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TECHNICAL SPECIFICATION

**Hybrid Digital Radio (DAB, DRM, RadioDNS);
XML Specification for Service and
Programme Information (SPI)**

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Foreword

This Technical Specification (TS) has been produced by 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 1: 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.

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The Eureka Project 147 was established in 1987, with funding from the European Commission, to develop a system for the broadcasting of audio and data to fixed, portable or mobile receivers. Their work resulted in the publication of European Standard, ETSI EN 300 401 [13], for DAB (see note 2) which now has worldwide acceptance.

NOTE 2: DAB is a registered trademark owned by one of the Eureka Project 147 partners.

The DAB family of standards is supported by World DAB, an organization with members drawn from broadcasting organizations and telecommunication providers together with companies from the professional and consumer electronics industry.

The RadioDNS Project was established in 2010 to standardize the combination of broadcast radio systems with additional applications, content and meta-data delivered over fixed or mobile IP networks. The project produced a specification using DNS to locate the broadcaster's Internet domain which is in use worldwide, and now standardized as ETSI TS 103 270 [18]. RadioDNS operates the authoritative name servers for the radiodns.org domain, and has members drawn from broadcasting organizations, manufacturers and service providers.

NOTE 3: "RadioDNS Hybrid Radio" and the RadioDNS Hybrid Radio logo are registered trademarks of RadioDNS Limited, a not-for-profit company owned by its members.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document defines the XML schema data model for Service and Programme Information (SPI) and methods for delivery by broadcast digital radio - DAB and DRM - and IP.

In respect to the previous version of the present document, provision is added for client authorisation for IP delivered metadata. The use of the present document allows content to be created once by the service provider for delivery by both mechanisms and allows manufacturers to implement devices with many common elements.

It is envisaged that this data format could be used both for transmitting service and schedule data to SPI applications on devices and as the basis for exchanging information between service providers, network operators and content providers.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1]   ETSI TS 102 822-4: "Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 4: Phase 1 - Content referencing".

[2]   ISO 8601: "Data elements and interchange formats - Information interchange - Representation of dates and times".

[3]   IETF RFC 2616: "Hypertext Transfer Protocol -- HTTP/1.1".

[4]   W3C Recommendation 4 February 2004: "Extensible Markup Language (XML) 1.0 (Third Edition)".

[5]   IETF RFC 2045: "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies".

[6]   IETF RFC 3066: "Tags for the Identification of Languages".

[7]   Void.

[8]   IETF RFC 3966: "The tel URI for Telephone Numbers".

[9]   IETF RFC 3191: "Minimal GSTN address format in Internet Mail".

[10]   IETF RFC 6068: "The 'mailto' URI scheme".

[11]   IETF RFC 2046: "Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types".

[12]   IETF RFC 4289: "Multipurpose Internet Mail Extensions (MIME) Part Four: Registration Procedures".

[13]   ETSI EN 300 401: "Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".

[14]   ISO/IEC 10646: "Information technology - Universal Multiple-Octet Coded Character Set (UCS)".

[15]   Void.

[16]   ETSI TS 102 822-3-1: "Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 1: Phase 1 - Metadata schemas".

[17]   ETSI ES 201 980: "Digital Radio Mondiale (DRM); System specification".

[18]   ETSI TS 103 270: "Radio DNS Hybrid Radio; Hybrid lookup for radio services".

[19]   ISO 3166-1: "Codes for the representation of names of countries and their subdivisions - Part 1: Country codes".

[20]   "GeoRSS: Geographically Encoded objects for RSS feeds".

NOTE: Available at http://www.georss.org.

[21]   ETSI TS 102 371 (V3.1.1 and later): "Digital Audio Broadcasting (DAB); Digital Radio Mondiale (DRM); Transportation and Binary Encoding Specification for Service and Programme Information (SPI)".

NOTE: This reference is made to V3.1.1 and possible later versions.

[22]   IETF RFC 2782 (2000): "A DNS RR for specifying the location of services (DNS SRV)".

[23]   IETF RFC 5724: "URI Scheme for Global System for Mobile Communications (GSM) Short Message Service (SMS)".

[24]   ETSI TS 103 177: "Digital Audio Broadcasting (DAB); Filecasting; User application specification".

[25]   ETSI TS 101 756: "Digital Audio Broadcasting (DAB); Registered tables".

[26]   IETF RFC 4078: "The TV-Anytime Content Reference Identifier (CRID)".

[27]   ISO/IEC 11172-3: "Information technology -- Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s -- Part 3: Audio".

[28]   ISO/IEC 13818-3: "Information technology -- Generic coding of moving pictures and associated audio information -- Part 3: Audio".

[29]   IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax".

2.2   Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1]   ETSI TS 102 818 (V1.5.1): "Digital Audio Broadcasting (DAB); Digital Radio Mondiale (DRM); XML Specification for Electronic Programme Guide (EPG)".

[i.2]   ETSI TS 102 371 (V1.3.1): "Digital Audio Broadcasting (DAB); Digital Radio Mondiale (DRM); Transportation and Binary Encoding Specification for Electronic Programme Guide (EPG)".

3   Definition of terms, symbols and abbreviations

3.1   Terms

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

bearer: method of carriage of the radio service

service: linear radio service

3.2   Symbols

Void.

3.3   Abbreviations

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

AAC	Advanced Audio Coding
AF	Alternate Frequency
AM	Amplitude Modulation
AMSS	Amplitude Modulation Signalling System
CA	Conditional Access
CDATA	Character DATA
CRID	Content Reference ID
CS	Classification Schemes
DAB	Digital Audio Broadcasting
DNS	Domain Name Server
DRM	Digital Radio Mondiale
EBU	European Broadcasting Union
EPG	Electronic Programme Guide
FM	Frequency Modulation
FQDN	Fully Qualified Domain Name
FTP	File Transfer Protocol
GI	Group Information
HE	High Efficiency
HTTP	Hyper Text Transfer Protocol
IANA	Internet Assigned Numbers Authority
IP	Internet Protocol
ISO	International Organization for Standardization
JTC	Joint Technical Committee
MIME	Multipurpose Internet Mail Extensions
MOT	Multimedia Object Transfer
MPEG	Moving Picture Experts Group
PAD	Programme Associated Data
PI	Programme Information
PNG	Portable Network Graphics
PPI	Pixels Per Inch
RDS	Radio Data System
RFC	Request For Comments
RSS	Rich Site Summary
SI	Service Information
SMS	Short Messaging Service
SPI	Service and Programme Information
SRV	SeRVice (record)
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol (but this is a conjunction of TCP and IP)
TV	TeleVision

UI	User Interface
URI	Uniform Resource Identifier
URL	Uniform Resource Location
UTC	Co-ordinated Universal Time
UTF	Unicode Transform Format
XML	eXtensible Markup Language
XSD	eXtensible markup language Schema Definition language
XSLT	eXtensible Stylesheet Language Transformation

4 Introduction

It is intended that service providers will use the present document to provide service information and programme listings information for audio services, whether delivered by analogue or digital broadcast systems or via IP, and that device manufacturers will use this metadata to provide a mechanism for the user to select services, programmes and related content for live or on-demand listening.

The present document allows rich metadata to be added to service descriptions, permitting attractive visualizations for user interfaces. Programme listings may be forward and backward in time, and on-demand content, whether part of the linear schedule or stand-alone content, may be described; again with rich metadata.

A key requirement is that the metadata is suited to a range of devices with differing display capabilities, resources and back-channel capabilities. To achieve this, a flexible structure has been defined, as shown in figure 1.

The SPI data is broken down into Service Information (services) and Programme Information (schedules, programmes, and programme events). Additionally programmes and programme events can be linked together into groups (e.g. for grouping programmes together into serials or series), which may have additional Group Information.

The SPI data is designed to be extensible, allowing it to be used as a core set of metadata that may be augmented with additional information within specific namespaces for third party applications, as further explained in Annex H.

Service information

```
┌─────────────┐
│   SERVICE   │      Information about one or more services
└─────────────┘
       ⇕
┌─────────────┐
│   BEARER    │      Information about the bearers of a service
└─────────────┘
```

Programme information

```
┌─────────────┐
│  SCHEDULE   │      Information about a schedule for one or more services
└─────────────┘
       ⇕
┌─────────────┐
│  PROGRAMME  │      Information about a programme and a link to its service
└─────────────┘
       ⇕
┌─────────────┐
│    EVENT    │      Information about an event
└─────────────┘
```
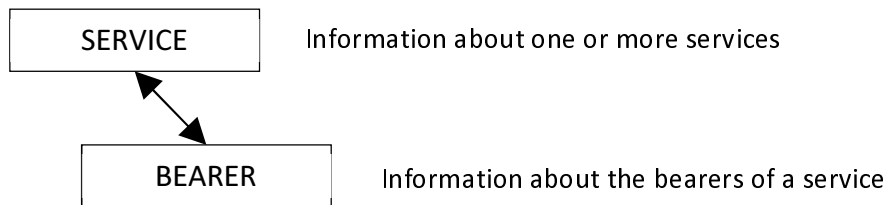
Group information

```
┌─────────────┐
│    GROUP    │      Information about a group
└─────────────┘
       ⇕
┌─────────────┐
│    GROUP    │      Information about a group and links to parent groups
└─────────────┘
       ⇕
┌─────────────┐
│     ...     │
└─────────────┘
       ⇕
┌─────────────┐
│  PROGRAMME  │      A programme links to its parent groups
└─────────────┘
```
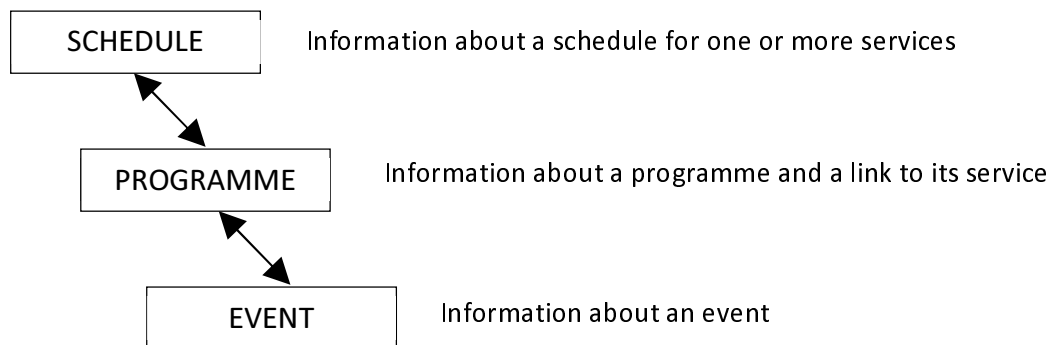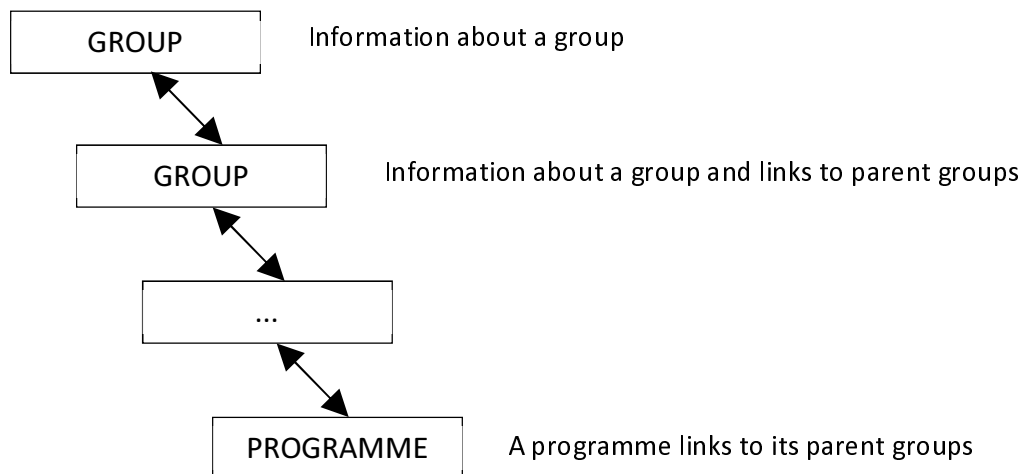
Figure 1: Structure of SPI metadata

The present document is split into three parts:

- Service Information (SI);

- Programme Information (PI);

- Group Information (GI).

The present document defines common data types in clause 5, service information in clause 6, programme information in clause 7 and group information in clause 8.

The SPI and any supporting files may be delivered by two methods:

- DAB/DRM broadcasting systems (see clause 9).

- TCP/IP (see clause 10).

There are several use cases for service providers using the present document:

1) The service provider has analogue broadcasting platforms only (e.g. FM with RDS, AM with AMSS) or has no broadcast platforms (internet only).

2) The service provider has digital broadcasting platforms only (e.g. DAB and/or DRM).

3) The service provider has both analogue and digital broadcasting platforms.

In case 1, all the XML documents are accessed via TCP/IP.

In case 2, the service provider may provide all the XML documents over the broadcast platform only; or he may provide all the documents in parallel via the broadcast platform and TCP/IP to additionally support connected devices; or he may provide the Service Information (SI) document over the broadcast platform and the remaining documents via TCP/IP; or some other combination.

In case 3, the service provider may provide all the XML documents over the broadcast platform to support his digital platforms independently of a TCP/IP connection, and in parallel via TCP/IP to support his analogue platforms and all connected devices; or some other combination.

In order to support these three cases, a common set of XML documents are generated.

5 Common data types, groups and elements

5.1 Basics

5.1.1 Character encoding

The ISO/IEC 10646 [14] character set using UTF-8 character encoding shall be used in all XML documents defined in the present document.

NOTE: The ISO/IEC 10646 [14] character set contains all characters of the "Complete EBU Latin based repertoire".

5.1.2 Text

Any text sections in attributes or elements should be careful to avoid using any of the reserved XML characters:

$$\& < > " \,'$$

These characters should be encoded using the predefined entity references (& < > " ') or enclosed in a CDATA section (e.g. <![CDATA[Some text including an &]]>).

5.2 Schema types

5.2.1 CRID type

A unique identifier for a **programme**, **programmeEvent, programmeGroup** or **memberOf** in the format of a Content Reference ID (CRID) as defined in the TV-Anytime specification [1].

This shall be in the following form:

```
crid://<authority>/<data>
```

Where **authority** is a registered Internet domain name that the CRID author has permission to use and is case insensitive. The **data** is a free format string (URI compliant and case insensitive) that is meaningful to the given authority and should uniquely identify the content within that authority [26].

EXAMPLE 1:   `crid://www.example.com/4472/1148985`

EXAMPLE 2:   `crid://www.example.co.uk/breakfast`

5.2.2   shortCRID type

A complementary identifier to the CRID type, used with the same elements.

The shortCRID is a 24-bit integer, expressed as a decimal value within the element content, with a range of 0 to 16 777 215 inclusive. The following rules shall be applied whenever shortCRIDs are used:

- The shortCRID shall only be unique within a single SPI service (see note), therefore a device shall process it in some way on decoding to ensure that it is globally unique.

- The shortCRID shall not be re-used within that SPI service for a minimum of six months.

NOTE: An "SPI service" is defined as SPI data for one or more services, provided from a single source. This could be SPI data from a particular FQDN, or from a broadcast MOT carousel.

5.2.3   MIME type

This indicates the MIME [5] of contained data or links and shall be used where it is applicable. The registered list of MIME types is available from the IANA list of Mime Types (IETF RFC 2046 [11] and IETF RFC 4289 [12]).

However, an application is permitted to use values not in this list as long as they conform to the requirements set out in IETF RFC 2046 [11].

