 removeAdjustmentListener(HAdjustmentListener) - of org.havi.ui.HAdjustmentValue 651
 removeAdjustmentListener(HAdjustmentListener) - of org.havi.ui.HRangeValue 855
 removeAll() - of org.dvb.user.Preference 322
 removeAllArrowKeys() - of org.dvb.event.UserEventRepository 307
 removeAllColourKeys() - of org.dvb.event.UserEventRepository 308
 removeAllItems() - of org.havi.ui.HListGroup 794
 removeAllNumericKeys() - of org.dvb.event.UserEventRepository 308

removeAppStateChangeListener(AppStateChangeListener) - of org.dvb.application.AppProxy 561
 removeBouquetMonitoringListener(SIMonitoringListener, int) - of org.dvb.si.SIDatabase 352
 removeConnectionListener(ConnectionListener) - of org.dvb.net.rc.ConnectionRCInterface 537
 removeEventPresentFollowingMonitoringListener(SIMonitoringListener, int, int, int) - of org.dvb.si.SIDatabase 352
 removeEventScheduleMonitoringListener(SIMonitoringListener, int, int, int) - of org.dvb.si.SIDatabase 352
 removeExclusiveAccessToAWTEvent(ResourceClient) - of org.dvb.event.EventManager 299
 removeHActionListener(HActionListener) - of org.havi.ui.HActionable 641
 removeHActionListener(HActionListener) - of org.havi.ui.HGraphicButton 739
 removeHActionListener(HActionListener) - of org.havi.ui.HTextButton 968
 removeHActionListener(HActionListener) - of org.havi.ui.HToggleButton 988
 removeInternal(EventListener, EventListener) - of org.havi.ui.HEventMulticaster 712
 removeItem(int) - of org.havi.ui.HListGroup 794
 removeItemListener(HItemListener) - of org.havi.ui.HItemValue 779
 removeItemListener(HItemListener) - of org.havi.ui.HListGroup 795
 removeKey(int) - of org.dvb.event.UserEventRepository 308
 removeListener(AppsDatabaseEventListener) - of org.dvb.application.AppsDatabase 569
 removeNetworkMonitoringListener(SIMonitoringListener, int) - of org.dvb.si.SIDatabase 353
 removeNPTListener(NPTListener) - of org.dvb.dsmcc.DSMCCStream 479
 removeObjectChangeEventListeners(ObjectChangeListener) - of org.dvb.dsmcc.DSMCCObject 474
 removeOnScreenLocationModifiedListener(HScreenLocationModifiedListener) - of org.havi.ui.HVideoComponent 1001
 removePMTServiceMonitoringListener(SIMonitoringListener, int, int, int) - of org.dvb.si.SIDatabase 353
 removeResourceStatusEventListener(ResourceStatusListener) - of org.dvb.event.EventManager 299
 removeResourceStatusEventListener(ResourceStatusListener) - of org.dvb.net.rc.RCInterfaceManager 545
 removeResourceStatusEventListener(ResourceStatusListener) - of org.havi.ui.HScreenDevice 895
 removeScreenConfigurationListener(HScreenConfigurationListener) - of org.havi.ui.HScreenDevice 895
 removeServiceMonitoringListener(SIMonitoringListener, int, int) - of org.dvb.si.SIDatabase 353
 removeShortcut(int) - of org.havi.ui.HScene 869
 removeSubtitleListener(SubtitleListener) - of org.dvb.media.SubtitlingEventControl 440
 removeTextOverflowListener(TextOverflowListener) - of org.dvb.ui.DVBTextLayoutManager 619
 removeToggleGroup() - of org.havi.ui.HToggleButton 988
 removeUserEvent(UserEvent) - of org.dvb.event.UserEventRepository 308
 removeUserEventListener(UserEventListener) - of org.dvb.event.EventManager 299
 removeUserPreferenceChangeListener(UserPreferenceChangeListener) - of org.dvb.user.UserPreferenceManager 327
 removeVideoFormatListener(VideoFormatListener) - of org.dvb.media.VideoFormatControl 445
 removeWindowListener(WindowListener) - of org.havi.ui.HScene 869
 render(String, Graphics, HVisible, Insets) - of org.dvb.ui.DVBTextLayoutManager 619
 render(String, Graphics, HVisible, Insets) - of org.havi.ui.HDefaultTextLayoutManager 699
 render(String, Graphics, HVisible, Insets) - of org.havi.ui.HTextLayoutManager 973
 REPEAT_INFINITE - of org.havi.ui.HAnimateEffect 654
 report(HScreenConfigurationEvent) - of org.havi.ui.event.HScreenConfigurationListener 1078
 report(HScreenConfigurationEvent) - of org.havi.ui.HEventMulticaster 713
 report(HScreenLocationModifiedEvent) - of org.havi.ui.event.HScreenLocationModifiedListener 1083
 report(HScreenLocationModifiedEvent) - of org.havi.ui.HEventMulticaster 713
 RepositoryDescriptor - of org.dvb.event 301
 REQUIRED - of org.havi.ui.HSceneTemplate 877
 REQUIRED - of org.havi.ui.HScreenConfigTemplate 887
 REQUIRED_NOT - of org.havi.ui.HScreenConfigTemplate 887
 reserve(ResourceClient, Object) - of org.dvb.net.rc.ConnectionRCInterface 537
 reserveDevice(ResourceClient) - of org.havi.ui.HScreenDevice 896
 RESIZE_ARBITRARY - of org.havi.ui.HVisible 1022
 RESIZE_NONE - of org.havi.ui.HVisible 1022