EXAMPLE 1:   `audio/mpeg`

EXAMPLE 2:   `text/html`

EXAMPLE 3:   `image/png`

EXAMPLE 4:   `application/x-myapplication`

EXAMPLE 5:   `application/xml+pi`

5.2.4   timepoint type

This is a time field in **local time**. It is based on the ISO 8601 [2] extended format: *YYYY-MM-DDThh:mm:ss* where "*YYYY*" is the year, "*MM*" the month and "*DD*" the date. The letter "*T*" is the date/time separator and "*hh*", "*mm*" and "*ss*" represent the hour, minute and second respectively. To indicate the time zone, i.e. the difference between the local time and UTC, the difference immediately follows the time and consists of a sign, + or - , followed by hh:mm. If the difference between local time and UTC is 0, then a"Z" may be used in place of "+00:00".

EXAMPLE 1:   `2013-06-07T15:05:00+01:00`

EXAMPLE 2:   `2014-02-03T23:03:15Z`

5.2.5   duration type

Duration is based on the ISO 8601 [2] format: PTnHnMnS, where "T" represents the date/time separator, "nH" the number of hours, "nM" the number of minutes and "nS" the number of seconds. The values of the hours, minutes and seconds components are not restricted but allow an arbitrary integer. Reduced precision and truncated representations of this format are allowed provided they conform to the following:

- The lowest order items may be omitted. If omitted their value is assumed to be zero.

- If the number of hours, minutes or seconds in any expression equals zero, the number and its corresponding designator may be omitted. However, at least one number and its designator shall be present.

The designator "PT" shall always be present.

Durations of greater than 18 hours should be avoided for reasons of backwards compatibility with broadcast binary encoding.

EXAMPLE 1:   `PT2H`

EXAMPLE 2:   `PT1H12M`

EXAMPLE 3:   `PT12M30S`

5.2.6   bearerURI type

This is a string describing the identifier of a **bearer** element according to the format described in ETSI TS 103 270 [18].

5.3   genre element

This indicates the genre of a **programme**, **programmeEvent**, **programmeGroup** or **service**. The genre scheme is based on that used by TV-Anytime [16].The supported classification schemes are:

- IntentionCS.

- FormatCS.

- ContentCS.

- OriginationCS.

- IntendedAudienceCS.

- ContentAlertCS.

- MediaTypeCS.

- AtmosphereCS.

The text content of the element, if used, should contain the name of the genre. This is purely intended to make the element more human-readable.

The type attribute indicates the type of the genre. The types of genres are defined as follows:

Its attributes are detailed below:

Attribute	Description	Type	Status
href	Indicates the genre, the Classification Scheme (CS) and the genre scheme used.	*xs:anyURI*	Required
type	Indicates the type of the genre, from the list below: **main**. The specified genre is the main, or primary. **secondary**. The specified genre is secondary genre, such as a subgenre. **other**. The specified genre is an alternative genre, such as one defined or used by third parties.	*xs:enumeration*	Optional, defaults to **main**

EXAMPLE: `<genre href="urn:tva:metadata:cs:ContentCS:2002:3.6.9">`
                 `<![CDATA[World/Traditional/Ethnic/Folk music]]>`
               `</genre>`

5.4   keywords element

This contains a comma-separated case-insensitive list of keywords. The language attribute indicates the language of the keyword list and is in the form of an xml:lang attribute [4] and IETF RFC 3066 [6]. The keywords shall be separated by commas. The comma-separated list may have leading and trailing spaces, but these are not considered to contain information.

Zero or more of these elements may exist under a **programme**, **programmeEvent**, **programmeGroup** or **service** element, in any valid language.

Its attributes are detailed below:

Attribute	Description	Type	Status
xml:lang	Defines the language of the keywords.	*xml:lang*	Optional, defaults to the default language of the document.

EXAMPLE: `<keywords xml:lang="en">music, dance, hip-hop, jazz, soul</keywords>`

5.5   link element

This is used to link from a **service**, **programme**, **programmeEvent** or **programmeGroup** to an additional resource. This may be additional content, data, or interaction related to the parent element.

Its attributes are detailed below:

Attribute	Description	Type	Status
uri	Destination URI for the link.	*xs:anyURI*	Required
mimeValue	Indicates the MIME type (IETF RFC 2045 [5]) of any data linked to, if applicable.	MIME type	Optional
xml:lang	Defines the language of the link.	*xml:lang*	Optional, defaults to the default language of the document
description	A short description of what the link describes, up to a maximum of 180 characters. Note that this should purely for descriptive purposes, or for possible display as a short description. It should not be used to infer machine-readable context on the link contents.	*xs:string*	Optional
expiryTime	This indicates the datetime at which the link is deemed to have expired. It should not be treated as valid beyond this time and should not be used or surfaced. If this attribute is not specified, then no expiry is defined on the link. However, should the containing document be updated and the link not be included, this shall be interpreted as it having expired.	timepoint type	Optional

```
EXAMPLE:      <link mimeValue="text/html" uri="http://www.example.com/"/>
              <link description="Text the Studio" uri="sms:61812"/>
              <link description="Track Listing"
               uri="http://www.example.com/2014/11/27/full-works"
               mimeValue="text/html"
               expiryTime="2014-12-04T00:00:00Z" />
```

Guidance on the usage and determining of link context can be found in Annex C.

5.6   nameGroup elements

This is a group of elements for adding names to programmes, programme events, programme groups and services. Three variants are supported: **shortName**, **mediumName** and **longName**, with the following character limits:

Element	Character Limit
shortName	8
mediumName	16
longName	128

Each element has the attribute detailed below:

Attribute	Description	Type	Status
xml:lang	Defines the language of the name.	*xml:lang*	Optional, defaults to the default language of the document.

Each may be specified more than once, with the same or other languages, with the following restrictions:

- Names for the **service** element shall include at least one **shortName** and one **mediumName** in the default document language.

- Names for **programme**, **programmeEvent** and **programmeGroup** elements shall include at least one **mediumName** element in the default document language.

5.7 descriptionGroup elements

This is a group of elements for adding textual descriptions to programmes, programme events, programme groups and services. Two variants are supported: **shortDescription** and **longDescription**, with the following character limits:

Element	Character Limit
shortDescription	180
longDescription	1 200

Each element has the attribute detailed below:

Attribute	Description	Type	Status
xml:lang	Defines the language of the contained text.	*xml:lang*	Optional, defaults to the default language of the document.

Each may be specified zero or more times, with the same or other languages.

5.8 multimedia element

This element describes multimedia content related to the parent element, accessible via IP or carried in the same broadcast MOT carousel. This may be video, audio or image content, such as a service or programme logo, or a programme event audio clip.

Its attributes are detailed below:

Attribute	Description	Type	Status
xml:lang	Defines the language of the multimedia content.	*xml:lang*	Optional, defaults to the default language of the document
url	Location of the multimedia content as either an HTTP URL or MOT ContentName.	*xs:string*	Required
mimeValue	Indicates the MIME type (IETF RFC 2045 [5]) of the multimedia content.	MIME type	Required except if the type is logo_colour_square or logo_colour_rectangle
type	The type of logo chosen from: **logo_unrestricted:** The image format is unrestricted and shall be signalled with the "mimeValue", "width" and "height" attributes. **logo_colour_square:** The image shall be in PNG v1.1 format and shall be 32 × 32 pixels at a colour depth of 256. The "mimeValue" , "width" and "height" attributes shall not be used **logo_colour_rectangle:** This image shall be in PNG v1.1 format and shall be 32 pixels high and 112 pixels wide at a colour depth of 256. The "mimeValue", "width" and "height" attributes shall not be used.	*xs:enumerated*	Optional
width	Width, in pixels, of image multimedia content.	*xs:positiveInteger*	Required if the type is logo_unrestricted
height	Height, in pixels, of image multimedia content.	*xs:positiveInteger*	Required if the type is logo_unrestricted

IP client decoders shall be able to discard multimedia elements that refer to any non-http asset in the url; this may be the case for a service provider who provides multimedia assets via the broadcast platform.

It is recommended that devices with graphical capabilities should support the following format:

- PNG V1.1: This format is suitable for colour images for display on more capable devices. The minimum image specification supported by PNG-compatible devices should be 32 × 32 pixels at a colour depth of 256 [8].

It is recommended that devices with the capability to play audio files should support the following formats:

- The native "system" audio format. For DAB the native audio formats are MPEG-1 audio layer II (ISO/IEC 11172-3 [27]), MPEG-2 audio layer II (ISO/IEC 13818-3 [28]) and HE AAC v2 [24]. For DRM the native audio formats are specified in ETSI ES 201 980 [17].

- MPEG-1 layer 3 audio playback.

5.9 mediaDescription element

This element represents an aggregation of the descriptive elements descriptionGroup (text) and multimedia. This element describes content related to the parent **service**, **serviceGroup**, **programme**, **programmeEvent** or **programmeGroup** element.

Can contain one of the following elements:

- descriptionGroup (shortDescription, longDescription);

- multimedia.

```
EXAMPLE:     <mediaDescription>
               <shortDescription xml:lang="en">Rock and pop music from the best radio
             station.</shortDescription>
             </mediaDescription>
             <mediaDescription>
               <multimedia type="logo_colour_square"
             url="http://www.example.co.uk/radio1/r1logo32.png"/>
               </multimedia>
             </mediaDescription>
```

5.10 memberOf element

This element can be contained within **programme**, **programmeEvent** or **programmeGroup** elements to indicate which group the parent element belongs to. Note that the grouping is implicit from multiple elements sharing the same group identifier. Additional information on the group itself may be specified within a Group Information (GI) document.

Its attributes are detailed below:

Attribute	Description	Type	Status
id	A unique identifier for this group, as a Content Reference ID (CRID). The same identifier shall be used for this attribute by all members of the group.	CRID type	Required
shortId	An identifier for this group, as a Content Reference ID (CRID). The same identifier shall be used for this attribute by all members of the group.	shortCRID type	Required
index	This is the index for the item within the specified group. This may be used, for example, to specify an episode number for a programme in a series.	*xs:positiveInteger*	Optional

```
EXAMPLE:     <memberOf id="crid://www.example.com/4772" shortId="4772" index="206"/>
```

5.11 bearer element

5.11.1 General

This element can be contained within **service, location** and **onDemand** elements to indicate on which bearer(s) the service or programme or programme event is carried.

Can contain zero or one of the following element:

- Geolocation

Its attributes are detailed below:

Attribute	Description	Type	Status
id	A URI describing the bearer details [18].	bearerURI type	Required
cost	An indication of a relative 'cost' of acquiring the service from the service provider. This may be used by a device as a means of selecting an appropriate bearer to use, see Annex E.	*xs:nonNegativeInteger*	Required
mimeValue	Indicates the MIME type (RFC 2045 [5]) of the audio carried by the bearer.	MIME type	Dependant on the bearer
bitrate	Bitrate of the audio carried by the bearer, in kilobits per second (kbps).	*xs:nonNegativeInteger*	Dependant on the bearer
offset	An indication of the offset given to the audio on this bearer by the service provider, in milliseconds relative to other bearers in the same document.	*xs:nonNegativeInteger*	Optional, defaults to zero

It is strongly recommended that all available bearers for the service are listed, in order to assist effective service following for hybrid devices.

Specific bearer types have additional requirements, as defined in the following clauses.

5.11.2 Digital Audio Broadcasting (DAB/DAB+)

The **mimeValue** attribute is required and shall be defined as **audio/mpeg** for DAB and **audio/aacp** for DAB+ services.

5.11.3 Digital Radio Mondiale (DRM)

The **mimeValue** attribute is required and shall be defined as the MIME type of the encoded audio stream.

5.11.4 IP-based

The **mimeValue** attribute is required and shall indicate the MIME type of the audio codec carried.

The **bitrate** attribute is recommended and should indicate the bitrate of the audio stream.

5.12 geolocation element

This element can be contained within **service**, **serviceProvider**, **serviceGroup** or **bearer** elements to indicate geographical applicability, using zero or more of the following child elements in any combination.

Element	Description	Type	Status
country	Specifies location by country, using ISO 3166-1 alpha-2 country codes [19].	*xs:string*	Optional
point	Based on the geoRSS simple point type [20], this specifies one point by latitude and longitude in the WGS84 coordinate reference system, in the format: `<latitude> <longitude>`	*georss:doubleList*	Optional
polygon	Based on the geoRSS simple polygon [21] type, this specifies a space-separated series of points by latitude and longitude in the WGS84 coordinate reference system, forming an enclosed area, in the format: `<[<latitude> <longitude>]...>` The first pair and last pair shall be identical. A minimum of three pairs shall be given.	*georss:doubleList*	Optional

Each may be interpreted in a different way based on its parent element and no particular meaning is mandated. The following paragraphs are given as suggestions:

- A *country code* for a **serviceProvider**, **service**, **serviceGroup** or **bearer** may indicate the country or countries in which the provider, service, grouping or bearer is available, accessible or located.

- A *point* for a **serviceProvider** or **service** may indicate the exact coordinates of where the provider or service is based or located. For a **serviceGroup** this may be set of points indicating the locations of the services within the network the group represents, or a single point showing the network centre. For a broadcast **bearer**, it may represent the coordinates of the transmitter it represents.

- A polygon for a **service** or **serviceGroup** may indicate the editorial or 'brand' area for that service or service group. For a broadcast **bearer** it may indicate the effective transmission area– to be used as additional information by clients wishing to perform service following between the different bearers of a service.

Its attributes are detailed below:

Attribute	Description	Type	Status
xml:id	A unique label to identify a geolocation definition	xs:ID	Optional
ref	A unique label (previously defined) to identify a geolocation definition	xs:IDREF	Optional

The **xml:id**, attribute allows a geolocation definition to be provided once within the document and referenced elsewhere within the document by using the **ref** attribute.

The following restrictions apply:

- a **geolocation** element containing a cross-reference to another shall not define any child elements;

- if a **geolocation** element makes a non-existent reference, then the element shall be ignored;

- a **geolocation** element shall only make a cross-reference to another **geolocation** element within the same document.

EXAMPLE 1: Against a **serviceProvider** element, showing the location of the provider of the service:

```
<geolocation>
  <country>GB</country>
  <point>51.473939 -2.508112</point>
</geolocation>
```

EXAMPLE 2: Against a **service** element, showing its "brand" area as a polygon:

```
<geolocation>
  <polygon>
    51.524124 -2.709503 51.572803 -2.668304 51.616310 -2.572174
    51.575363 -2.412872 51.504471 -2.379913 51.426613 -2.471924
    51.400063 -2.460937 51.387211 -2.511749 51.328896 -2.708130
    51.273087 -2.772675 51.238705 -2.938843 51.258476 -3.036346
    51.376068 -3.026733 51.472401 -2.859879 51.524124 -2.709503
  </polygon>
</geolocation>
```

EXAMPLE 3:   Against a **bearer** element, when indicating multiple FM broadcast bearers with the same transmission area, first defining and then using a reference:

```
<bearer cost="30" id="fm:ce1.c36b.09630">
  <geolocation xml:id="bristol-fm">
    <polygon>
      51.574081 -2.660065 51.551460 -2.545395 51.555302 -2.408752
      51.533096 -2.376480 51.480099 -2.400513 51.394920 -2.489090
      51.393208 -2.592087 51.417194 -2.664185 51.489937 -2.736969
      51.574081 -2.660065
    </polygon>
  </geolocation>
</bearer>

...

<bearer cost="30" id="fm:ce1.c46b.09630">
  <geolocation ref="bristol-fm"/>
</bearer>
```

Both describe the same transmitter with an equal transmission area, for a scenario where the PI code is switched around commercial breaks. To avoid duplication, the first occurrence of the **geolocation** element is marked with an identifier using the **xml:id** attribute, and subsequent occurrences may cross-reference to this by using the **ref** attribute.

5.13   epg element

This is the root element of the Programme Information (PI) and Group information (GI) documents.

Can contain zero or more of the following elements:

- schedule;

- programmeGroups.

Its attributes are detailed below:

Attribute	Description	Type	Status
xml:lang	Defines the language of the multimedia content.	*xml:lang*	Optional, defaults to the default language of the document.

6   Service Information

6.1   Introduction

The Service Information (SI) document holds a definition of services provided by the service provider, including any relevant metadata and bearer details, such as:

- Names (in different lengths and languages)

- Descriptions (in different lengths and languages)

- Logos (in different sizes, and formats)

- Genres

- Keywords

- Bearers the service can be received over (both broadcast and IP)

- Geolocations

In addition, services can be grouped together.

EXAMPLE:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<serviceInformation xmlns="http://www.worlddab.org/schemas/spi/31"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:xml="http://www.w3.org/XML/1998/namespace"
   xsi:schemaLocation="http://www.worlddab.org/schemas/spi/31
http://www.worlddab.org/schemas/spi/31/spi_31.xsd"
   creationTime="2014-04-25T00:05:31+01:00" originator="Global Radio"
   xml:lang="en">
   <services>
      <serviceProvider>
         <shortName>Global</shortName>
         <mediumName>Global Radio</mediumName>
         <mediaDescription>
            <multimedia url="http://epg.musicradio.com/logos/global/320x240.png"
                        type="logo_unrestricted" mimeValue="image/png" height="240" width="320" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://epg.musicradio.com/logos/global/32x32.png"
                        type="logo_colour_square" />
         </mediaDescription>
         <keywords>radio, television, publishing, talent, charities &amp; communities
         </keywords>
         <link uri="http://www.thisisglobal.com" mimeValue="text/html" description="Homepage" />
         <link uri="postal:Global%20Radio/30%20Leicester%20Square/London/WC2H%207LA" />
         <link uri="tel:+44-020-77666000" />
         <geolocation>
            <country>GB</country>
            <point>51.473939 -2.508112</point>
         </geolocation>
      </serviceProvider>
      <service>
         <shortName>Capital</shortName>
         <mediumName>Capital FM</mediumName>
         <longName>Capital London</longName>
         <mediaDescription>
            <shortDescription>
               The UK's No.1 Hit Music Station
            </shortDescription>
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/32x32.png"
                        type="logo_colour_square" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/112x32.png"
                        type="logo_colour_rectangle" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/128x128.png"
                        type="logo_unrestricted" mimeValue="image/png" height="128" width="128" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/320x240.png"
                        type="logo_unrestricted" mimeValue="image/png" height="240" width="320" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/600x600.jpg"
                        type="logo_unrestricted" mimeValue="image/jpeg" height="600" width="600" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/1024x768.jpg"
                        type="logo_unrestricted" mimeValue="image/jpeg" height="768" width="1024" />
         </mediaDescription>
         <genre href="urn:tva:metadata:cs:ContentCS:2004:3.6.10">
            Hit-Chart/Song Requests
         </genre>
         <genre href="urn:tva:metadata:cs:ContentCS:2004:3.6.8">
            Electronic/Club/Urban/Dance
         </genre>
         <genre href="urn:tva:metadata:cs:ContentCS:2004:3.1.1.11">
            Local/Regional
```

```xml
            </genre>
            <genre href="urn:tva:metadata:cs:ContentCS:2004:3.6.8.14">
               Dance/Dance-pop
            </genre>
            <genre href="urn:tva:metadata:cs:ContentCS:2004:3.1.4.12">
               Showbiz
            </genre>
            <keywords>London, music, pop, rock, dance, urban</keywords>
            <link description="Text the Studio" uri="sms:83958" />
            <link uri="http://www.capitalfm.com/london" mimeValue="text/html" />
            <bearer id="dab:ce1.c185.c479.0" mimeValue="audio/mpeg" offset="2000" cost="20" />
            <bearer id="fm:ce1.c479.09580" cost="30" />
            <bearer id="http://media-ice.musicradio.com/Capital" offset="4000"
                    mimeValue="audio/aacp" bitrate="48" cost="40" />
            <bearer id="http://media-ice.musicradio.com/CapitalMP3Low" offset="4000"
                    mimeValue="audio/mpeg" bitrate="48" cost="40" />
            <radiodns fqdn="www.capitalfm.com" serviceIdentifier="london" />
            <geolocation>
               <country>GB</country>
               <polygon>
                  51.524124 -2.709503 51.572803 -2.668304 51.616310 -2.572174
                  51.575363 -2.412872 51.504471 -2.379913 51.426613 -2.471924
                  51.400063 -2.460937 51.387211 -2.511749 51.328896 -2.708130
                  51.273087 -2.772675 51.238705 -2.938843 51.258476 -3.036346
                  51.376068 -3.026733 51.472401 -2.859879 51.524124 -2.709503
               </polygon>
            </geolocation>
            <serviceGroupMember id="capital" />
         </service>
      </services>
      <serviceGroups>
         <serviceGroup id="capital">
            <shortName>Capital</shortName>
            <mediumName>Capital FM</mediumName>
            <mediaDescription>
               <shortDescription>The UK's No.1 Hit Music Station</shortDescription>
            </mediaDescription>
            <mediaDescription>
               <multimedia url="http://owdo.thisisglobal.com/2.0/id/153/logo/32x32.png"
                           type="logo_colour_square"/>
            </mediaDescription>
            <mediaDescription>
               <multimedia url="http://owdo.thisisglobal.com/2.0/id/153/logo/112x32.png"
                           type="logo_colour_rectangle"/>
            </mediaDescription>
            <mediaDescription>
               <multimedia url="http://owdo.thisisglobal.com/2.0/id/153/logo/128x128.jpg"
                           type="logo_unrestricted" mimeValue="image/jpeg" height="128" width="128" />
            </mediaDescription>
            <mediaDescription>
               <multimedia url="http://owdo.thisisglobal.com/2.0/id/153/logo/320x240.jpg"
                           type="logo_unrestricted" mimeValue="image/jpeg" height="240" width="320" />
            </mediaDescription>
            <mediaDescription>
               <multimedia url="http://owdo.thisisglobal.com/2.0/id/153/logo/600x600.jpg"
                           type="logo_unrestricted" mimeValue="image/jpeg" height="600" width="600" />
            </mediaDescription>
            <link description="Capital on Wikipedia" mimeValue="text/html"
                  uri="http://en.wikipedia.org/wiki/Capital_(radio_network)" />
         </serviceGroup>
      </serviceGroups>
</serviceInformation>
```

6.2 serviceInformation element

This is the root element of the Service Information (SI) document and can contain zero or one of each of the following elements:

- services;

- serviceGroups.

Its attributes are detailed below:

Attribute	Description	Type	Status
version	Indicator for changed content; shall be incremented by one for every new version of the serviceInformation	*xs:positiveInteger*	Optional, defaults to 1
creationTime	Initial creation datetime of this xml document	timepoint type	Optional
originator	Describes the originator of the parent document, up to a maximum of 128 characters	*xs:string*	Optional
serviceProvider	Defines the Service Provider of the services in the document, up to a maximum of 128 characters. If this attribute is defined, the SI document shall not contain a **serviceProvider** element	*xs:string*	Optional
terms	Defines the URL of a plain text document containing metadata usage Terms and Conditions If defined, this also applies to every PI and GI document for all services defined within the SI document	*xs:anyURI*	Optional
xml:lang	Defines the default language within the document Any elements not explicitly indicated with a different language should be assumed to use this	*xml:lang*	Optional, defaults to **en**

6.3   services element

Services element can contain zero or one **serviceProvider** element and zero or more **service** elements.

6.4   serviceProvider element

ServiceProvider element contains information on the provider of the services detailed within the SI document. Zero or one of this element may exist under the **services** element.

ServiceProvider element can contain the following elements:

- nameGroup (shortName, mediumName, longName)
- mediaDescription
- keywords
- link
- geolocation

At least one of each of the following descriptive elements shall be specified for each service provider, in the default document language:

- shortName;
- mediumName.

If this element is used then the **serviceInformation** element shall not define a **serviceProvider** attribute.

6.5   service element

Service element describes metadata and available bearers for a service.

Service element can contain the following elements:

- nameGroup (shortName, mediumName, longName)

- mediaDescription

- genre

- keywords

- link

- bearer

- radiodns

- geolocation

- serviceGroupMember

At least one of each of the following descriptive elements shall be specified for each service, in the default document language:

- shortName

- mediumName

At least one **genre** element shall be given.

Service logos shall be provided using the **mediaDescription/multimedia** element. For delivery by broadcast, four required sizes shall be described and the assets included within the same MOT carousel as the SI document. For delivery by IP, five required sizes shall be described and the assets made available at the corresponding HTTP URL. Additional sizes may also be described for either delivery method, including HTTP assets referenced in a broadcast delivered SI document.

NOTE 1: IP clients should provide a mechanism to ignore references to broadcast assets because when a service provider delivers the **service** element by both broadcast and IP these references may be present.

NOTE 2: Broadcast clients without IP connectivity cannot access HTTP assets.

The minimum required logo assets for broadcast delivery are as follows:

- MIME type: PNG;

- Width x height: 32x32; 112x32; 128x128; 320x240.

The minimum required logo assets for IP delivery are as follows:

- MIME type: PNG or JPEG;

- Width x height: 32x32; 112x32; 128x128; 320x240; 600x600.

NOTE 3: Service providers delivering the SPI by both broadcast and IP may use MOT ContentNames that are identical to the HTTP URL. This allows the broadcast logo assets to be described by the IP HTTP URLs without requiring separate mediaDescription/multimedia elements.

Additional guidance on logos is provided in Annex D.

Its attributes are detailed below:

Attribute	Description	Type	Status
version	Indicator for changed content; shall be incremented by one for every new version of the service	xs:positiveInteger	Optional, defaults to 1

6.6   radiodns element

This element details the RadioDNS lookup parameters for the service, and can be used in the discovery of additional RadioDNS applications as per ETSI TS 103 270 [18].

Its attributes are detailed below:

Attribute	Description	Type	Status
fqdn	The Authoritative FQDN used in the discovery of RadioDNS applications as an alternative to using Broadcast Parameters.	*xs:anyURI*	Required
serviceIdentifier	The Service Identifier used in the discovery of RadioDNS applications as an alternative to using Broadcast Parameters. Maximum 16 lower case characters in the range [a-z] [0-9]. This shall be unique across all the services using the same Authoritative FQDN.	*xs:string*	Required

6.7   serviceGroupMember element

This element can be used to indicate membership of a **serviceGroup** for the purposes of similar service selection or presentation to a user. A service may be a member of zero or more **serviceGroup**s, using zero or more **serviceGroupMember** elements.

The **serviceGroup** the service belongs to is indicated with the **id** attribute.

Its attributes are detailed below:

Attribute	Description	Type	Status
id	An identifer for the group.	*xs:string*	Required

Other members of the group shall share this identifier to be placed in the same group, and the group shall be defined with the exact identifying string as stated against the group definition within the relevant **serviceGroup** element.

6.8   serviceGroups element

This element contains zero or more **serviceGroup** elements.

6.9   serviceGroup element

This element can be used to describe a group of services, for example services with similar features which might aid with service selection or presentation to a user.

Each serviceGroup can contain the following common elements to add additional information about the group:

- nameGroup (shortName, mediumName, longName)

- mediaDescription

- genre

- keywords

- link

- geolocation

Its attributes are detailed below:

Attribute	Description	Type	Status
id	An identifier for the group.	*xs:string*	Required

A service determined to be a member of the group shall use this group identifier in its **serviceGroupMember** element.

NOTE: serviceGroups without members should not be presented to users by devices.

7   Programme Information

7.1   Introduction

Programme information is composed into a schedule.

A "linear schedule" describes programmes for a linear service (radio station) over a defined time interval, typically around a 24-hour period from midnight to midnight. Individual programmes may also include programme events, signifying events within the programme. A linear schedule may also indicate that the programme or programme event is available on-demand.

An "on-demand schedule" describes programmes that are available on-demand, either via IP or delivered by a broadcast Filecast Channel, during defined acquisition periods.

   EXAMPLE:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<epg xmlns="http://www.worlddab.org/schemas/spi/31"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:xml="http://www.w3.org/XML/1998/namespace"
    xsi:schemaLocation="http://www.worlddab.org/schemas/spi/31
http://www.worlddab.org/schemas/spi/31/spi_31.xsd">
    <schedule creationTime="2014-04-11T01:20:00+01:00" originator="Global Radio">
        <scope startTime="2014-04-25T06:00:00+01:00" stopTime="2014-04-25T13:00:00+01:00">
            <serviceScope id="dab:ce1.c185.c479.0" />
            <serviceScope id="fm:ce1.c479.09580" />
            <serviceScope id="http://media-ice.musicradio.com/Capital" />
            <serviceScope id="http://media-ice.musicradio.com/CapitalMP3Low" />
        </scope>
        <programme id="crid://www.capitalfm.com/4772/1190223" shortId="1190223">
            <shortName>B'fast</shortName>
            <mediumName>Breakfast</mediumName>
            <longName>Capital Breakfast</longName>
            <location>
                <time time="2014-04-25T06:00:00+01:00" duration="PT4H"
                    actualTime="2014-04-25T06:00:00+01:00" actualDuration="PT4H"/>
            </location>
            <mediaDescription>
                <shortDescription>Forget the coffee, Capital gives you the perfect morning pick-me-
up with a blend of the latest hits, travel news and incomparable morning banter.</shortDescription>
            </mediaDescription>
            <genre href="urn:tva:metadata:cs:ContentCS:2002:3.6.8">
                <![CDATA[ Electronic/Club/Urban/Dance]]>
            </genre>
            <genre href="urn:tva:metadata:cs:IntentionCS:2002:1.1">
                <![CDATA[ ENTERTAINMENT]]>
            </genre>
            <memberOf id="crid://www.capitalfm.com/4772" shortId="4772"/>
            <link uri="mailto:capital.breakfast@capitalfm.com" description="Email the Capital
Breakfast team!" />
            <link uri="http://www.capitalfm.com/on-air/breakfast-show/" />
            <programmeEvent id="crid://thisisglobal.com/4772/1190223/788946" shortId="788946">
                <shortName>Pun</shortName>
                <mediumName>No.1 Pun</mediumName>
                <longName>London's No. 1 Pun</longName>
                <location>
                    <relativeTime time="PT3H10M" duration="PT25M"/>
                </location>
                <mediaDescription>
                    <shortDescription>
                        Can you come up with London's No.1 Pun for our story of the day?
                    </shortDescription>
                </mediaDescription>
            </programmeEvent>
        </programme>
    </schedule>
</epg>
```

7.2 epg element

This is the root element of the Programme Information (PI) document, see clause 5.13.

7.3 schedule element

This is a container for a set of programmes and may contain the following elements:

- scope

- programme

Its attributes are detailed below:

Attribute	Description	Type	Status
creationTime	Initial creation datetime of the document	timepoint type	Optional
originator	Describes the originator of the document, up to a maximum of 180 characters	*xs:string*	Optional
version	Indicator for changed content; shall be incremented by one for every new version of the schedule	*xs:positiveInteger*	Optional, defaults to 1
xml:lang	Defines the default language within the document Any elements not explicitly indicated with a different language should be assumed to use this	*xml:lang*	Optional, defaults to **en**

NOTE: A schedule containing no programme elements may be used to indicate that any previously acquired programme within the same scope should be deleted.

7.4 scope element

This element indicates the time interval over which the specified programmes will cover and the identifiers of the services the programmes are part of. It may contain zero or more of the following element:

- serviceScope

This may extend beyond the bounds of a single day. For a linear schedule, any gaps between the entire span of all programmes in the schedule, and the time covered by an indicated scope shall be interpreted as there being no available on-air programme content for that service during those times.

Its attributes are detailed below:

Attribute	Description	Type	Status
startTime	The start time of the interval over which the schedule applies. Note that for a linear schedule this may be equal to or before the start time of the first programme.	timepoint type	Required
stopTime	The end time of the interval over which the schedule applies. Note that for a linear schedule this may be equal to or after the end time of the last programme.	timepoint type	Required

7.5 serviceScope element

Bearers are fully described using the **bearer** element in a **service, location** or **onDemand** element. The **serviceScope** element is used to provide the reference to the parent service(s) for the **programme** elements contained in the schedule. Zero or more of this element may be added to the **scope** element.