RESIZE_PRESERVE_ASPECT - of org.havi.ui.HVisible 1022
 resizeScene(HScene, HSceneTemplate) - of org.havi.ui.HSceneFactory 875
 resume() - of org.dvb.application.AppProxy 562
 retrieveActualSINetwork(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIDatabase 354
 retrieveActualSIServices(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIDatabase 354
 retrieveActualSITransportStream(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIDatabase 355
 retrieveDescriptors(short, Object, SIRetrievalListener) - of org.dvb.si.SIBouquet 345
 retrieveDescriptors(short, Object, SIRetrievalListener) - of org.dvb.si.SIInformation 372
 retrieveDescriptors(short, Object, SIRetrievalListener) - of org.dvb.si.SINetwork 383
 retrieveDescriptors(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIBouquet 346
 retrieveDescriptors(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIInformation 372
 retrieveDescriptors(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SINetwork 383
 retrieveFollowingSIEvent(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIService 396
 retrievePMTElementaryStreams(short, Object, SIRetrievalListener, DvbLocator, short[]) - of org.dvb.si.SIDatabase 356
 retrievePMTElementaryStreams(short, Object, SIRetrievalListener, int, int, short[]) - of org.dvb.si.SIDatabase 356
 retrievePMTElementaryStreams(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.PMTService 342
 retrievePMTService(short, Object, SIRetrievalListener, DvbLocator, short[]) - of org.dvb.si.SIDatabase 357
 retrievePMTService(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIService 397
 retrievePMTServices(short, Object, SIRetrievalListener, int, short[]) - of org.dvb.si.SIDatabase 358
 retrievePresentSIEvent(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIService 398
 retrieveScheduledSIEvents(short, Object, SIRetrievalListener, short[], Date, Date) - of org.dvb.si.SIService 398
 retrieveSIBouquets(short, Object, SIRetrievalListener, int, short[]) - of org.dvb.si.SIDatabase 359
 retrieveSIBouquetTransportStreams(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIBouquet 346
 retrieveSINetworks(short, Object, SIRetrievalListener, int, short[]) - of org.dvb.si.SIDatabase 359
 retrieveSIService(short, Object, SIRetrievalListener, DvbLocator, short[]) - of org.dvb.si.SIDatabase 360
 retrieveSIService(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIEvent 366
 retrieveSIServices(short, Object, SIRetrievalListener, int, int, int, short[]) - of org.dvb.si.SIDatabase 361
 retrieveSIServices(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SITransportStream 407
 retrieveSITimeFromTDT(short, Object, SIRetrievalListener) - of org.dvb.si.SIDatabase 362
 retrieveSITimeFromTOT(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIDatabase 362
 retrieveSITransportStreamDescription(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SIDatabase 363
 retrieveSITransportStreams(short, Object, SIRetrievalListener, short[]) - of org.dvb.si.SINetwork 384
 RUNNING - of org.dvb.si.SIRunningStatus 393

S

SATELLITE_DELIVERY_SYSTEM - of org.dvb.si.DescriptorTag 337
 SCENE_PIXEL_DIMENSION - of org.havi.ui.HSceneTemplate 877
 SCENE_PIXEL_LOCATION - of org.havi.ui.HSceneTemplate 878
 SCENE_SCREEN_DIMENSION - of org.havi.ui.HSceneTemplate 878
 SCENE_SCREEN_LOCATION - of org.havi.ui.HSceneTemplate 878
 SCHEDULED_EVENT - of org.dvb.si.SIMonitoringType 381
 SCREEN_RECTANGLE - of org.havi.ui.HScreenConfigTemplate 887
 SCROLLBAR_BEHAVIOR - of org.havi.ui.HStaticRange 941
 SECAM - of org.dvb.si.SIServiceType 401
 selectionChanged(HItemEvent) - of org.havi.ui.event.HItemListener 1059
 selectionChanged(HItemEvent) - of org.havi.ui.HEventMulticaster 713
 ServerDeliveryErrorEvent - of org.dvb.dsmcc 508
 ServerDeliveryErrorEvent(DSMCCObject) - of org.dvb.dsmcc.ServerDeliveryErrorEvent 508
 ServerDeliveryException - of org.dvb.dsmcc 509
 ServerDeliveryException() - of org.dvb.dsmcc.ServerDeliveryException 509

ServerDeliveryException(String) - of org.dvb.dsmcc.ServerDeliveryException 509
 SERVICE - of org.dvb.si.DescriptorTag 337
 SERVICE - of org.dvb.si.SIMonitoringType 381
 SERVICE_LIST - of org.dvb.si.DescriptorTag 337
 SERVICE_MOVE - of org.dvb.si.DescriptorTag 337
 ServiceDomain - of org.dvb.dsmcc 510
 ServiceDomain() - of org.dvb.dsmcc.ServiceDomain 510
 ServiceRemovedEvent - of org.dvb.media 431
 ServiceRemovedEvent(Controller) - of org.dvb.media.ServiceRemovedEvent 431
 ServiceRemovedEvent(Controller, MediaLocator) - of org.dvb.media.ServiceRemovedEvent 431
 ServiceXFRErrorEvent - of org.dvb.dsmcc 514
 ServiceXFRErrorEvent(DSMCCObject, ServiceXFRReference) - of org.dvb.dsmcc.ServiceXFRErrorEvent 514
 ServiceXFRException - of org.dvb.dsmcc 515
 ServiceXFRException(byte[], String) - of org.dvb.dsmcc.ServiceXFRException 515
 ServiceXFRException(Locator, int, String) - of org.dvb.dsmcc.ServiceXFRException 515
 ServiceXFRReference - of org.dvb.dsmcc 517
 ServiceXFRReference(byte[], String) - of org.dvb.dsmcc.ServiceXFRReference 517
 ServiceXFRReference(Locator, int, String) - of org.dvb.dsmcc.ServiceXFRReference 517
 set(byte[]) - of org.havi.ui.HSound 925
 setActionCommand(String) - of org.havi.ui.HActionable 641
 setActionCommand(String) - of org.havi.ui.HGraphicButton 739
 setActionCommand(String) - of org.havi.ui.HTextButton 968
 setActionCommand(String) - of org.havi.ui.HToggleButton 988
 setActionSound(HSound) - of org.havi.ui.HActionable 642
 setActionSound(HSound) - of org.havi.ui.HGraphicButton 740
 setActionSound(HSound) - of org.havi.ui.HTextButton 968
 setActionSound(HSound) - of org.havi.ui.HToggleButton 989
 setAdjustmentSound(HSound) - of org.havi.ui.HAdjustmentValue 651
 setAdjustmentSound(HSound) - of org.havi.ui.HRangeValue 855
 setAdjustMode(boolean) - of org.havi.ui.HAdjustmentInputPreferred 648
 setAdjustMode(boolean) - of org.havi.ui.HRangeValue 856
 setAnimateContent(Image[], int) - of org.havi.ui.HVisible 1029
 setBackgroundConfiguration(HBackgroundConfiguration) - of org.havi.ui.HBackgroundDevice 676
 setBackgroundImage(Image) - of org.havi.ui.HScene 870
 setBackgroundMode(int) - of org.havi.ui.HScene 870
 setBackgroundMode(int) - of org.havi.ui.HVisible 1029
 setBehavior(int) - of org.havi.ui.HStaticRange 943
 setBlockIncrement(int) - of org.havi.ui.HAdjustmentValue 651
 setBlockIncrement(int) - of org.havi.ui.HRangeValue 856
 setCaretCharPosition(int) - of org.havi.ui.HSinglelineEntry 914
 setClipRegion(Rectangle) - of org.dvb.media.VideoPresentationControl 451
 setClipRegion(Rectangle) - of org.dvb.media.VideoTransformation 454
 setCoherentScreenConfigurations(HScreenConfiguration[]) - of org.havi.ui.HScreen 884
 setColor(Color) - of org.dvb.ui.DVBGraphics 612
 setColor(Color) - of org.havi.ui.event.HEventRepresentation 1050
 setColor(Color) - of org.havi.ui.HBackgroundConfiguration 673
 setColor(Color) - of org.havi.ui.HStillImageBackgroundConfiguration 951
 setContent(Object, int) - of org.havi.ui.HVisible 1029
 setCurrent(HToggleButton) - of org.havi.ui.HToggleGroup 994
 setCurrentItem(int) - of org.havi.ui.HListGroup 795
 setDefaultLook(HAnimateLook) - of org.havi.ui.HAnimation 666
 setDefaultLook(HAnimateLook) - of org.havi.ui.HStaticAnimation 933
 setDefaultLook(HGraphicLook) - of org.havi.ui.HGraphicButton 740
 setDefaultLook(HGraphicLook) - of org.havi.ui.HIcon 765