Its attributes are detailed below:

Attribute	Description	Type	Status
id	A URI describing the bearer details [18]	bearerURI type	Required

7.6   programme

The programme contains information specific to an individual programme, including its descriptive elements, timings, and any bearer information that differs from the parent service the PI document belongs to.

The programme element can contain the following elements:

- nameGroup (shortName, mediumName, longName)

- location

- onDemand

- mediaDescription

- genre

- keywords

- memberOf

- link

- programmeEvent

At least one **mediumName** element shall be specified, in the default document language.

At least one **location** or **onDemand** element shall be specified.

Its attributes are detailed below:

Attribute	Description	Type	Status
shortId	Short identifier	shortCRID type	Required
id	Unique identifier for the programme	CRID type	Required
version	Indicator for changed content; shall be incremented by one for every new version of the programme	*xs:positiveInteger*	Optional, defaults to 1
recommendation	Indicator for promotion of special programmes; may take the values "no" and "yes"	*xs:enumeration*	Optional, defaults to "no"
broadcast	Indicator for whether the programme has audio content chosen from: **on-air:** there is audio content **off-air:** there is no audio content; may be used to allow a dummy programme to be placed into a linear schedule for a part hours service to give information to the user, for example, "Back at 18:00"	*xs:enumeration*	Optional, defaults to "on-air"
xml:lang	Defines the language of the content within the programme	*xml:lang*	Optional, defaults to document language

7.7   programmeEvent

This element describes an event within a programme and can be used to break a programme into sections or to highlight particular sections of the programme.

programmeEvent element can contain the following elements:

- nameGroup (shortName, mediumName, longName)

- location

- onDemand

- multimediaDescription

- genre

- keywords

- memberOf

- link

At least one **mediumName** element shall be specified, in the default document language.

At least one **location** element shall be specified. Zero or more **onDemand** elements shall be specified.

Its attributes are detailed below:

Attribute	Description	Type	Status
shortId	Short identifier	shortCRID type	Required
id	Unique identifier for the programme event	CRID type	Required
version	Indicator for changed content; shall be incremented by one for every new version of the programmeEvent	*xs:positiveInteger*	Optional, defaults to 1
recommendation	Indicator for promotion of special programmes; may take the values "no" and "yes"	*xs:enumeration*	Optional, defaults to "no"
broadcast	Indicator for whether the programmeEvent has audio content chosen from: **on-air:** there is audio content **off-air:** there is no audio content	*xs:enumeration*	Optional, defaults to "on-air"
xml:lang	Defines the language of the content within the programme event. This should be used if the language is different from that declared on the parent programme	*xml:lang*	Optional, defaults to language of the parent **programme** element

7.8   location element

This element specifies the times and bearers on which a programme or programme event is available, or the relative times and bearers on which a programme event is available in a linear schedule. The **location** element may appear zero or more times within a **programme** or **programmeEvent** element.

The **location** element can contain the following elements:

- time or relativeTime

- bearer (see clause 5.11)

If no **bearer** element for a **programmeEvent** is present, the **bearer** element(s) from the parent **programme** define the bearer(s) for that **programmeEvent**.

If no **bearer** element for a **programme** is present, the **bearer** element(s) from the parent **service** define the bearer(s) for that **programme**.

The **bearer** element(s) describe the source(s) of a **programme** or **programmeEvent** when these differ from the parent element.

7.9   time element

This element is used within a **location** element of a programme or programme event, the **time** element describes an absolute time point and has the following attributes:

Attribute	Description	Type	Status
time	Billed start time of the programme. This should be the start time as advertised.	timepoint type	Required
duration	Billed duration of the programme. This should be the duration as advertised.	duration type	Required
actualTime	May be defined if the actual start time of the programme differs from the billed time (e.g. if the actual start of the programme is after a 3 minute news bulletin).	timepoint type	Optional
actualDuration	May be defined if the actual duration of the programme differs from the billed duration.	duration type	Optional

Multiple times shall only be used if the programme is identical between repeats, and the times all appear within the interval covered by the document.

For a series, the next programme should have a separate programme entry, and the programmes linked together into the same programmeGroup using the **memberOf** element.

Several examples are shown below:

EXAMPLE 1:   A single **programme** element billed to start at 11:00 with a duration of 3 hours, using the bearers of the parent service:

```
<location>
  <time time="2013-04-25T11:00:00+01:00" duration="PT3H"/>
</location>
```

EXAMPLE 2:   A single **programme** element billed to start at 14:00 with a duration of 1 hour, but actually starting after a 3 minute new bulletin, using the bearer information of the parent service:

```
<location>
  <time time="2013-04-25T14:00:00+01:00" duration="PT1H"
        actualTime="2013-04-25T14:03:00+01:00" actualDuration="PT57M" />
</location>
```

EXAMPLE 3:   A **programme** element scheduled at a single time across 3 bearers, overriding the bearers of the parent service:

```
<location>
  <time time="2013-12-05T12:00:00Z" duration="PT3H"/>
  <bearer id="dab:ce1.c185.c479.0" cost="20"
        mimeValue="audio/mpeg" offset="2000" />
  <bearer id="fm:ce1.c479.09580" cost="30" />
  <bearer id="http://media-ice.example.com/Super" cost="70"
        mimeValue="audio/aacp" bitrate="48" />
</location>
```

EXAMPLE 4:   A **programme** element scheduled to repeat at multiple times within the scope of the document, using the bearers of the parent service:

```
<location>
  <time time="2013-12-05T09:30:00Z" duration="PT5M"/>
  <time time="2013-12-05T11:30:00Z" duration="PT5M"/>
  <time time="2013-12-05T15:30:00Z" duration="PT5M"/>
</location>
```

EXAMPLE 5: A **programme** element scheduled to repeat at multiple times within the scope of the document, on a mix of bearers. The programme is simulcasted at 11:00 and 16:00 on both FM and DAB bearers, and then repeated 21:00 on FM and 22:00 on DAB:

```
<location>
  <time time="2013-12-05T11:00:00Z" duration="PT1H"/>
  <time time="2013-12-05T16:00:00Z" duration="PT1H"/>
  <bearer id="fm:ce1.c479.09580" cost="30" />
  <bearer id="dab:ce1.c185.c479.0" cost="20"
          mimeValue="audio/mpeg" offset="2000" />
</location>
<location>
  <time time="2013-12-05T21:00:00Z" duration="PT1H"/>
  <bearer id="fm:ce1.c479.09580" cost="30" />
</location>
<location>
  <time time="2013-12-05T22:00:00Z" duration="PT1H"/>
  <bearer id="dab:ce1.c185.c479.0" cost="20"
          mimeValue="audio/mpeg" offset="2000" />
</location>
```

7.10 relativeTime element

This element is used within the **location** element of a programme event, the **relativeTime** element describes a relative time point from the start of the parent programme that the programme event appears within and has the following attributes:

Attribute	Description	Type	Status
time	Billed start time offset of the programme event from the start of the programme.	duration type	Required
duration	Billed duration of the programme event. This should be the duration as advertised.	duration type	Required
actualTime	May be defined if the actual start time offset of the programme event differs from the billed time offset.	duration type	Optional
actualDuration	May be defined if the actual duration of the programme event differs from the billed duration.	duration type	Optional

7.11 onDemand element

This element specifies the means by which the programme or programme event may be acquired on-demand. It may appear in a linear schedule, indicating that the live programme is *also* available as on-demand content, or within an on-demand schedule. The **onDemand** element may appear zero or more times within a **programme** or **programmeEvent** element.

The **onDemand** element can contain the following elements:

- presentationTime

- acquisitionTime

- bearer (see clause 5.11)

A single **presentationTime** element shall be specified. At least one **bearer** element shall be specified. Zero or more **acquisitionTime** elements may be specified.

7.12 presentationTime element

This element is used within an **onDemand** element of a programme or programme event, the **presentationTime** element describes the duration of on-demand content and when it is valid to be presented, and has the following attributes:

Attribute	Description	Type	Status
start	Time from when the content may be presented to the user.	timepoint type	Optional
end	Time after which the content shall no longer be presented to the user.	timepoint type	Optional
duration	The audio duration of the content.	duration type	Required

If the **start** attribute is not specified, the content is valid to be presented immediately, up until the time given in the **end** attribute, if defined.

If the **end** attribute is not specified, the content may be presented indefinitely.

EXAMPLE: A single **programme** element within a linear schedule billed to start at 15:00 with a duration of 30 minutes, but actually starting after a 2 minute news bulletin, using the bearer information of the parent service and available on-demand for 7 days after transmission:

```
<location>
  <time time="2014-02-15T15:00:00Z" duration="PT30M"
        actualTime="2014-02-15T15:02:00Z" actualDuration="PT28M" />
</location>
...
<onDemand>
  <presentationTime start="2014-02-15T15:30:00Z"
                    end="2014-02-22T14:59:59Z" duration="PT28M" />
  <bearer id="http://downloads.bbc.co.uk/podcasts/radio4/makinghistory/
makinghistory20140215-1530a.mp4a"
        mimeValue="audio/aacp" cost="70" bitrate="48" />
  <bearer id="dab:ce1.ce15.e1cf11ec.0.00d" cost="20"
        mimeValue="audio/aacp" />
</onDemand>
```

7.13 acquisitionTime element

This element is used within an **onDemand** element of a programme or programme event within an on-demand schedule when the content is not continuously available for acquisition during the time period indicated by the **presentationTime** element. The **aquisitionTime** element describes the time windows during the time scope of the PI document in which the on-demand content can be acquired.

NOTE: If the on-demand content is continuously available during the time period indicated by the **presentationTime** element then this element is not used.

It has the following attributes:

Attribute	Description	Type	Status
start	Start of acquisition window during which the content is available.	timepoint type	Required
end	End of acquisition window during which the content is available.	timepoint type	Required

EXAMPLE: A programme element within an on-demand schedule (scope is for 2014-02-16) containing an audio file available via IP for 7 days and delivered by Filecast on DAB during two time periods (01:00 to 05:00 and 11:00 to 16:00):

```
<onDemand>
  <presentationTime start="2014-02-15T15:30:00Z"
                    end="2014-02-22T14:59:59Z" duration="PT28M" />
  <bearer id="http://downloads.bbc.co.uk/podcasts/radio4/makinghistory/
makinghistory20140215-1530a.mp4a"
          mimeValue="audio/aacp" cost="70" bitrate="48" />
</onDemand>
<onDemand>
  <presentationTime start="2014-02-15T15:30:00Z"
                    end="2014-02-22T14:59:59Z" duration="PT28M" />
  <acquisitionTime start="2014-02-16T01:00:00Z"
                   end="2014-02-16T04:59:59Z" />
  <acquisitionTime start="2014-02-16T11:00:00Z"
                   end="2014-02-16T15:59:59Z" />
<bearer id="dab:ce1.ce15.e1cf11ec.0.00d"
        mimeValue="audio/aacp" cost="20" />
</onDemand>
```

8   Group Information

8.1   Introduction

Group information allows programmes and programme events to be put into groups. These may be series, serials or just general themes. A hierarchical approach also allows groups to be member of other groups.

EXAMPLE:

```
<?xml version="1.0" encoding="UTF-8"?>
<epg xmlns="http://www.worlddab.org/schemas/spi/31"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
     xmlns:xml="http://www.w3.org/XML/1998/namespace"
     xsi:schemaLocation="http://www.worlddab.org/schemas/spi/31
http://www.worlddab.org/schemas/spi/31/spi_31.xsd" >
    <programmeGroups xml:lang="en" creationTime="2013-04-25T14:21:15+01:00" originator="Global
Radio">
      <programmeGroup id="crid://www.classicfm.com/shows/tour" shortId="3451" type="show"
numOfItems="24">
        <mediumName>Musical Tour</mediumName>
        <longName>Classic's Magical Musical Tour</longName>
        <mediaDescription>
          <shortDescription>Every Saturday night, join us on a Magical Musical Tour of all things
classical music.</shortDescription>
        </mediaDescription>
        <genre href="urn:tva:metadata:cs:ContentCS:2009:3.6.1">
          <![CDATA[ Classical music]]>
        </genre>
        <genre href="urn:tva:metadata:cs:FormatCS:2002:2.5">
          <![CDATA[ ARTISTIC PERFORMANCE]]>
        </genre>
        <genre href="urn:tva:metadata:cs:IntentionCS:2005:1.1">
          <![CDATA[ ENTERTAINMENT]]>
      </genre>
      <memberOf id="crid://www.classicfm.com/shows/weekend" shortId="122751"/>
      </programmeGroup>
    </programmeGroups>
</epg>
```

8.2   epg element

This is the root element of the Group Information (GI) document, see clause 5.13.

8.3 programmeGroups element

This element can contain zero or more **programmeGroup** elements.

Its attributes are detailed below:

Attribute	Description	Type	Status
version	Indicator for changed content; shall be incremented by one for every new version of the programmeGroups	xs:positiveInteger	Optional, defaults to 1
creationTime	Initial creation timestamp of the parent document	timepoint type	Optional
originator	Describes the originator of the parent document, up to a maximum of 180 characters	xs:string	Optional
xml:lang	Defines the default language within the document. Any elements not explicitly indicated with a different language should be assumed to use this	xml:lang	Optional, defaults to en

8.4 programmeGroup element

This is used to add additional information on a grouping of **programme**s, **programmeEvent**s or other groups. A group is identified by its CRID.

Grouped programmes and programme events will declare their grouping within their own PI document using the memberOf element.

This element can contain the following elements:

- nameGroup (shortName, mediumName, longName)

- mediaDescription

- genre

- keywords

- memberOf

- link

At least one **mediumName** element shall be specified in the default document language.

Its attributes are detailed below:

Attribute	Description	Type	Status
shortId	Short identifier	shortCRID type	Required
id	Unique identifier for the group	CRID type	Required
version	Indicator for changed content; shall be incremented by one for every new version of the programmeGroup	xs:positiveInteger	Optional, defaults to 1
type	Defines the type of the group	xs:enumeration	Optional
numOfItems	The total number of grouped items, across all documents that this group is used within	xs:positiveInteger	Optional
hide	Indicator to hide a programme group from users, chosen from: **no:** display the programme group to users **yes:** hide the programme group from users (programme group is used for grouping programmes for another application)	xs:enumeration	Optional, defaults to "no"

The **type** attribute is an enumeration used to indicate the type of grouping.

Value	Description
series	an ordered or unordered collection of programmes that is shown in a sequence (e.g. "The News Quiz" season 1).
show	a programme theme that is typically associated with a collection or series (e.g. all episodes of "The News Quiz").
programConcept	the editorial concept for a programme from which specific programme versions have been derived (e.g. the concept of "Blood Runner" as opposed to "Blood Runner - The Director's Cut" as a specific version of that concept).
magazine	a collection of individual programmes that are shown as a group because they are editorially coherent (e.g. a general sports programme with individual sub-programmes covering different events).
topic	a collection of programmes on a particular topic or theme.
programCompilation	a collection of programmes that is used to allow segments from multiple programmes to be combined in segment groups.
otherCollection	can be used for any group not defined in the preceding list where all members of the group should be acquired if the group is selected. For example, a group of channel highlights or recommendations.
otherChoice	can be used for any group not defined in the list above where only one member of the group should be acquired if the group is selected.

9   Delivery of SPI over DAB/DRM

9.1   General

The present document specifies an XML format for carrying SPI. This may be used for a number of different purposes, including exchanging information amongst service providers and provision via IP. There are a wide range of possibilities available to service providers in the way that they partition information into SPI documents. When broadcast over DAB/DRM, some constraints are placed on the content of the individual documents and each XML document is encoded into a binary format, and delivered using the MOT protocol in directory mode, as given in ETSI TS 102 371 [21].

Merging and partitioning of SPI XML documents may be performed using an XSLT customized to provide the required behaviour for a particular process.

9.2   Document conventions

9.2.1   General

The following document conventions shall be used (note that all document names are case-insensitive).