setDefaultLook(HGraphicLook) - of org.havi.ui.HStaticIcon 938
setDefaultLook(HGraphicLook) - of org.havi.ui.HToggleButton 989
setDefaultLook(HListGroupLook) - of org.havi.ui.HListGroup 795
setDefaultLook(HMultilineEntryLook) - of org.havi.ui.HMultilineEntry 819
setDefaultLook(HRangeLook) - of org.havi.ui.HRange 842
setDefaultLook(HRangeLook) - of org.havi.ui.HRangeValue 856
setDefaultLook(HRangeLook) - of org.havi.ui.HStaticRange 943
setDefaultLook(HSinglelineEntryLook) - of org.havi.ui.HSinglelineEntry 914
setDefaultLook(HTextLook) - of org.havi.ui.HStaticText 948
setDefaultLook(HTextLook) - of org.havi.ui.HText 960
setDefaultLook(HTextLook) - of org.havi.ui.HTextButton 968
setDefaultSize(Dimension) - of org.havi.ui.HVisible 1029
setDelay(int) - of org.havi.ui.HAnimateEffect 655
setDelay(int) - of org.havi.ui.HFlatEffectMatte 718
setDelay(int) - of org.havi.ui.HImageEffectMatte 769
setDelay(int) - of org.havi.ui.HStaticAnimation 934
setDVBComposite(DVBAlphaComposite) - of org.dvb.ui.DVBGraphics 612
setEchoChar(char) - of org.havi.ui.HSinglelineEntry 914
setEditMode(boolean) - of org.havi.ui.HKeyboardInputPreferred 782
setEditMode(boolean) - of org.havi.ui.HSinglelineEntry 914
setEnabled(boolean) - of org.havi.ui.HToggleGroup 994
setExpirationDate(Date) - of org.dvb.io.persistent.FileAttributes 314
setFileAttributes(FileAttributes, File) - of org.dvb.io.persistent.FileAttributes 314
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HAnimation 666
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HGraphicButton 740
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HIcon 765
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HListGroup 796
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HNavigable 828
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HRange 842
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HRangeValue 856
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HSinglelineEntry 914
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HText 960
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HTextButton 968
setFocusTraversal(HNavigable, HNavigable, HNavigable, HNavigable) - of org.havi.ui.HToggleButton 989
setForcedSelection(boolean) - of org.havi.ui.HToggleGroup 995
setGainFocusSound(HSound) - of org.havi.ui.HAnimation 667
setGainFocusSound(HSound) - of org.havi.ui.HGraphicButton 741
setGainFocusSound(HSound) - of org.havi.ui.HIcon 765
setGainFocusSound(HSound) - of org.havi.ui.HListGroup 796
setGainFocusSound(HSound) - of org.havi.ui.HNavigable 829
setGainFocusSound(HSound) - of org.havi.ui.HRange 843
setGainFocusSound(HSound) - of org.havi.ui.HRangeValue 857
setGainFocusSound(HSound) - of org.havi.ui.HSinglelineEntry 915
setGainFocusSound(HSound) - of org.havi.ui.HText 960
setGainFocusSound(HSound) - of org.havi.ui.HTextButton 969
setGainFocusSound(HSound) - of org.havi.ui.HToggleButton 990
setGraphicContent(Image, int) - of org.havi.ui.HVisible 1030
setGraphicsConfiguration(HEmulatedGraphicsConfiguration) - of org.havi.ui.HEmulatedGraphicsDevice 703
setGraphicsConfiguration(HGraphicsConfiguration) - of org.havi.ui.HGraphicsDevice 760
setHorizontalAlign(int) - of org.dvb.ui.DVBTextLayoutManager 619
setHorizontalAlignment(int) - of org.havi.ui.HVisible 1030
setHorizontalTabSpacing(int) - of org.dvb.ui.DVBTextLayoutManager 620
setIcon(Image) - of org.havi.ui.HListElement 784
setIconSize(Dimension) - of org.havi.ui.HListGroup 796
setInsets(Insets) - of org.dvb.ui.DVBTextLayoutManager 620

setInteractionState(int) - of org.havi.ui.HVisible 1030
 setItemSelected(int, boolean) - of org.havi.ui.HListGroup 797
 setLabel(String) - of org.havi.ui.HListElement 784
 setLabelSize(Dimension) - of org.havi.ui.HListGroup 797
 setLetterSpace(int) - of org.dvb.ui.DVBTextLayoutManager 620
 setLineOrientation(int) - of org.dvb.ui.DVBTextLayoutManager 620
 setLineSpace(int) - of org.dvb.ui.DVBTextLayoutManager 620
 setListContent(HListElement[]) - of org.havi.ui.HListGroup 797
 setLocation(float, float) - of org.havi.ui.HScreenPoint 900
 setLocation(float, float) - of org.havi.ui.HScreenRectangle 902
 setLook(HLook) - of org.havi.ui.HListGroup 797
 setLook(HLook) - of org.havi.ui.HMultilineEntry 819
 setLook(HLook) - of org.havi.ui.HSinglelineEntry 915
 setLook(HLook) - of org.havi.ui.HStaticAnimation 934
 setLook(HLook) - of org.havi.ui.HStaticIcon 938
 setLook(HLook) - of org.havi.ui.HStaticRange 943
 setLook(HLook) - of org.havi.ui.HStaticText 948
 setLook(HLook) - of org.havi.ui.HVisible 1031
 setLookData(Object, Object) - of org.havi.ui.HVisible 1031
 setLoseFocusSound(HSound) - of org.havi.ui.HAnimation 667
 setLoseFocusSound(HSound) - of org.havi.ui.HGraphicButton 741
 setLoseFocusSound(HSound) - of org.havi.ui.HIcon 766
 setLoseFocusSound(HSound) - of org.havi.ui.HListGroup 798
 setLoseFocusSound(HSound) - of org.havi.ui.HNavigable 829
 setLoseFocusSound(HSound) - of org.havi.ui.HRange 843
 setLoseFocusSound(HSound) - of org.havi.ui.HRangeValue 857
 setLoseFocusSound(HSound) - of org.havi.ui.HSinglelineEntry 916
 setLoseFocusSound(HSound) - of org.havi.ui.HText 961
 setLoseFocusSound(HSound) - of org.havi.ui.HTextButton 969
 setLoseFocusSound(HSound) - of org.havi.ui.HToggleButton 990
 setMatte(HMatte) - of org.havi.ui.HComponent 684
 setMatte(HMatte) - of org.havi.ui.HContainer 696
 setMatte(HMatte) - of org.havi.ui.HMatteLayer 815
 setMatteData(float) - of org.havi.ui.HFlatMatte 722
 setMatteData(float[]) - of org.havi.ui.HFlatEffectMatte 718
 setMatteData(Image) - of org.havi.ui.HImageMatte 775
 setMatteData(Image[]) - of org.havi.ui.HImageEffectMatte 770
 setMaxCharsPerLine(int) - of org.havi.ui.HSinglelineEntry 916
 setMostFavourite(String) - of org.dvb.user.Preference 322
 setMove(int, HNavigable) - of org.havi.ui.HAnimation 668
 setMove(int, HNavigable) - of org.havi.ui.HGraphicButton 741
 setMove(int, HNavigable) - of org.havi.ui.HIcon 766
 setMove(int, HNavigable) - of org.havi.ui.HListGroup 798
 setMove(int, HNavigable) - of org.havi.ui.HNavigable 829
 setMove(int, HNavigable) - of org.havi.ui.HRange 843
 setMove(int, HNavigable) - of org.havi.ui.HRangeValue 858
 setMove(int, HNavigable) - of org.havi.ui.HSinglelineEntry 916
 setMove(int, HNavigable) - of org.havi.ui.HText 961
 setMove(int, HNavigable) - of org.havi.ui.HTextButton 970
 setMove(int, HNavigable) - of org.havi.ui.HToggleButton 990
 setMultiSelection(boolean) - of org.havi.ui.HListGroup 798
 setOffset(Point) - of org.havi.ui.HImageMatte 775
 setOffset(Point, int) - of org.havi.ui.HImageEffectMatte 770
 setOrientation(int) - of org.havi.ui.HListGroup 798
 setOrientation(int) - of org.havi.ui.HOrientable 835

setOrientation(int) - of org.havi.ui.HStaticRange 943
 setPermissions(boolean, boolean, boolean, boolean, boolean, boolean) - of org.dvb.io.persistent.FileAccessPermissions 312
 setPermissions(FileAccessPermissions) - of org.dvb.io.persistent.FileAttributes 315
 setPlayMode(int) - of org.havi.ui.HAnimateEffect 655
 setPlayMode(int) - of org.havi.ui.HFlatEffectMatte 719
 setPlayMode(int) - of org.havi.ui.HImageEffectMatte 770
 setPlayMode(int) - of org.havi.ui.HStaticAnimation 934
 setPosition(int) - of org.havi.ui.HAnimateEffect 655
 setPosition(int) - of org.havi.ui.HFlatEffectMatte 719
 setPosition(int) - of org.havi.ui.HImageEffectMatte 770
 setPosition(int) - of org.havi.ui.HStaticAnimation 934
 setPreference(int, int) - of org.havi.ui.HBackgroundConfigTemplate 671
 setPreference(int, int) - of org.havi.ui.HGraphicsConfigTemplate 750
 setPreference(int, int) - of org.havi.ui.HScreenConfigTemplate 890
 setPreference(int, Object, int) - of org.havi.ui.HGraphicsConfigTemplate 751
 setPreference(int, Object, int) - of org.havi.ui.HSceneTemplate 879
 setPreference(int, Object, int) - of org.havi.ui.HScreenConfigTemplate 890
 setPreference(int, Object, int) - of org.havi.ui.HVideoConfigTemplate 1004
 setPriority(int) - of org.dvb.io.persistent.FileAttributes 315
 setRange(int, int) - of org.havi.ui.HStaticRange 944
 setReceiveBufferSize(DatagramSocket, int) - of org.dvb.net.DatagramSocketBufferControl 526
 setRenderMode(int) - of org.havi.ui.HScene 870
 setRepeatCount(int) - of org.havi.ui.HAnimateEffect 655
 setRepeatCount(int) - of org.havi.ui.HFlatEffectMatte 719
 setRepeatCount(int) - of org.havi.ui.HImageEffectMatte 771
 setRepeatCount(int) - of org.havi.ui.HStaticAnimation 935
 setResizeMode(int) - of org.havi.ui.HVisible 1031
 setRetrievalMode(int) - of org.dvb.dsmcc.DSMCCObject 474
 setRGB(int, int, int) - of org.dvb.ui.DVBBufferedImage 604
 setRGB(int, int, int, int, int[], int, int) - of org.dvb.ui.DVBBufferedImage 604
 setScalingFactors(float, float) - of org.dvb.media.VideoTransformation 454
 setScrollPosition(int) - of org.havi.ui.HListGroup 799
 setSelectionMode(boolean) - of org.havi.ui.HListGroup 799
 setSelectionMode(boolean) - of org.havi.ui.HSelectionInputPreferred 904
 setSelectionSound(HSound) - of org.havi.ui.HItemValue 779
 setSelectionSound(HSound) - of org.havi.ui.HListGroup 799
 setSize(float, float) - of org.havi.ui.HScreenDimension 898
 setSize(float, float) - of org.havi.ui.HScreenRectangle 903
 setStartCorner(int) - of org.dvb.ui.DVBTextLayoutManager 620
 setString(String) - of org.havi.ui.event.HEventRepresentation 1050
 setSwitchableState(boolean) - of org.havi.ui.HSwitchable 954
 setSwitchableState(boolean) - of org.havi.ui.HToggleButton 991
 setSymbol(Image) - of org.havi.ui.event.HEventRepresentation 1050
 setTarget(ConnectionParameters) - of org.dvb.net.rc.ConnectionRCInterface 537
 setTargetToDefault() - of org.dvb.net.rc.ConnectionRCInterface 537
 setTextContent(String, int) - of org.havi.ui.HSinglelineEntry 916
 setTextContent(String, int) - of org.havi.ui.HVisible 1031
 setTextLayoutManager(HTextLayoutManager) - of org.havi.ui.HVisible 1032
 setTextWrapping(boolean) - of org.dvb.ui.DVBTextLayoutManager 620
 setThumbOffsets(int, int) - of org.havi.ui.HStaticRange 944
 setToggleGroup(HToggleButton) - of org.havi.ui.HToggleButton 991
 setType(int) - of org.havi.ui.event.HEventRepresentation 1051
 setType(int) - of org.havi.ui.HImageHints 773
 setType(int) - of org.havi.ui.HSinglelineEntry 917