9.2.2   Service Information documents

9.2.2.1   General

One SI document per ensemble/channel named:

```
YYYYMMDD_<name>_SI.xml
```

Where YYYY represents the year, MM represents the month, DD the day and <name> is a string identifying the ensemble/channel.

9.2.2.2   DAB

The SPI XML definition no longer contains an element to represent the ensemble. This information is largely static, and service providers may find that the required information can be part of the configuration information of the binary encoding process. However, to provide backwards compatibility for service providers that wish to include more dynamic ensemble metadata in their SI document, a **serviceGroup** element describing the DAB ensemble may be used. In this case, the configuration information of the binary encoding process needs to know the **id** attribute of the **serviceGroup** in order to provide the link to the correct information.

The SI document shall also contain **service** elements for all services in the ensemble described by this SPI service. The **serviceGroup** element describing the ensemble shall not have any members defined within the SI document. The information is valid from the date indicated in the document name.

    EXAMPLE: "20140805_e1.ce15_SI.xml"

9.2.2.3   DRM

The SI document shall contain service elements for all services described by this SPI service. The information is valid from the date indicated in the document name.

    EXAMPLE: "20140805_e1c238_SI.xml"

9.2.3   Programme Information (Schedule) documents

One document per service per day named:

    YYYYMMDD_<service>_PI.xml

Where YYYY represents the year, MM represents the month, DD the day and <service> is a string identifying the service. Each PI document contains a single **schedule** element. For a linear schedule the schedule contains **programme** elements, ordered by start time, for all programmes carried on this service that are billed to start at or between 00:00:00 and 23:59:59 on the date indicated in the document name. For an on-demand schedule the schedule contains **programme** elements for all programmes carried on this Filecast Channel that can be acquired between 00:00:00 and 23:59:59 on the date indicated in the document name. It may also contain **programme** elements for programmes available only via IP.

    NOTE: The **scope** element in a schedule indicates the time period covered by the schedule; the **serviceScope** element indicates the reference to the parent service.

    EXAMPLE 1:   "20140805_e1.ce15.c221.0_PI.xml" for DAB

    EXAMPLE 2:   "20140805_e1c238_PI.xml" for DRM

9.2.4   Group Information documents

One document per ensemble/channel named:

    YYYYMMDD_<ensemble>_GI.xml

Where YYYY represents the year, MM represents the month, DD the day and <ensemble> is a string identifying the ensemble/channel. The GI document shall contain a single <programmeGroups> element.

    EXAMPLE 1:   "20140805_e1.ce15_GI.xml" for DAB

    EXAMPLE 2:   "20140805_e1c238_GI.xml" for DRM

9.3   Delivery of multimedia assets

Multimedia assets, such as logo images, may be carried in the same MOT carousel as the SPI binary encoded metadata. The correspondence between the objects in the MOT carousel and the url of the multimedia element is assured by the matching of the url with the MOT ContentName.

In the case of service logos only, the four required logo assets shall be provided in the MOT carousel, such that devices without an IP-connection can display the logos in their UI.

The service provider may also provide logos in other sizes for the service, or logos for other elements of the SPI, or audio or video clips, etc, either by reference to HTTP assets (in which case only IP-connected devices can acquire them) and/or by including the assets in the MOT carousel.

The url of the multimedia element is any string and therefore the service provider can chose freely how he names the multimedia assets.- it may be a name, such as r1logo2.png which is only available as an MOT object with the same ContentName, or it may take the form of an HTTP URL, in which case the service provider is indicating the availability of the asset via IP. In the latter case, the asset can also be an MOT object with a ContentName that begins "http://".

9.4 Filecasting

A Filecasting service may be provided by the service provider ETSI TS 103 177 [24]. The SPI only carries information about audio objects; text and video files are not referenced in the SPI. The following conventions shall be observed.

A service provider may provide a standalone Filecast Channel containing all his audio files, some of which may be associated to audio services within the same ensemble, or he may deliver an associated Filecast Channel containing all his audio files associated with a single parent audio service, either as PAD or as a packet mode component.

The Filecast Channel may be defined as a service in the SI document, in which case the **bearer** element **id** attribute shall be coded according to the bearerURI definition ETSI TS 103 270 [18] for data components, setting the UAType parameter to "Filecasting", see ETSI TS 101 756 [25].

A PI document shall exist for each Filecast Channel each day which contains a single schedule element. Whether the Filecast Channel appears in the SI document or not, the **serviceScope** element shall be used to reference the service to allow devices to quickly determine that the PI document contains an on-demand schedule. The **id** attribute shall be coded according to the bearerURI definition [18] for data components, setting the UAType parameter to "Filecasting", see [25]. A **programme** element shall be used to describe each audio file. No **location** elements shall be present. The **onDemand** element shall be present: the **presentationTime** element shall be used to indicate the period over which the programme may be presented to the user and the duration of the programme (audio file); if the content is not continuously available for the whole period indicated by the **presentationTime** element, then an **acquisitionTime** element shall be used for each time window during which the programme is available to be acquired within the scope of the PI document. Additional **onDemand** elements may be used to specify additional bearers for individual programmes (for example, if the audio file is also available via IP). However, the attributes of the **presentationTime** element shall be identical for all **onDemand** elements for the same programme.

The **memberOf** element may be used to group programmes together into programmeGroups and provide association to linear programmes.

The audio files are carried in the MOT carousel of the Filecast Channel. In order to allow the user access to these files, the MOT ContentName of each audio file shall be in the form: <shortId>.mp4a where <shortId> is the **shortId** attribute of the corresponding **programme** element describing the audio file.

10 Delivery of SPI over IP

10.1 Introduction

For devices with hybrid functionality, able to receive both broadcast and IP Services, as well as those able to receive only IP Services, methods may be made available by the service provider to receive SPI data over IP.

Documents may be acquired over IP by using the HTTP protocol (and the HTTPS extension), using URLs formatted for each document type and associated parameters. The following clauses detail how each document may be retrieved.

Guidance for effective use of the HTTP protocol for acquiring SPI data is given in clause 10.5.

Client identification may be offered by a service provider to enable delivery of tailored responses, as defined in ETSI TS 103 270 [18]. Any SI or PI document may be acquired over IP using a service that supports client identification, as detailed in clause 10.5.5.

Only SI (clause 10.2) and PI (clause 10.3) documents may be acquired by including a client identifier; any other links or resource references within these documents (e.g. IP bearers, logo URLs, web links) shall not be requested including a client identifier.

The following clauses detail how SI, PI and GI files can be discovered, and the signalling of support for client identification by the service provider.

10.2   SI document discovery

10.2.1   General

The **Service Information (SI)** document may be discovered by any of 3 methods, at least one of which shall be supported by the service provider:

- Lookup using the Authoritative FQDN.

- Link contained within the HTML content of the service's website.

- Placed in a defined location on the service website.

Once the SI document is acquired, a service may be identified from its bearer (i.e. broadcast parameters or stream URL), as detailed in clause E.5, Bearer Matching.

The service definition within the SI document may specify a **radiodns** element, giving the Authoritative FQDN and serviceIdentifier values which can be used to locate the other documents, or perform a lookup for other applications.

An SI document may contain references to broadcast bearers other than the one initially used to locate it. These bearers shall be validated using DNS. The client shall, for every broadcast bearer that it intends to use, validate the bearer using DNS in the following sequence:

1) Perform a RadioDNS lookup using the bearer to acquire the Authoritative FQDN. If the Authoritative FQDN matches that of the Authoritative FQDN of the bearer initially used to locate the SI document, the bearer is trusted.

2) If this Authoritative FQDN does not match, perform a DNS lookup of one of the application SRV records for the Authoritative FQDN resolved in step 1. If any of the returned SRV record hosts matches that of the host of the SI document URL, then the bearer is trusted.

3) Failing these previous two steps, the bearer is untrusted and shall not be used.

Bearers that cannot be resolved using DNS, e.g. streaming bearers, do not require validation.

10.2.2   Lookup using the Authoritative FQDN

10.2.2.1   Introduction

To support application discovery, a device shall be capable of determining the Authoritative FQDN for a service via the methodology defined in ETSI TS 103 270 [18].

A DNS SRV record request for the TCP protocol shall then be made against this Authoritative FQDN using the DNS SRV service name specific to this application.

The present document defines two DNS SRV service names:

- for application servers not supporting client identification: **radioepg**;

- for application servers supporting client identification: **radiospi**.

NOTE: Multiple records may be returned for both DNS SRV service names with different values. This can be used for load balancing purposes by providing different hosts/ports with different priorities/weightings. The SRV record specification IETF RFC 2782 [22] provides more detailed explanations on handling DNS SRV records.

For an application that signals support for both DNS SRV service names, clients that support client identification are recommended to prioritize the use of application servers that support client identification.

10.2.2.2 Services not supporting client identification

If at least one SRV record is successfully returned for the DNS SRV service name **radioepg**, this indicates that the server supports the SPI, accessed using the host and port indicated in the relevant SRV record, but does not support client identification.

For example, for the Authoritative FQDN **rdns.musicradio.com**, a DNS SRV record query is made to:

```
_radioepg._tcp.rdns.musicradio.com
```

Using the `nslookup` tool, this would yield the following DNS SRV record:

```
service = 0 100 80 epg.musicradio.com.
```

This indicates that SPI data can be accessed on the host **epg.musicradio.com**, port **80**.

The URL to obtain the SI document is constructed as follows:

```
<scheme>://<host>:<port>/radiodns/spi/3.1/SI.xml
```

Where `scheme` is either http or https and `host` and `port` are populated by the host and port values obtained through the DNS SRV record query.

10.2.2.3 Services supporting client identification

If at least one SRV record is successfully returned for the service name **radiospi**, this indicates that the server supports the SPI with client identification over HTTPS, accessed using the host and port indicated in the relevant SRV record.

For example, for the Authoritative FQDN **rdns.musicradio.com**, a DNS SRV record query is made to:

```
_radiospi._tcp.rdns.musicradio.com
```

Using the `nslookup` tool, this would yield the following DNS SRV record:

```
service = 0 100 443 epg.musicradio.com.
```

This indicates that SPI data can be accessed using HTTPS on the host **epg.musicradio.com**, port **443**.

The HTTPS URL to obtain the SI document is constructed as follows:

```
https://<host>:<port>/radiodns/spi/3.1/SI.xml
```

Where `host` and `port` are populated by the host and port values obtained above.

Clients may make the request including a previously acquired client identifier specific to that Authoritative FQDN.

10.2.3 Link contained within the HTML content of the service website

The URL of the SI document may be contained within the (X)HTML header section `<link>` element of any HTML pages for, or related to a radio service, likely to be discovered.

Links given with the rel attribute value of **radioepg** may use either HTTP or HTTPS URLs but shall not be provided with a client identifier.

For example, for a service with a website at http://www.example.com/london, the header section may contain:

```
<head>
    <link rel="radioepg"
          href="http://epg.example.com/radiodns/spi/3.1/SI.xml">
</head>
```

If multiple services are provided by the same service provider, similar links on each website may point to the same SI document URL, and so the document may already have been retrieved and cached by a device.

10.2.4   Placed in a defined location on the service website

The URL of the SI document may be inferred from the service's website domain, and constructed as follows:

```
<scheme>://<host>:<port>/radiodns/spi/3.1/SI.xml
```

Where scheme is either http or https and host and port are populated by the host and port of the service website.

For example, for a radio service with a website on HTTP port 80 at:

http://www.example.com

The SI document URL will be:

http://www.example.com/radiodns/spi/3.1/SI.xml

And for a radio service with a website on HTTPS port 443 at:

https://www.example.com

The SI document URL can be:

http://www.example.com/radiodns/spi/3.1/SI.xml

or:

https://www.example.com/radiodns/spi/3.1/SI.xml

The SI document URL shall not be provided with a client identifier.

10.3   PI document discovery

In order to discover PI documents for a service, the host and port for the SPI application shall first have been discovered from the Authoritative FQDN for that service.

The Authoritative FQDN may either be found by performing a RadioDNS lookup from the broadcast parameters of the current service, or by having already acquired the SI document and using the Authoritative FQDN as given by the **radiodns** element for that service, once matched.

If an Authoritative FQDN is found by either of these methods, it may then be used to find the host and port of the SPI application, using DNS SRV record lookup, see clause 10.2.2.

Where the DNS SRV record indicates support for client identification, a PI document may be acquired using HTTPS by a URL constructed from the format:

```
https://<host>:<port>/radiodns/spi/3.1/<ServiceIdentifier>/<date>_PI.xml
```

where **host** and **port** are populated by the host and port values obtained from the SRV record lookup for the SPI application.

If the DNS SRV record does not indicate support for client identification, a PI document may be acquired using either HTTP or HTTPS by a URL constructed from the format:

```
<scheme>://<host>:<port>/radiodns/spi/3.1/<ServiceIdentifier>/<date>_PI.xml
```

where `scheme` is either http or https and `host` and `port` are populated by the host and port values obtained from the SRV record lookup for the SPI application.

The value for **ServiceIdentifier** is given in ETSI TS 103 270 [18].

The **date** value represents the day for which the schedule is needed. It is populated in the format `YYYYMMDD`, for example Wednesday, 13th February 2019 would be represented as `20190213`.

PI documents discovered by this method typically contain linear schedules for the day indicated in the document name. This may be more or less than a complete 24 hours, although the majority of the schedule shall be within that day.

Note that the service may be located in a different timezone than the device requesting the PI document and, as such, the current date may not be the same for both. Because of this, a device should examine the returned PI document and determine whether the programmes contained within cover the desired time period. If not, additional requests for dates either before or after should be performed, depending on the requirements. The device may use an indication of the service location (e.g. by using the service geolocation information, if defined, or by derivation from any indicated broadcast parameters) to better predict the difference in timezones and speed up this process.

The location of additional PI documents (for example, holding purely on-demand content) may be indicated within an SI, PI or GI document using a **link** element with the **mimeValue** attribute set to `application/xml+pi`. Devices may then use the respective **uri** attribute to obtain the corresponding PI document.

For example, a link to a PI document from the **service** element within a SI document:

```
<service>
    ...
    <link uri="http://www.example.com/epg/ondemand.xml"
          mimeValue="application/xml+pi " />
    ...
</service>
```

The PI document may contain a list of on-demand programmes for a service.

A PI document may itself contain links to other PI documents, defining additional on-demand content. A device may use these additional PI documents to create a more complete view of available on-demand content.

10.4   GI document discovery

The location of a GI document may be indicated within an SI, PI or GI document using a **link** element with the **mimeValue** attribute set to `application/xml+gi`. Devices may then use the respective **uri** to obtain the corresponding GI document.

For example, a link to a GI document from the **programme** element within a PI document:

```
<programme id="crid://example.com/1190223" shortId="1190223">
      ...
      <link uri="http://www.example.com/spi/groups.xml"
          mimeValue="application/xml+gi " />
      ...
<programme/>
```

The GI document may give more detail on the group or groups that the **programme** element is a member of.

A GI document may itself contain links to other GI documents, defining additional groups. As defined in clause 8, groups have a hierarchical structure such that groups may be members of other groups, and a device may use these additional GI documents to create a more complete view of groups and their associated metadata.

10.5   Guidance for document retrieval

10.5.1   General

Because documents are returned via HTTP or HTTPS, the HTTP specification [3] should be correctly implemented. Attention is particularly drawn to the status codes section, which may be used to indicate problems and failures during attempts to retrieve documents.

In particular, the following behaviours shall be adhered to:

- a device shall correctly follow any HTTP redirects that are returned when retrieving a document;

- a device shall respect any indicated document expiry in the HTTP response;

- it is recommended that devices cache retrieved documents, as per the HTTP specification.

All document paths and document names given in the previous clauses shall be treated as *case sensitive* in order to support different web servers.