setUnitIncrement(int) - of org.havi.ui.HAdjustmentValue 652
 setUnitIncrement(int) - of org.havi.ui.HRangeValue 858
 setUnsetActionSound(HSound) - of org.havi.ui.HSwitchable 954
 setUnsetActionSound(HSound) - of org.havi.ui.HToggleButton 991
 setValidInput(char[]) - of org.havi.ui.HSinglelineEntry 917
 setValue(int) - of org.havi.ui.HStaticRange 944
 setVerticalAlign(int) - of org.dvb.ui.DVBTextLayoutManager 621
 setVerticalAlignment(int) - of org.havi.ui.HVisible 1032
 setVideoConfiguration(HVideoConfiguration) - of org.havi.ui.HVideoDevice 1010
 setVideoPosition(HScreenPoint) - of org.dvb.media.VideoTransformation 455
 setVideoTransformation(VideoTransformation) - of org.dvb.media.BackgroundVideoPresentationControl 418
 setVisible(boolean) - of org.havi.ui.HScene 871
 SHORT_EVENT - of org.dvb.si.DescriptorTag 338
 SHORT_SMOOTHING_BUFFER - of org.dvb.si.DescriptorTag 338
 show() - of org.havi.ui.HScene 871
 showLook(Graphics, HVisible, int) - of org.havi.ui.HAnimateLook 660
 showLook(Graphics, HVisible, int) - of org.havi.ui.HGraphicLook 746
 showLook(Graphics, HVisible, int) - of org.havi.ui.HListGroupLook 804
 showLook(Graphics, HVisible, int) - of org.havi.ui.HLook 810
 showLook(Graphics, HVisible, int) - of org.havi.ui.HMultilineEntryLook 824
 showLook(Graphics, HVisible, int) - of org.havi.ui.HRangeLook 848
 showLook(Graphics, HVisible, int) - of org.havi.ui.HSinglelineEntryLook 921
 showLook(Graphics, HVisible, int) - of org.havi.ui.HTextLook 977
 SIBouquet - of org.dvb.si 344
 SIDatabase - of org.dvb.si 348
 SIEvent - of org.dvb.si 364
 SIException - of org.dvb.si 368
 SIException() - of org.dvb.si.SIException 368
 SIException(String) - of org.dvb.si.SIException 368
 SIIllegalArgumentException - of org.dvb.si 369
 SIIllegalArgumentException() - of org.dvb.si.SIIllegalArgumentException 369
 SIIllegalArgumentException(String) - of org.dvb.si.SIIllegalArgumentException 369
 SIInformation - of org.dvb.si 370
 SIInvalidPeriodException - of org.dvb.si 374
 SIInvalidPeriodException() - of org.dvb.si.SIInvalidPeriodException 374
 SIInvalidPeriodException(String) - of org.dvb.si.SIInvalidPeriodException 374
 SIIterator - of org.dvb.si 375
 SILackOfResourcesEvent - of org.dvb.si 376
 SILackOfResourcesEvent(Object, SIRequest) - of org.dvb.si.SILackOfResourcesEvent 376
 SIMonitoringEvent - of org.dvb.si 377
 SIMonitoringEvent(SIDatabase, byte, int, int, int, int, Date, Date) - of org.dvb.si.SIMonitoringEvent 377
 SIMonitoringListener - of org.dvb.si 380
 SIMonitoringType - of org.dvb.si 381
 SINetwork - of org.dvb.si 382
 SINotInCacheEvent - of org.dvb.si 386
 SINotInCacheEvent(Object, SIRequest) - of org.dvb.si.SINotInCacheEvent 386
 SIOBJECTNOTINTABLEEVENT - of org.dvb.si 387
 SIOBJECTNOTINTABLEEVENT(Object, SIRequest) - of org.dvb.si.SIOBJECTNOTINTABLEEVENT 387
 SIRequest - of org.dvb.si 388
 SIRequestCancelledEvent - of org.dvb.si 389
 SIRequestCancelledEvent(Object, SIRequest) - of org.dvb.si.SIRequestCancelledEvent 389
 SIRetrievalEvent - of org.dvb.si 390
 SIRetrievalEvent(Object, SIRequest) - of org.dvb.si.SIRetrievalEvent 390
 SIRetrievalListener - of org.dvb.si 392

SIRunningStatus - of org.dvb.si 393
 SIService - of org.dvb.si 394
 SIServiceType - of org.dvb.si 400
 SISuccessfulRetrieveEvent - of org.dvb.si 402
 SISuccessfulRetrieveEvent(Object, SIREquest, SIIterator) - of org.dvb.si.SISuccessfulRetrieveEvent 402
 SITableNotFoundEvent - of org.dvb.si 403
 SITableNotFoundEvent(Object, SIREquest) - of org.dvb.si.SITableNotFoundEvent 403
 SITableUpdatedEvent - of org.dvb.si 404
 SITableUpdatedEvent(Object, SIREquest) - of org.dvb.si.SITableUpdatedEvent 404
 SITime - of org.dvb.si 405
 SITransportStream - of org.dvb.si 406
 SITransportStreamBAT - of org.dvb.si 408
 SITransportStreamDescription - of org.dvb.si 409
 SITransportStreamNIT - of org.dvb.si 410
 SIUtil - of org.dvb.si 411
 size() - of org.dvb.application.AppsDatabase 569
 SLIDER_BEHAVIOR - of org.havi.ui.HStaticRange 941
 SMALL_FORM_VARIANTS - of org.havi.ui.HFontCapabilities 731
 SPACING_MODIFIER_LETTERS - of org.havi.ui.HFontCapabilities 731
 SPECIALS - of org.havi.ui.HFontCapabilities 731
 SRC - of org.dvb.ui.DVBAlphaComposite 596
 Src - of org.dvb.ui.DVBAlphaComposite 596
 SRC_IN - of org.dvb.ui.DVBAlphaComposite 596
 SRC_OUT - of org.dvb.ui.DVBAlphaComposite 596
 SRC_OVER - of org.dvb.ui.DVBAlphaComposite 597
 SrcIn - of org.dvb.ui.DVBAlphaComposite 597
 SrcOut - of org.dvb.ui.DVBAlphaComposite 597
 SrcOver - of org.dvb.ui.DVBAlphaComposite 597
 start() - of org.dvb.application.AppProxy 562
 start() - of org.dvb.media.DripFeedDataSource 425
 start() - of org.havi.ui.HAnimateEffect 656
 start() - of org.havi.ui.HFlatEffectMatte 719
 start() - of org.havi.ui.HImageEffectMatte 771
 start() - of org.havi.ui.HStaticAnimation 935
 start(String[]) - of org.dvb.application.AppProxy 562
 START_CORNER_LOWER_LEFT - of org.dvb.ui.DVBTextLayoutManager 616
 START_CORNER_LOWER_RIGHT - of org.dvb.ui.DVBTextLayoutManager 616
 START_CORNER_UPPER_LEFT - of org.dvb.ui.DVBTextLayoutManager 616
 START_CORNER_UPPER_RIGHT - of org.dvb.ui.DVBTextLayoutManager 616
 STARTED - of org.dvb.application.AppProxy 561
 STARTS_IN_A_FEW_SECONDS - of org.dvb.si.SIRunningStatus 393
 startTrigger(Date) - of org.dvb.application.DVBHTMLProxy 579
 STATE_CHANGE - of org.havi.ui.HVisible 1022
 stateChange(AppStateChangeEvent) - of org.dvb.application.AppStateChangeListener 577
 statusChanged(ResourceStatusEvent) - of org.havi.ui.HEventMulticaster 713
 STILL_IMAGE - of org.havi.ui.HBackgroundConfigTemplate 670
 stop() - of org.dvb.media.DripFeedDataSource 425
 stop() - of org.havi.ui.HAnimateEffect 656
 stop() - of org.havi.ui.HFlatEffectMatte 720
 stop() - of org.havi.ui.HImageEffectMatte 771
 stop() - of org.havi.ui.HSound 925
 stop() - of org.havi.ui.HStaticAnimation 935
 stop(boolean) - of org.dvb.application.AppProxy 563
 StopByResourceLossEvent - of org.dvb.media 433
 StopByResourceLossEvent(Controller) - of org.dvb.media.StopByResourceLossEvent 433

StopByResourceLossEvent(Controller, MediaLocator) - of org.dvb.media.StopByResourceLossEvent 433
 STREAM_IDENTIFIER - of org.dvb.si.DescriptorTag 338
 STREAM_UNAVAILABLE - of org.dvb.media.PresentationChangedEvent 429
 StreamEvent - of org.dvb.dsmcc 519
 StreamEvent(DSMCCStreamEvent, long, String, int, byte[]) - of org.dvb.dsmcc.StreamEvent 519
 StreamEventListener - of org.dvb.dsmcc 521
 STUFFING - of org.dvb.si.DescriptorTag 338
 subscribe(String, StreamEventListener) - of org.dvb.dsmcc.DSMCCStreamEvent 481
 SubtitleAvailableEvent - of org.dvb.media 435
 SubtitleAvailableEvent(SubtitlingLanguageControl) - of org.dvb.media.SubtitleAvailableEvent 435
 SubtitleListener - of org.dvb.media 436
 SubtitleNotAvailableEvent - of org.dvb.media 437
 SubtitleNotAvailableEvent(SubtitlingLanguageControl) - of org.dvb.media.SubtitleNotAvailableEvent 437
 SubtitleNotSelectedEvent - of org.dvb.media 438
 SubtitleNotSelectedEvent(SubtitlingLanguageControl) - of org.dvb.media.SubtitleNotSelectedEvent 438
 SubtitleSelectedEvent - of org.dvb.media 439
 SubtitleSelectedEvent(SubtitlingLanguageControl) - of org.dvb.media.SubtitleSelectedEvent 439
 subtitleStatusChanged(EventObject) - of org.dvb.media.SubtitleListener 436
 SUBTITLING - of org.dvb.si.DescriptorTag 338
 SubtitlingEventControl - of org.dvb.media 440
 SuccessEvent - of org.dvb.dsmcc 522
 SuccessEvent(DSMCCObject) - of org.dvb.dsmcc.SuccessEvent 522
 SUPERSCRIPTS_AND_SUBSCRIPTS - of org.havi.ui.HFontCapabilities 731
 supportsArbitraryHorizontalScaling() - of org.dvb.media.VideoPresentationControl 451
 supportsArbitraryVerticalScaling() - of org.dvb.media.VideoPresentationControl 452
 supportsClipping() - of org.dvb.media.VideoPresentationControl 452
 synchronousLoad() - of org.dvb.dsmcc.DSMCCObject 475

T

TAMIL - of org.havi.ui.HFontCapabilities 731
 TELEPHONE - of org.dvb.si.DescriptorTag 338
 TELETEXT - of org.dvb.si.DescriptorTag 338
 TELETEXT - of org.dvb.si.SIServiceType 401
 TELUGU - of org.havi.ui.HFontCapabilities 731
 terminate(String, int) - of org.dvb.test.DVBTest 1097
 TERRESTRIAL_DELIVERY_SYSTEM - of org.dvb.si.DescriptorTag 338
 TestOpacity - of org.dvb.ui 626
 TEXT_CARET_CHANGE - of org.havi.ui.event.HTextEvent 1085
 TEXT_CHANGE - of org.havi.ui.event.HTextEvent 1086
 TEXT_CONTENT_CHANGE - of org.havi.ui.HVisible 1022
 TEXT_END_CHANGE - of org.havi.ui.event.HTextEvent 1086
 TEXT_FIRST - of org.havi.ui.event.HTextEvent 1086
 TEXT_LAST - of org.havi.ui.event.HTextEvent 1086
 TEXT_START_CHANGE - of org.havi.ui.event.HTextEvent 1086
 TEXT_VALUE_CHANGE - of org.havi.ui.HVisible 1022
 textChanged(HTextEvent) - of org.havi.ui.event.HTextListener 1088
 textChanged(HTextEvent) - of org.havi.ui.HEventMulticaster 713
 TextOverflowListener - of org.dvb.ui 627
 TextualServiceIdentifierQuery - of org.dvb.si 412
 THAI - of org.havi.ui.HFontCapabilities 732
 THUMB_OFFSETS_CHANGE - of org.havi.ui.HVisible 1023
 TIME_SHIFTED_EVENT - of org.dvb.si.DescriptorTag 338
 TIME_SHIFTED_SERVICE - of org.dvb.si.DescriptorTag 338
 toString() - of org.dvb.application.AppID 559