The HTTP specification allows for the client to send additional parameters in the request header to a service provider in order for a more appropriate resource to be returned. The following clauses give a few examples of HTTP request parameters that may be used for specific purposes. Note that other parameters may be sent by devices and clients, and a service provider may optionally choose to vary the response as a result.

If a different response is sent back from a service provider based on the request headers, it is recommended that the HTTP response include the **Vary** header to indicate to any intermediate caching layers that the response has been varied because of the originating request.

10.5.2 Compression

Should a client request indicate that they accept compressed documents using the **Accept-Encoding** header, the service provider may respond with a compressed document using one of the indicated encodings.

The service provider shall include the compression method of the response within the **Content-Encoding** header in the HTTP response, as per standard HTTP behaviour IETF RFC 2616 [3].

If requesting any compression, the client shall then inspect the response to determine if, and how, any returned documents have been compressed and expand accordingly.

10.5.3 Language

Should a client request indicate desired languages using the **Accept-Encoding** header, the service provider may respond with a version of the document more appropriate to that language.

The language of any element data should be correctly indicated using the **xml:lang** attribute, where applicable, as given in the specific document definition.

10.5.4 Document Size

There are no limits placed on the size of an SPI document as delivered over IP and so it is recommended that a device inspect the value of the HTTP response parameter **Content-Length** in order to determine whether it is able to fully ingest the document.

10.5.5 Client Identification

The methods for client identification when acquiring SI and PI documents are given in ETSI TS 103 270 [18], clause 9.2.2.

When making a request for a document whose location is derived from the Authoritative FQDN (SI and PI), clients that support client identification shall first perform a lookup for services supporting client identification. If none can be found, a lookup for services not supporting client identification should be made.

If a client makes a request for a document whose location is derived from the Authoritative FQDN presenting a client identifier, and the service provider returns an error indicating that the identifier is not valid, the client may make another request for the same document using a service that does not support client identification. It shall not present any client identification when making a request to a service that does not support client identification.

```
┌──────────────┐              ┌──────────────┐    ┌──────────────┐
│    Client    │              │ HTTPS Server │    │ HTTP Server  │
└──────────────┘              └──────────────┘    └──────────────┘
       │                             │                   │
       │ GET /radiodns/spi/3.1/SI.xml HTTP/1.1           │
       │ Authorization: ClientIdentifier ZZZZ987654      │
       │────────────────────────────▶│                   │
       │                             │                   │
       │◀────────────────────────────│                   │
       │        HTTP/1.1 403 Forbidden                   │
       │                             │                   │
       │ GET /radiodns/spi/3.1/SI.xml HTTP/1.1           │
       │────────────────────────────────────────────────▶│
       │                             │                   │
       │◀────────────────────────────────────────────────│
       │                             │ HTTP/1.1 200 OK   │
       │                             │                   │
```
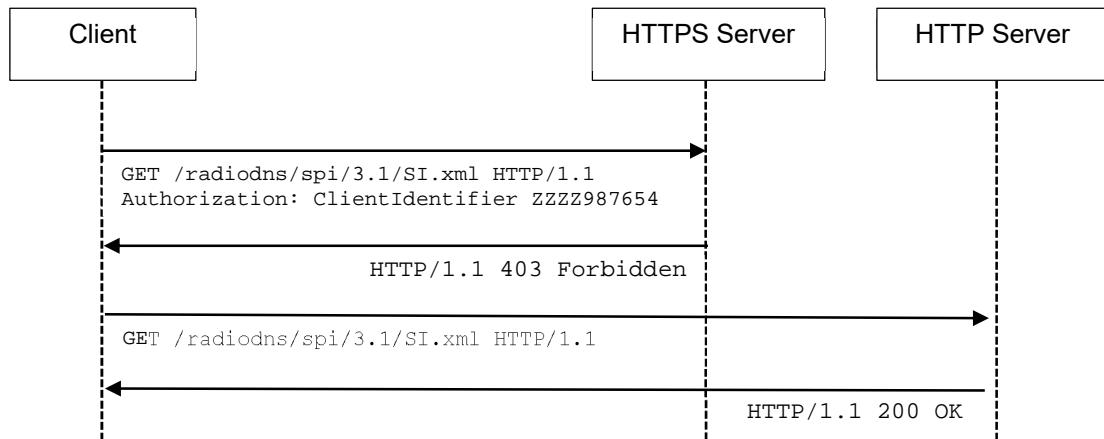
Figure 2: Example of request sequence with service that does not support client authentication

If a client makes a request for a document whose location is derived from the Authoritative FQDN without presenting a client identifier, and the service provider returns an error indicating that it requires client identification, the client may make anotherrequest for the same document using the same service and presenting its client identification.

```
┌──────────────┐                         ┌──────────────┐
│    Client    │                         │ HTTPS Server │
└──────────────┘                         └──────────────┘
       │                                        │
       │ GET /radiodns/spi/3.1/SI.xml HTTP/1.1  │
       │───────────────────────────────────────▶│
       │                                        │
       │◀───────────────────────────────────────│
       │           HTTP/1.1 401 Unauthorized    │
       │     WWW-Authenticate: ClientIdentifier │
       │ GET /radiodns/spi/3.1/SI.xml HTTP/1.1  │
       │ Authorization: ClientIdentifier ABCD12346│
       │◀───────────────────────────────────────│
       │                HTTP/1.1 200 OK         │
       │                                        │
```
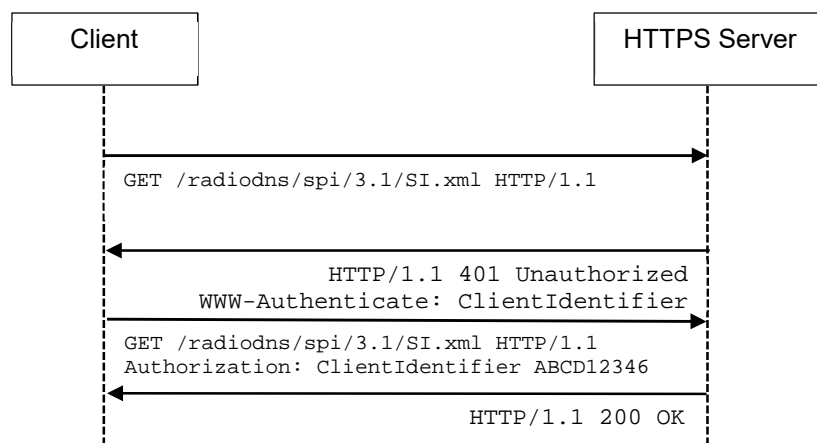
Figure 3: Example of request sequence with service that supports client authentication

If the client does not know of a valid client identifier to use for that Authoritative FQDN, it may make another request for the same document using a service that does not support client identification.

Annex A (normative):
URI schemes

A.1   URI scheme for postal addresses

This clause defines a URI scheme for defining postal addresses. The format is a URI-compliant and case insensitive string in the form:

```
addressuri  = "postal:" addressdata
addressdata = segment *("/" segment)
segment     = *urlchar
urlchar     = unreserved | escaped
```

Either the most generalized part OR the most localized part of the address should come first (depending on the postal scheme practices of the target country), separating each main fragment with a slash ("/"), through the hierarchy until the most localized/generalized resource is reached. `unreserved` and `escaped` are defined in IETF RFC 3986 [29].

NOTE: Where "/" is needed as a character in the address (e.g. "20/22 High St") it should be encoded as the hex equivalent (i.e. "%2F").

EXAMPLE: `postal:Creative%20Technologies/1%20Passage%20Street/Bristol/`
              `BS2%200JF/United%20Kingdom/`

A.2   URI scheme examples

Many URIs have been defined. The interpretation of URIs used in the link element is given in Annex C. A few examples of URIs applicable to the SPI are shown in table A.1.

Table A.1: URI scheme examples

Information	Reference	Example
Telephone and fax numbers	IETF RFC 3966 [8]	tel:+44-1737-839500
SMS	IETF RFC 5724 [23]	sms:12345?body=more%20info
Postal address	Clause A.1	postal:Kingswood%20Warren/Tadworth/Surrey/KT20%206NP/United%20Kingdom/
email	IETF RFC 6068 [10]	mailto:gilles.peterson@bbc.co.uk
internet	IETF RFC 3986 [29]	http://www.bbc.co.uk/
programme	IETF RFC 4078 [26]	crid://www.bbc.co.uk/BC81123456

Annex B (normative): spi_31.xsd

In order to validate documents against the schema below, a 1.1 XSD schema processor should be used.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema targetNamespace="http://www.worlddab.org/schemas/spi/31"
   xmlns="http://www.worlddab.org/schemas/spi/31"
   xmlns:xs="http://www.w3.org/2001/XMLSchema"
   xmlns:georss="http://www.georss.org/georss/10"
   elementFormDefault="qualified">

   <xs:import namespace="http://www.w3.org/XML/1998/namespace"
      schemaLocation="http://www.w3.org/2001/xml.xsd" />
   <xs:import namespace="http://www.georss.org/georss/10"
      schemaLocation="http://www.georss.org/xml/1.0/georss.xsd" />

   <!-- ############################################################# -->
   <!-- Common data types, groups and elements (clause 5) -->
   <!-- ############################################################# -->

   <!-- Definition of CRIDType -->
   <xs:simpleType name="CRIDType">
      <xs:restriction base="xs:anyURI">
         <xs:whiteSpace value="collapse" />
         <xs:pattern value="(c|C)(r|R)(i|I)(d|D)://.*/.*" />
      </xs:restriction>
   </xs:simpleType>

<!-- Definition of shortCRIDType -->
   <xs:simpleType name="shortCRIDType">
      <xs:restriction base="xs:integer">
         <xs:minInclusive value="0"/>
         <xs:maxInclusive value="16777215"/>
      </xs:restriction>
   </xs:simpleType>

<!-- Definition of mimeType (Multipurpose Internet Mail Extension -->
   <xs:simpleType name="mimeType">
      <xs:restriction base="xs:string">
         <xs:whiteSpace value="collapse" />
         <xs:pattern value="([!-\.0-~]{1,}/[!-\.0-~]{1,})+" />
      </xs:restriction>
   </xs:simpleType>

   <!-- Definition of timePointType -->
   <xs:simpleType name="timePointType">
      <xs:restriction base="xs:dateTime">
         <xs:pattern value="[^\-].+T[^\.]+" />
      </xs:restriction>
   </xs:simpleType>

   <!-- Definition of durationType -->
   <xs:simpleType name="durationType">
      <xs:restriction base="xs:duration">
         <xs:pattern value="PT[^\.]+" />
      </xs:restriction>
   </xs:simpleType>

   <!-- Definition of bearerURIType -->
   <xs:simpleType name="bearerURIType">
      <xs:restriction base="xs:anyURI"/>
   </xs:simpleType>

   <!-- Definition of genreType -->
   <xs:complexType name="genreType">
      <xs:simpleContent>
```

```xml
        <xs:extension base="xs:string">
            <xs:attribute name="href" type="xs:anyURI" use="required" />
            <xs:attribute name="type" use="optional" default="main">
                <xs:simpleType>
                    <xs:restriction base="xs:string">
                        <xs:enumeration value="main" />
                        <xs:enumeration value="secondary" />
                        <xs:enumeration value="other" />
                    </xs:restriction>
                </xs:simpleType>
            </xs:attribute>
            <xs:anyAttribute namespace="##other" processContents="lax" />
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>

 <!-- Definition of keywordsType -->
<xs:complexType name="keywordsType">
    <xs:simpleContent>
        <xs:restriction base="textType" />
    </xs:simpleContent>
</xs:complexType>

 <!-- Definition of textType -->
<xs:complexType name="textType" abstract="true">
    <xs:simpleContent>
        <xs:extension base="xs:string">
            <xs:attribute ref="xml:lang" use="optional" />
            <xs:anyAttribute namespace="##other" processContents="lax" />
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>

<!-- Definition of linkType -->
<xs:complexType name="linkType">
    <xs:attribute name="uri" type="xs:anyURI" use="required" />
    <xs:attribute name="mimeValue" type="mimeType" />
    <xs:attribute ref="xml:lang" use="optional" />
    <xs:attribute name="description">
        <xs:simpleType>
            <xs:restriction base="xs:string">
                <xs:maxLength value="180" />
            </xs:restriction>
        </xs:simpleType>
    </xs:attribute>
    <xs:attribute name="expiryTime" type="timePointType" />
    <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of shortNameType -->
<xs:complexType name="shortNameType">
    <xs:simpleContent>
        <xs:restriction base="textType">
            <xs:maxLength value="8" />
            <xs:anyAttribute namespace="##other" processContents="lax" />
        </xs:restriction>
    </xs:simpleContent>
 </xs:complexType>

 <!-- Definition of mediumNameType -->
<xs:complexType name="mediumNameType">
    <xs:simpleContent>
        <xs:restriction base="textType">
            <xs:maxLength value="16" />
            <xs:anyAttribute namespace="##other" processContents="lax" />
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>

 <!-- Definition of longNameType -->
```

```xml
<xs:complexType name="longNameType">
   <xs:simpleContent>
      <xs:restriction base="textType" >
         <xs:maxLength value="128" />
         <xs:anyAttribute namespace="##other" processContents="lax" />
      </xs:restriction>
   </xs:simpleContent>
</xs:complexType>

 <!-- Definition of serviceNameGroup -->
<xs:group name="serviceNameGroup">
   <xs:sequence>
      <xs:element name="shortName" type="shortNameType" maxOccurs="unbounded" />
      <xs:element name="mediumName" type="mediumNameType" maxOccurs="unbounded" />
      <xs:element name="longName" type="longNameType" minOccurs="0"
maxOccurs="unbounded" />
   </xs:sequence>
</xs:group>

 <!-- Definition of scheduleNameGroup -->
<xs:group name="scheduleNameGroup">
   <xs:sequence>
      <xs:element name="shortName" type="shortNameType" minOccurs="0"
maxOccurs="unbounded" />
      <xs:element name="mediumName" type="mediumNameType" maxOccurs="unbounded" />
      <xs:element name="longName" type="longNameType" minOccurs="0"
maxOccurs="unbounded" />
    </xs:sequence>
</xs:group>

 <!-- Definition of shortDescriptionType -->
<xs:complexType name="shortDescriptionType">
   <xs:simpleContent>
      <xs:restriction base="textType">
         <xs:maxLength value="180" />
         <xs:anyAttribute namespace="##other" processContents="lax" />
      </xs:restriction>
   </xs:simpleContent>
</xs:complexType>

 <!-- Definition of longDescriptionType -->
<xs:complexType name="longDescriptionType">
   <xs:simpleContent>
      <xs:restriction base="textType">
         <xs:maxLength value="1200" />
         <xs:anyAttribute namespace="##other" processContents="lax" />
      </xs:restriction>
   </xs:simpleContent>
</xs:complexType>

 <!-- Definition of descriptionGroup -->
<xs:group name="descriptionGroup">
   <xs:sequence>
      <xs:element name="shortDescription" type="shortDescriptionType" minOccurs="0"
maxOccurs="unbounded" />
      <xs:element name="longDescription" type="longDescriptionType" minOccurs="0"
maxOccurs="unbounded" />
   </xs:sequence>
</xs:group>

 <!-- Definition of multimediaType -->
<xs:complexType name="multimediaType">
   <xs:attribute ref="xml:lang" use="optional" />
   <xs:attribute name="url" type="xs:string" use="required" />
   <xs:attribute name="mimeValue" type="mimeType" />
   <xs:attribute name="type" type="logoType" use="optional" />
   <xs:attribute name="width" type="xs:positiveInteger"/>
   <xs:attribute name="height" type="xs:positiveInteger" />
   <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>
```

```xml
<!-- Definition of logoType -->
<xs:simpleType name="logoType">
   <xs:restriction base="xs:string">
      <xs:enumeration value="logo_unrestricted" />
      <xs:enumeration value="logo_colour_square" />
      <xs:enumeration value="logo_colour_rectangle" />
   </xs:restriction>
</xs:simpleType>