toString() - of org.dvb.ui.DVBBufferedImage 605
 toString() - of org.dvb.ui.DVBColor 609
 toString() - of org.dvb.ui.DVBGraphics 613
 toString() - of org.dvb.user.Preference 322
 trigger(Date, Object) - of org.dvb.application.DVBHTMLProxy 579
 TunerPermission - of org.dvb.net.tuning 591
 TunerPermission(String) - of org.dvb.net.tuning.TunerPermission 591
 TunerPermission(String, String) - of org.dvb.net.tuning.TunerPermission 591
 TYPE_ADVANCED - of org.dvb.ui.DVBBufferedImage 599
 TYPE_BASE - of org.dvb.ui.DVBBufferedImage 599
 TYPE_CATV - of org.dvb.net.rc.RCInterface 542
 TYPE_DECT - of org.dvb.net.rc.RCInterface 542
 TYPE_ISDN - of org.dvb.net.rc.RCInterface 542
 TYPE_LMDS - of org.dvb.net.rc.RCInterface 542
 TYPE_MATV - of org.dvb.net.rc.RCInterface 542
 TYPE_PSTN - of org.dvb.net.rc.RCInterface 543

U

UEF_KEY_EVENT - of org.dvb.event.UserEvent 302
 unbind(XletContext, String) - of org.dvb.io.ixc.IxcRegistry 1104
 UNDEFINED - of org.dvb.si.SIRunningStatus 393
 ungroup() - of org.havi.ui.HContainer 697
 UNKNOWN - of org.dvb.si.SIServiceType 401
 UNKNOWN_CHANGE - of org.havi.ui.HVisible 1023
 UnknownEventException - of org.dvb.dsmcc 523
 UnknownEventException() - of org.dvb.dsmcc.UnknownEventException 523
 UnknownEventException(String) - of org.dvb.dsmcc.UnknownEventException 523
 unload() - of org.dvb.dsmcc.DSMCCObject 475
 UNNECESSARY - of org.havi.ui.HSceneTemplate 878
 UNRESOLVED - of org.dvb.test.DVBTest 1095
 unsubscribe(int, StreamEventListener) - of org.dvb.dsmcc.DSMCCStreamEvent 481
 unsubscribe(String, StreamEventListener) - of org.dvb.dsmcc.DSMCCStreamEvent 482
 UnsupportedDrawingOperationException - of org.dvb.ui 628
 UnsupportedDrawingOperationException(String) - of org.dvb.ui.UnsupportedDrawingOperationException 628
 UnsupportedPreferenceException - of org.dvb.user 323
 UnsupportedPreferenceException() - of org.dvb.user.UnsupportedPreferenceException 323
 UnsupportedPreferenceException(String) - of org.dvb.user.UnsupportedPreferenceException 323
 UNTESTED - of org.dvb.test.DVBTest 1095
 update(Graphics) - of org.havi.ui.HVisible 1032
 UserEvent - of org.dvb.event 302
 UserEvent(Object, int, char) - of org.dvb.event.UserEvent 302
 UserEvent(Object, int, int, int, int) - of org.dvb.event.UserEvent 303
 UserEventListener - of org.dvb.event 305
 userEventReceived(UserEvent) - of org.dvb.event.UserEventListener 305
 UserEventRepository - of org.dvb.event 306
 UserEventRepository(String) - of org.dvb.event.UserEventRepository 306
 UserPreferenceChangeEvent - of org.dvb.user 324
 UserPreferenceChangeEvent(String) - of org.dvb.user.UserPreferenceChangeEvent 324
 UserPreferenceChangeListener - of org.dvb.user 325
 UserPreferenceManager - of org.dvb.user 326
 UserPreferencePermission - of org.dvb.user 328
 UserPreferencePermission(String) - of org.dvb.user.UserPreferencePermission 328
 UserPreferencePermission(String, String) - of org.dvb.user.UserPreferencePermission 328

V

VALIGN_BOTTOM - of org.havi.ui.HVisible 1023
 VALIGN_CENTER - of org.havi.ui.HVisible 1023
 VALIGN_JUSTIFY - of org.havi.ui.HVisible 1023
 VALIGN_TOP - of org.havi.ui.HVisible 1023
 valueChanged(HAdjustmentEvent) - of org.havi.ui.event.HAdjustmentListener 1041
 valueChanged(HAdjustmentEvent) - of org.havi.ui.HEventMulticaster 714
 VERTICAL_CENTER - of org.dvb.ui.DVBTextLayoutManager 616
 VERTICAL_END_ALIGN - of org.dvb.ui.DVBTextLayoutManager 616
 VERTICAL_START_ALIGN - of org.dvb.ui.DVBTextLayoutManager 616
 VIDEO_GRAPHICS_PIXEL_ALIGNED - of org.havi.ui.HScreenConfigTemplate 887
 VIDEO_MIXING - of org.havi.ui.HGraphicsConfigTemplate 749
 VideoFormatControl - of org.dvb.media 441
 VideoFormatEvent - of org.dvb.media 446
 VideoFormatEvent(Object) - of org.dvb.media.VideoFormatEvent 446
 VideoFormatListener - of org.dvb.media 447
 VideoPresentationControl - of org.dvb.media 448
 VideoTransformation - of org.dvb.media 453
 VideoTransformation() - of org.dvb.media.VideoTransformation 453
 VideoTransformation(Rectangle, float, float, HScreenPoint) - of org.dvb.media.VideoTransformation 453
 VK_BALANCE_LEFT - of org.havi.ui.event.HRcEvent 1069
 VK_BALANCE_RIGHT - of org.havi.ui.event.HRcEvent 1069
 VK_BASS_BOOST_DOWN - of org.havi.ui.event.HRcEvent 1069
 VK_BASS_BOOST_UP - of org.havi.ui.event.HRcEvent 1069
 VK_CHANNEL_DOWN - of org.havi.ui.event.HRcEvent 1069
 VK_CHANNEL_UP - of org.havi.ui.event.HRcEvent 1069
 VK_CLEAR_FAVORITE_0 - of org.havi.ui.event.HRcEvent 1069
 VK_CLEAR_FAVORITE_1 - of org.havi.ui.event.HRcEvent 1069
 VK_CLEAR_FAVORITE_2 - of org.havi.ui.event.HRcEvent 1070
 VK_CLEAR_FAVORITE_3 - of org.havi.ui.event.HRcEvent 1070
 VK_COLORED_KEY_0 - of org.havi.ui.event.HRcEvent 1070
 VK_COLORED_KEY_1 - of org.havi.ui.event.HRcEvent 1070
 VK_COLORED_KEY_2 - of org.havi.ui.event.HRcEvent 1070
 VK_COLORED_KEY_3 - of org.havi.ui.event.HRcEvent 1070
 VK_COLORED_KEY_4 - of org.havi.ui.event.HRcEvent 1071
 VK_COLORED_KEY_5 - of org.havi.ui.event.HRcEvent 1071
 VK_DIMMER - of org.havi.ui.event.HRcEvent 1071
 VK_DISPLAY_SWAP - of org.havi.ui.event.HRcEvent 1071
 VK_EJECT_TOGGLE - of org.havi.ui.event.HRcEvent 1071
 VK_FADER_FRONT - of org.havi.ui.event.HRcEvent 1071
 VK_FADER_REAR - of org.havi.ui.event.HRcEvent 1071
 VK_FAST_FWD - of org.havi.ui.event.HRcEvent 1071
 VK_GO_TO_END - of org.havi.ui.event.HRcEvent 1071
 VK_GO_TO_START - of org.havi.ui.event.HRcEvent 1072
 VK_GUIDE - of org.havi.ui.event.HRcEvent 1072
 VK_INFO - of org.havi.ui.event.HRcEvent 1072
 VK_MUTE - of org.havi.ui.event.HRcEvent 1072
 VK_PINP_TOGGLE - of org.havi.ui.event.HRcEvent 1072
 VK_PLAY - of org.havi.ui.event.HRcEvent 1072
 VK_PLAY_SPEED_DOWN - of org.havi.ui.event.HRcEvent 1072
 VK_PLAY_SPEED_RESET - of org.havi.ui.event.HRcEvent 1072
 VK_PLAY_SPEED_UP - of org.havi.ui.event.HRcEvent 1072
 VK_POWER - of org.havi.ui.event.HRcEvent 1073
 VK_RANDOM_TOGGLE - of org.havi.ui.event.HRcEvent 1073