<!-- Definition of mediaDescriptionType -->
<xs:complexType name="mediaDescriptionType">
   <xs:choice>
      <xs:group ref="descriptionGroup" />
      <xs:element name="multimedia" type="multimediaType" />
   </xs:choice>
   <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of memberOfType -->
<xs:complexType name="memberOfType">
   <xs:attribute name="id" type="CRIDType" use="required" />
   <xs:attribute name="shortId" type="shortCRIDType" use="required" />
   <xs:attribute name="index" type="xs:positiveInteger" use="optional" />
   <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of bearerType -->
<xs:complexType name="bearerType">
   <xs:sequence>
      <xs:element name="geolocation" type="geolocationType" minOccurs="0"
maxOccurs="unbounded" />
   </xs:sequence>
  <xs:attribute name="id" type="bearerURIType" use="required" />
   <xs:attribute name="cost" type="xs:nonNegativeInteger" use="required" />
   <xs:attribute name="mimeValue" type="mimeType" />
   <xs:attribute name="bitrate" type="xs:nonNegativeInteger" />
   <xs:attribute name="offset" type="xs:nonNegativeInteger" default="0" />
   <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of geolocationType -->
<xs:complexType name="geolocationType">
   <xs:choice minOccurs="0" maxOccurs="unbounded">
      <xs:element name="country" type="xs:string" minOccurs="0" maxOccurs="unbounded"
/>
      <xs:element name="point" type="georss:doubleList" minOccurs="0"
maxOccurs="unbounded" />
      <xs:element name="polygon" type="georss:doubleList" minOccurs="0"
maxOccurs="unbounded" />
      <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded" />
   </xs:choice>
   <xs:attribute ref="xml:id" use="optional" />
   <xs:attribute name="ref" type="xs:IDREF" use="optional" />
   <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of epg element -->
<xs:element name="epg">
   <xs:complexType>
      <xs:choice minOccurs="0" maxOccurs="unbounded">
         <xs:element name="programmeGroups" type="programmeGroupsType" />
         <xs:element name="schedule" type="scheduleType" />
      </xs:choice>
      <xs:attribute ref="xml:lang" default="en" />
      <xs:anyAttribute namespace="##other" processContents="lax" />
   </xs:complexType>
</xs:element>
```

```xml
<!-- ################################################################### -->
<!-- Service Information (clause 6) -->
<!-- ################################################################### -->

<!-- Definition of serviceInformation element -->
<xs:element name="serviceInformation">
    <xs:complexType>
        <xs:sequence maxOccurs="unbounded">
            <xs:element name="services" type="servicesType"  minOccurs="0" />
            <xs:element name="serviceGroups" type="serviceGroupsType" minOccurs="0" />
            <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="version" type="xs:positiveInteger" default="1" />
        <xs:attribute name="creationTime" type="timePointType" />
        <xs:attribute name="originator" type="originatorType" />
        <xs:attribute name="serviceProvider" type="originatorType"/>
        <xs:attribute name="terms" type="xs:anyURI" />
        <xs:attribute ref="xml:lang" default="en" />
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>
</xs:element>

 <!-- Definition of originatorType -->
<xs:simpleType name="originatorType">
    <xs:restriction base="xs:string">
        <xs:maxLength value="128" />
    </xs:restriction>
</xs:simpleType>

<!-- Definition of servicesType -->
<xs:complexType name="servicesType">
    <xs:sequence>
        <xs:element name="serviceProvider" type="serviceProviderType" minOccurs="0"/>
        <xs:element name="service" type="serviceType" minOccurs="0"
maxOccurs="unbounded"/>
        <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of serviceProviderType -->
<xs:complexType name="serviceProviderType">
    <xs:sequence>
        <xs:group ref="serviceNameGroup" maxOccurs="unbounded" />
        <xs:element name="mediaDescription" type="mediaDescriptionType" minOccurs="0"
maxOccurs="unbounded" />
        <xs:element name="keywords" type="keywordsType" minOccurs="0"
maxOccurs="unbounded" />
        <xs:element name="link" type="linkType" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="geolocation" type="geolocationType" minOccurs="0" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of serviceType -->
<xs:complexType name="serviceType">
    <xs:sequence>
        <xs:group ref="serviceNameGroup" maxOccurs="unbounded" />
        <xs:element name="mediaDescription" type="mediaDescriptionType" minOccurs="0"
maxOccurs="unbounded" />
        <xs:element name="genre" type="genreType" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="keywords" type="keywordsType" minOccurs="0"
maxOccurs="unbounded" />
        <xs:element name="link" type="linkType" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="bearer" type="bearerType" minOccurs="0" maxOccurs="unbounded"
```

```xml
/>
            <xs:element name="radiodns" type="radiodnsType" minOccurs="0" />
            <xs:element name="geolocation" type="geolocationType" minOccurs="0" />
            <xs:element name="serviceGroupMember" type="serviceGroupMemberType"
minOccurs="0" maxOccurs="unbounded" />
             <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="version" type="xs:positiveInteger" default="1"/>
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>

    <!-- Definition of radiodnsType -->
    <xs:complexType name="radiodnsType">
        <xs:attribute name="fqdn" type="xs:string" use="required" />
        <xs:attribute name="serviceIdentifier" use="required">
            <xs:simpleType>
                <xs:restriction base="xs:string">
                    <xs:pattern value="[a-z0-9]*" />
                    <xs:minLength value="1" />
                    <xs:maxLength value="16" />
                </xs:restriction>
            </xs:simpleType>
        </xs:attribute>
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>

    <!-- Definition of serviceGroupMemberType -->
    <xs:complexType name="serviceGroupMemberType">
        <xs:attribute name="id" type="xs:string" use="required" />
    </xs:complexType>

    <!-- Definition of serviceGroupsType -->
    <xs:complexType name="serviceGroupsType">
        <xs:sequence>
            <xs:element name="serviceGroup" type="serviceGroupType" maxOccurs="unbounded" />
            <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>

    <!-- Definition of serviceGroupType -->
    <xs:complexType name="serviceGroupType">
        <xs:sequence>
            <xs:group ref="serviceNameGroup" maxOccurs="unbounded" />
            <xs:element name="mediaDescription" type="mediaDescriptionType" minOccurs="0"
maxOccurs="unbounded" />
            <xs:element name="genre" type="genreType" minOccurs="0" maxOccurs="unbounded" />
            <xs:element name="keywords" type="keywordsType" minOccurs="0"
maxOccurs="unbounded" />
            <xs:element name="link" type="linkType" minOccurs="0" maxOccurs="unbounded" />
            <xs:element name="geolocation" type="geolocationType" minOccurs="0" />
            <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded" />
        </xs:sequence>
        <xs:attribute name="id" type="xs:string" use="required" />
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>


    <!-- ################################################################### -->
    <!-- Programme Information (clause 7) -->
    <!-- ################################################################### -->

    <!-- Definition of scheduleType -->
    <xs:complexType name="scheduleType">
        <xs:sequence>
            <xs:element name="scope" type="scopeType" minOccurs="0" />
            <xs:element name="programme" type="programmeType" minOccurs="0"
```

```
maxOccurs="unbounded" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0
maxOccurs="unbounded" />
    </xs:sequence>
    <xs:attribute name="creationTime" type="timePointType" />
    <xs:attribute name="originator" type="originatorType" />
    <xs:attribute name="version" type="xs:positiveInteger" default="1" />
    <xs:attribute ref="xml:lang" default="en" />
    <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of scopeType -->
<xs:complexType name="scopeType">
    <xs:sequence>
        <xs:element name="serviceScope" type="serviceScopeType" minOccurs="0
maxOccurs="unbounded" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0
maxOccurs="unbounded" />
    </xs:sequence>
    <xs:attribute name="startTime" type="timePointType" use="required" />
    <xs:attribute name="stopTime" type="timePointType" use="required" />
    <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of serviceScopeType -->
<xs:complexType name="serviceScopeType">
    <xs:attribute name="id" type="bearerURIType" use="required"/>
</xs:complexType>

<!-- Definition of programmeType -->
<xs:complexType name="programmeType">
    <xs:sequence>
        <xs:group ref="scheduleNameGroup" maxOccurs="unbounded" />
        <xs:element name="location" type="locationType" minOccurs="0
maxOccurs="unbounded" />
        <xs:element name="onDemand" type="onDemandType" minOccurs="0
maxOccurs="unbounded" />
        <xs:element name="mediaDescription" type="mediaDescriptionType" minOccurs="0
maxOccurs="unbounded" />
        <xs:element name="genre" type="genreType" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="keywords" type="keywordsType" minOccurs="0
maxOccurs="unbounded" />
        <xs:element name="memberOf" type="memberOfType" minOccurs="0
maxOccurs="unbounded" />
        <xs:element name="link" type="linkType" minOccurs="0" maxOccurs="unbounded" />
        <xs:element name="programmeEvent" type="programmeEventType" minOccurs="0
maxOccurs="unbounded" />
        <xs:any namespace="##other" processContents="lax" minOccurs="0
maxOccurs="unbounded" />
    </xs:sequence>
    <xs:attribute name="shortId" type="shortCRIDType" use="required" />
    <xs:attribute name="id" type="CRIDType" use="required" />
    <xs:attribute name="version" type="xs:positiveInteger" default="1"/>
    <xs:attribute name="recommendation" type="recommendationType" default="no" />
    <xs:attribute name="broadcast" type="broadcastType" default="on-air" />
    <xs:attribute ref="xml:lang" use="optional" />
    <xs:anyAttribute namespace="##other" processContents="lax" />
</xs:complexType>

<!-- Definition of recommendationType -->
<xs:simpleType name="recommendationType">
    <xs:restriction base="xs:NMTOKEN">
        <xs:enumeration value="yes"/>
        <xs:enumeration value="no"/>
    </xs:restriction>
</xs:simpleType>

<!-- Definition of broadcastType -->
<xs:simpleType name="broadcastType">
    <xs:restriction base="xs:NMTOKEN">
```

```xml
            <xs:enumeration value="on-air" />
            <xs:enumeration value="off-air" />
        </xs:restriction>
    </xs:simpleType>

    <!-- Definition of programmeEventType -->
    <xs:complexType name="programmeEventType">
        <xs:sequence>
            <xs:group ref="scheduleNameGroup" maxOccurs="unbounded" />
            <xs:element name="location" type="locationType" minOccurs="0"
maxOccurs="unbounded" />
            <xs:element name="onDemand" type="onDemandType" minOccurs="0"
maxOccurs="unbounded" />
            <xs:element name="mediaDescription" type="mediaDescriptionType" minOccurs="0"
maxOccurs="unbounded" />
            <xs:element name="genre" type="genreType" minOccurs="0" maxOccurs="unbounded" />
            <xs:element name="keywords" type="keywordsType" minOccurs="0"
maxOccurs="unbounded" />
            <xs:element name="memberOf" type="memberOfType" minOccurs="0"
maxOccurs="unbounded" />
            <xs:element name="link" type="linkType" minOccurs="0" maxOccurs="unbounded" />
            <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="shortId" type="shortCRIDType" use="required" />
        <xs:attribute name="id" type="CRIDType" use="required" />
        <xs:attribute name="version" type="xs:positiveInteger" default="1"/>
        <xs:attribute name="recommendation" type="recommendationType" default="no" />
        <xs:attribute name="broadcast" type="broadcastType" default="on-air" />
        <xs:attribute ref="xml:lang" use="optional" />
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>

    <!-- Definition of locationType -->
    <xs:complexType name="locationType">
        <xs:sequence>
            <xs:choice>
                <xs:element name="time" type="timeType" maxOccurs="unbounded" />
                <xs:element name="relativeTime" type="relativeTimeType"
maxOccurs="unbounded" />
            </xs:choice>
            <xs:element name="bearer" type="bearerType" minOccurs="0"
maxOccurs="unbounded" />
        </xs:sequence>
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>

    <!-- Definition of timeType -->
    <xs:complexType name="timeType">
        <xs:attribute name="time" type="timePointType" use="required" />
        <xs:attribute name="duration" type="durationType" use="required" />
        <xs:attribute name="actualTime" type="timePointType" />
        <xs:attribute name="actualDuration" type="durationType" />
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>

    <!-- Definition of relativeTimeType -->
    <xs:complexType name="relativeTimeType">
        <xs:attribute name="time" type="durationType" use="required" />
        <xs:attribute name="duration" type="durationType" use="required" />
        <xs:attribute name="actualTime" type="durationType" />
        <xs:attribute name="actualDuration" type="durationType" />
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>

    <!-- Definition of onDemandType -->
    <xs:complexType name="onDemandType">
        <xs:sequence>
            <xs:element name="presentationTime" type="presentationTimeType" />
            <xs:element name="acquisitionTime" type="acquisitionTimeType" minOccurs="0"
```

```xml
maxOccurs="unbounded" />
          <xs:element name="bearer" type="bearerType" minOccurs="1" maxOccurs="unbounded"
/>
      </xs:sequence>
   </xs:complexType>

   <!-- Definition of presentationTimeType -->
   <xs:complexType name="presentationTimeType">
      <xs:attribute name="start" type="timePointType" use="optional" />
      <xs:attribute name="end" type="timePointType" use="optional" />
      <xs:attribute name="duration" type="durationType" use="required" />
   </xs:complexType>

   <!-- Definition of acquisitionTimeType -->
   <xs:complexType name="acquisitionTimeType">
      <xs:attribute name="start" type="timePointType" use="required" />
      <xs:attribute name="end" type="timePointType" use="required" />
   </xs:complexType>


   <!-- ############################################################### -->
   <!-- Group Information (clause 8) -->
   <!-- ############################################################### -->

   <!-- Definition of programmeGroupsType -->
   <xs:complexType name="programmeGroupsType">
      <xs:sequence>
         <xs:element name="programmeGroup" type="programmeGroupType" minOccurs="0"
maxOccurs="unbounded" />
         <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded" />
      </xs:sequence>
      <xs:attribute name="version" type="xs:positiveInteger" default="1"/>
      <xs:attribute name="creationTime" type="timePointType" />
      <xs:attribute name="originator" type="originatorType" />
      <xs:attribute ref="xml:lang" use="optional" />
      <xs:anyAttribute namespace="##other" processContents="lax" />
   </xs:complexType>

   <!-- Definition of programmeGroupType -->
   <xs:complexType name="programmeGroupType">
      <xs:sequence>
         <xs:group ref="scheduleNameGroup" maxOccurs="unbounded" />
         <xs:element name="mediaDescription" type="mediaDescriptionType" minOccurs="0"
maxOccurs="unbounded" />
         <xs:element name="genre" type="genreType" minOccurs="0" maxOccurs="unbounded"/>
         <xs:element name="keywords" type="keywordsType" minOccurs="0"
maxOccurs="unbounded"/>
         <xs:element name="memberOf" type="memberOfType" minOccurs="0"
maxOccurs="unbounded"/>
         <xs:element name="link" type="linkType" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
      <xs:attribute name="shortId" type="shortCRIDType" use="required" />
      <xs:attribute name="id" type="CRIDType" use="required" />
      <xs:attribute name="version" type="xs:positiveInteger" default="1" />
      <xs:attribute name="type" type="programmeGroupTypeType" />
      <xs:attribute name="numOfItems" type="xs:positiveInteger" />
      <xs:attribute name="hide" type="hideType" default="no" />
   </xs:complexType>

   <!-- Definition of programmeGroupTypeType -->
   <xs:simpleType name="programmeGroupTypeType">
      <xs:restriction base="xs:NMTOKEN">
         <xs:enumeration value="series" />
         <xs:enumeration value="show" />
         <xs:enumeration value="programConcept" />
         <xs:enumeration value="magazine" />
         <xs:enumeration value="topic" />
         <xs:enumeration value="programCompilation" />
         <xs:enumeration value="otherCollection" />
```

```xml
            <xs:enumeration value="otherChoice" />
        </xs:restriction>
    </xs:simpleType>