VK_RECALL_FAVORITE_0 - of org.havi.ui.event.HRcEvent 1073
 VK_RECALL_FAVORITE_1 - of org.havi.ui.event.HRcEvent 1073
 VK_RECALL_FAVORITE_2 - of org.havi.ui.event.HRcEvent 1073
 VK_RECALL_FAVORITE_3 - of org.havi.ui.event.HRcEvent 1073
 VK_RECORD - of org.havi.ui.event.HRcEvent 1073
 VK_RECORD_SPEED_NEXT - of org.havi.ui.event.HRcEvent 1073
 VK_REWIND - of org.havi.ui.event.HRcEvent 1073
 VK_SCAN_CHANNELS_TOGGGLE - of org.havi.ui.event.HRcEvent 1073
 VK_SCREEN_MODE_NEXT - of org.havi.ui.event.HRcEvent 1074
 VK_SPLIT_SCREEN_TOGGGLE - of org.havi.ui.event.HRcEvent 1074
 VK_STOP - of org.havi.ui.event.HRcEvent 1074
 VK_STORE_FAVORITE_0 - of org.havi.ui.event.HRcEvent 1074
 VK_STORE_FAVORITE_1 - of org.havi.ui.event.HRcEvent 1074
 VK_STORE_FAVORITE_2 - of org.havi.ui.event.HRcEvent 1074
 VK_STORE_FAVORITE_3 - of org.havi.ui.event.HRcEvent 1074
 VK_SUBTITLE - of org.havi.ui.event.HRcEvent 1074
 VK_SURROUND_MODE_NEXT - of org.havi.ui.event.HRcEvent 1074
 VK_TELETEXT - of org.havi.ui.event.HRcEvent 1075
 VK_TRACK_NEXT - of org.havi.ui.event.HRcEvent 1075
 VK_TRACK_PREV - of org.havi.ui.event.HRcEvent 1075
 VK_VIDEO_MODE_NEXT - of org.havi.ui.event.HRcEvent 1075
 VK_VOLUME_DOWN - of org.havi.ui.event.HRcEvent 1075
 VK_VOLUME_UP - of org.havi.ui.event.HRcEvent 1075
 VK_WINK - of org.havi.ui.event.HRcEvent 1075

W

widgetChanged(HVisible, HChangeData[]) - of org.havi.ui.HAnimateLook 661
 widgetChanged(HVisible, HChangeData[]) - of org.havi.ui.HGraphicLook 747
 widgetChanged(HVisible, HChangeData[]) - of org.havi.ui.HListGroupLook 805
 widgetChanged(HVisible, HChangeData[]) - of org.havi.ui.HLook 811
 widgetChanged(HVisible, HChangeData[]) - of org.havi.ui.HMultilineEntryLook 825
 widgetChanged(HVisible, HChangeData[]) - of org.havi.ui.HRangeLook 849
 widgetChanged(HVisible, HChangeData[]) - of org.havi.ui.HSinglelineEntryLook 922
 widgetChanged(HVisible, HChangeData[]) - of org.havi.ui.HTextLook 978
 width - of org.havi.ui.HScreenDimension 898
 width - of org.havi.ui.HScreenRectangle 902
 windowActivated(WindowEvent) - of org.havi.ui.HEventMulticaster 714
 windowClosed(WindowEvent) - of org.havi.ui.HEventMulticaster 714
 windowClosing(WindowEvent) - of org.havi.ui.HEventMulticaster 714
 windowDeactivated(WindowEvent) - of org.havi.ui.HEventMulticaster 715
 windowDeiconified(WindowEvent) - of org.havi.ui.HEventMulticaster 715
 windowIconified(WindowEvent) - of org.havi.ui.HEventMulticaster 715
 windowOpened(WindowEvent) - of org.havi.ui.HEventMulticaster 715
 write(Preference) - of org.dvb.user.UserPreferenceManager 327

X

x - of org.havi.ui.HScreenPoint 900
 x - of org.havi.ui.HScreenRectangle 902

Y

y - of org.havi.ui.HScreenPoint 900
 y - of org.havi.ui.HScreenRectangle 902

Z

ZERO_BACKGROUND_IMPACT - of org.havi.ui.HScreenConfigTemplate 888

ZERO_GRAPHICS_IMPACT - of org.havi.ui.HScreenConfigTemplate 888

ZERO_VIDEO_IMPACT - of org.havi.ui.HScreenConfigTemplate 888

History

Document history		
V1.1.1	July 2000	Published
V1.1.2	October 2001	Published