    <!-- Definition of hideType -->
    <xs:simpleType name="hideType">
        <xs:restriction base="xs:NMTOKEN">
            <xs:enumeration value="yes"/>
            <xs:enumeration value="no"/>
        </xs:restriction>
    </xs:simpleType>

</xs:schema>
```

Annex C (informative):
Guidance for usage of linked content

C.1   General

The **link** element may be used within SI and PI documents in order to indicate additional *linked* content from the parent element. This content is an additional external resource, which devices may make use of.

The use of an external resource depends on factors such as whether the device is capable of making use of the resource, and possible user choice or preferences. The resource may be shown/indicated to a user or it may be ingested as part of a process on the device.

No specific behaviour is mandated, but the following guidance is provided as to ways in which a device may use this information, including, but not limited to:

- Service/serviceGroup/programme website links.

- Podcasts/on-demand content.

- External identities for the Service/serviceGroup/programme.

The attributes of the link should be used in the following manner:

Attribute	Description
uri	The link uri may be deconstructed and examined to infer context, particularly by using the URI Scheme (HTTP, FTP, etc.) to determine a particular protocol. Depending on the protocol, the rest of the link uri may then be examined for additional context. For example, an HTTP URI contains a host that may be used to infer the context of the link.
mimeValue	The MIME type may be used to gather more context on the format of the resource, and potentially what it represents.
xml:lang	Indicates the language of the linked resource. This is most useful when the same link is being provided in different languages (i.e. for multilingual services/programmes/groups), to be used to select the most appropriate from a group of similar links.
description	Not machine-readable.
expiryTime	Only used to determine validity.

The following clauses give guidance for specific examples.

C.2   Website links examples

C.2.1   Programme links example

Showing a link to programme information on the station website, and a microsite for a specific feature within the programme:

```
<programme id="crid://thisisglobal.com/1190223" shortId="1190223">
  ...
  <link uri="http://www.capitalfm.com/on-air/breakfast-show" />
  <link uri="http://www.capitalfm.com/timetunnel" description="Can you guess
the year?" />
  ...
<programme/>
```

In the above example, no MIME Type is specified on either link. However, context can still be inferred from the URI scheme (HTTP), such that a device may reasonably expect the content to be displayable in a Web Browser.

C.2.2   Service links example

Showing the station homepage, and entry on Wikipedia:

```
<service>
  ...
  <link uri="http://www.capitalfm.com/london" mimeValue="text/html"/>
  <link uri="http://en.wikipedia.org/wiki/Capital_London"
mimeValue="text/html" xml:lang="en"/>
  ...
</service>
```

The links should be ordered in such a way that the most significant link appears first, for the purposes of disambiguating between otherwise equally significant links.

For example, a service provider may order the list in such a way that the first link with an HTTP scheme to their own domain refers to their Company, Service, Brand or Programme website.

C.3   Podcasts/on-demand content

Podcast and on-demand information in additional formats may be specified as a link from a Service, Programme or Group.

A device may interpret linked content as a podcast from its MIME type. For example, a programme linking to an RSS and an Atom feed:

Podcasts and On-Demand content may be specified in any number of additional formats, not limited to RSS and Atom, available over a range of protocols/methods. A device may select appropriate feeds to use based on a number of factors, such as the indicated MIME Type (if given), structure of the URI, or the result of acquiring the feed and examining it.

C.4   External identities

A Service, Programme or Group could have identities external to the service provider, e.g. within a directory service or aggregator.

Providing the link between this identity and the service provider's own service definition enables the metadata in both these places to be associated, or to use the combined information in a specific way such as within an application on a mobile device.

The identity should be formatted in a way that is specific to the provider of that identity, typically as a URL. For example, a service aggregator may hold information for a particular Service as indicated in the SI document:

```
<link uri="http://www.musicradio.com/directory/service-16859"
mimeValue="text/html"  />
```

Since this is the URL as supplied by the aggregator, it will be formatted in a way known to that aggregator – in this case, including a numeric identifier.

When the aggregator ingests the service provider's SI document, it will be able to link from its own representation of the service to the service provider's by identifying the service with this link. In this way, the URL is acting as a 'Foreign Key' between the two sources of information for that service.

A service may have multiple of these external identifiers, thereby allowing a network of identities between different providers to be linked together.

A URL such as the one shown in the above example may also be used as a normal HTTP URL to be displayed in a web browser on the device, in this case showing the aggregator's page on the service.

If the aggregator does not have the means to provide a URL containing the identity of the service, a URI may be specified, for example:

```
<link uri="musicradio:16859" />
```

As in the first example, the URI may be used as a key between the service provider and the Aggregator. However, the device would need to know how to interpret this URI syntax, perhaps by launching an application capable of handling the URI.

C.5 Contact details

A Service, Programme or Group could have associated contact details, such as a Postal Address IETF RFC 3191 [9], telephone number IETF RFC 3966 [8], email IETF RFC 6068 [10] or SMS short code IETF RFC 2046 [11], combined with the protocol defined in IETF RFC 4289 [12]. For example:

```
<link uri="postal:Global%20Radio/30%20Leicester%20Square/London/WC2H%207LA" />
<link uri="tel:+44-020-77666000" />
<link uri="sms:83958" />
```

Annex D (informative):
Logo usage

D.1   Introduction

This annex gives specific requirements to service providers on effective signalling of logos within an SI document, in order to allow device manufacturers to design user interfaces that provide a consistent and meaningful experience for the end user.

Modern devices are more likely to be supplied with highly graphical colour touchscreen interfaces, greatly expanding the scope for displaying station branding in a richer and more engaging way. Rather than a simple list of station names, logos and branding may assist in user discovery.

The provision of logos for each service is highly recommended for broadcast SPI and mandated for IP SPI. When logos are provided the required sizes are appropriate to various device use cases, including:

- Display of station logo in a selection list.

- "Splash" screen used to display on a device while additional information is being acquired, or as a default.

- Display of station logo in a list of presets.

- Display of station logo to be used as a visual representation of the station (e.g. to be (displayed as part of a social networking application action)).

They also take into account the possible devices upon which this may be displayed, including but not limited to:

- Car radios.

- Portable devices (including integration within Mobile Phones).

- Tabletop radios.

- Tablets.

- Connected TV devices.

- Web Browsers.

Logos may also be provided for many other elements of the SPI, including ensembles, service groups, programmes and programme events. No mandatory provisions are made for these logos, but it is recommended that the sizes and image formats should be chosen considering their likely usage.

D.2   Basic implementation

The basic requirements for logo provision is described in clause 6.5. Table D.1 provides a guide to the appearance of example logos at the required sizes.

Table D.1: Example logo sizes and parameters

Size (width x height in pixels)	Example	Size for PNG (in kB)
32x32		0,8
112x32		1,3
128x128		4,9
320x240		14,7
600x600		21,7

A minimal SI document supporting acquisition by IP and, after transform and binary encoding, delivery by broadcast of the required logos is shown below:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<serviceInformation xmlns="http://www.worlddab.org/schemas/spi/31"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://www.worlddab.org/schemas/spi/31
http://www.worlddab.org/schemas/spi/31/spi_31.xsd"
   creationTime="2014-04-25T00:05:31+01:00" originator="Global Radio"
   xml:lang="en">
   <services>
      <service>
         <shortName>Capital</shortName>
         <mediumName>Capital FM</mediumName>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/32x32.png"
                        type="logo_colour_square" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/112x32.png"
                        type="logo_colour_rectangle" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/128x128.png"
                        type="logo_unrestricted" mimeValue="image/png" height="128" width="128" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/320x240.png"
                        type="logo_unrestricted" mimeValue="image/png" height="240" width="320" />
         </mediaDescription>
         <mediaDescription>
            <multimedia url="http://owdo.thisisglobal.com/2.0/id/25/logo/600x600.jpg"
                        type="logo_unrestricted" mimeValue="image/jpeg" height="600" width="600" />
         </mediaDescription>
         <genre href="urn:tva:metadata:cs:ContentCS:2004:3.6.10" />
         <bearer id="dab:ce1.c185.c479.0" mimeValue="audio/mpeg" offset="2000" cost="20" />
      </service>
   </services>
</serviceInformation>
```

Since the SI document is designed for both IP and broadcast, five logos are specified for the service. The broadcast requirements mean that the smaller four logos are PNG images. All five logos are made available at their corresponding HTTP location; the four smaller logos are also carried in the MOT carousel, the ContentNames being set as the HTTP URL for compactness. It is up to the service provider to decide whether to make additional logos in other sizes available via either route.

For IP acquisition, the SI document is 1,8 kB.

For broadcast, the transformed SI document is binary encoded to around 300 bytes and delivered using the MOT protocol. The logo assets are carried in the same MOT carousel (at least the four broadcast required sizes) allowing logos to be acquired by devices which do not have an IP connection.

D.3 Extended implementation

D.3.1 General

Service providers may choose, in addition to the basic implementation, to provide a greater range of logo sizes. By doing so, a service provider may overcome the restriction in the device of only being able to select the *closest* match for their display size.

For extended implementations, HTTP content negotiation may be used between an IP-connected device and the server providing the station logos, using no additional information in the SI document. Use of the SI document to signal and/or convey station logo images can therefore scale in terms of service provider support for different classes of device.

D.3.2   Content negotiation

Upon acquisition and parsing of the SI document, the device will select an HTTP-locatable image (i.e. given as a URL with the **http** scheme) with dimensions closest to its own native screen size.

The device will then make an HTTP request to this resource, adding the following headers to its HTTP request.

Table D.2: HTTP request headers

Name	Value	Required
Display-Width	Display width in pixels	No
Display-Height	Display height in pixels	No
Display-PPI	Display pixel density in Pixels Per Inch (PPI)	No (default 72)

It is recommended that the standard HTTP request header **User-Agent** also be sent by the device when acquiring a logo. This should describe the general device profile, as in the HTTP specification, but cannot contain any user identifiable information.

These values *may* be used by the server providing the resource as additional information to select the most appropriate resource.

The resultant image returned may exactly match the requested dimensions, or may be close to these values, dependent on the ability of the service provider to supply exact image sizing. The service provider may decide to ignore the indicated device screen dimensions entirely, and will return an image of the dimensions signalled in the SI document for this URL, as these values are deemed to be the *default* dimensions.

The device will therefore examine the dimensions of the returned image as they may not match the device screen dimensions. Padding and scaling in order to best fit the device may be performed, although the original aspect ratio of the image needs to be preserved.

D.3.3   Caching

It is recommended that the device use standard HTTP methods for checking whether a resource has changed since last acquisition, e.g. by using the **If-Modified-Since** parameter in the HTTP request for the resource. Similarly, it is recommended that the service provider respond to such requests in the expected way with the appropriate HTTP status code if the resource has not changed.

Devices also follow the standard rules for managing assets within an MOT directory, such that if the service provider signals an updated logo asset either in the MOT directory itself, or as an updated SI document containing HTTP URLs to the logo asset, the device reacquires the image.

D.4   Logo scaling

The same logo is represented in different ways to most be most appropriate to the dimensions required. When preparing logos to fulfil the required sizes, it is not recommended to take a single image and simply scale this up or down.

For example, an image of 128x128 may look acceptable on a device with that same screen resolution:

If this is scaled down to 32x32 to be shown on a station list view, any text on the original image would be unreadable:

It is incorrect to assume that an image will scale to any dimension and its content remain equally as meaningful. In the above example, a simplified version of the above station logo may be more appropriate:

Annex E (informative):
Broadcast/IP service following

E.1 General

For hybrid devices, intelligent switching between broadcast and streaming can be used to provide the device with a common experience between different bearers of the same service, appropriate to the situation. It can also optimize the costs to both device and service provider, associated with the different bearers, e.g. by using broadcast instead of IP streaming.

Service following can be defined globally in the SI document, or on a per-programme basis in the relevant PI document if available.

E.2 Initial bearer selection

For a situation where a device is not already receiving a service, it is up to the device how it selects an initial bearer. It is recommended that this be a function of device preference, user preference and indicated bearer cost.

A device should determine the relative preference between certain bearers based on its own functionality (e.g. what bearers the device is able to use, available codecs).

A device may wish to expose a degree of choice of bearer to the user and allow them to indicate a preference to a particular bearer. This may also be an indirect consequence of a user action - for example, if a user deactivates Wi-Fi functionality on a mobile/cellular network phone, the device may decide to use FM instead of IP streaming over mobile data.

A **cost** is indicated against each bearer for a service, as determined by the service provider and indicates an order of preference *in respect to the service provider*. This is a relative non-negative non-zero integer, which may be used to select the *most preferred* bearer from the bearer list. The bearer with the lower cost value should be preferred when performing a comparison.

A device should start from the most preferred bearer and work down the list until it is deemed a successful reception has been made. A device should apply its own rules to determine what constitutes a successful reception, such as whether the broadcast signal quality is sufficiently strong, or whether an IP connection can be made and the available bandwidth is sufficient.

E.3 Bearer switching behaviour

Service following information provided in the Service Information (SI) document enables a device to consider a transition to IP streaming of the current service when all possible service following possibilities in the broadcast domain for the current service have been exhausted. It also allows a device receiving a service through IP streaming to consider switching to the same service on a broadcast bearer.

In all cases, the provided bearer cost should be considered in the decision to switch between broadcast and IP, and when deciding which of either broadcast or IP to switch to if multiple equitable options are available.

Information provided in the SI is not intended to be used in preference to information provided by a broadcast platform, such as AF information in RDS-FM and service following information in DAB. Where the broadcast platform allows signalling of similar services, such as soft links in DAB, the device may decide whether to offer the user a switch to the same service on IP streaming, or one of the alternative similar services specified in the broadcast domain.

For example, consider a service being received on DAB. DAB service following provides alternative sources for the current service on other ensembles and on FM radio, but the device finds that none are of an acceptable signal quality.

The device inspects the bearer information provided in the SI document and finds an appropriate IP streaming bearer for the current service, and switches to that. The device continues to monitor the broadcast signals available to it, and finds at a later time that the same service is now available with equitable signal qualities on both DAB and FM.

The service provider has specified a lower cost for the DAB bearer, so the device switches from IP Streaming to DAB. Devices should implement appropriate strategies for managing the frequency and duration of switches between IP and broadcast.

The value for an **offset** for a particular bearer, in milliseconds relative to other bearers in the same SI document, may allow the device to implement functionality to attempt co-timing when switching bearers, or to assist a decision as to the most appropriate bearer. It should be noted that any offset is indicative, rather than a precise value.

E.4 Implementation

The following matrix gives the conditions under which service following to another bearer may or may not be implemented by a device.

SI available and bearers defined for this service	PI available	Bearers defined in current on-air programme	Device behaviour
N	N	-	Service following not allowed
Y	N	-	Service following allowed to bearers defined for this service, within the SI
Y	Y	N	Service following allowed to bearers defined for this service, within the SI
Y	Y	Y	Service following allowed to bearers defined for the current programme, within the **location** element of the PI
N	Y	Y	Service following allowed to bearers defined for the current programme, within the **location** element of the PI
N	Y	N	Service following not allowed

Available refers to whether a document (SI or PI) can or cannot be located and retrieved by either broadcast or IP.

Bearers defined refers to a bearer being within the document, either within the **service** element of the SI document, or the **location** element of the current programme within the PI document. This signals that the bearer is allowed for that service/programme.

A service provider may wish to signal different bearer availability on a per-programme basis for a variety of reasons, e.g. to enforce licensing restrictions.

E.5 Bearer matching

A device may ingest an SI document for a variety of reasons. For example, in order to determine which service is currently being received and its associated metadata, or to find other bearers the service can be received on.

The implementation of this should be through *bearer matching*, i.e. constructing the bearerURI of the currently received bearer using the methods described in ETSI TS 103 270 [18]. This bearerURI can then be matched against bearers within the SI document to find the relevant service(s).

NOTE: More than one service may be matched, at which point a device may take additional steps to match the current service, for example by using location information.

As well as matching bearers by available broadcast parameters, it is recommended that a device also match against any available additional bearer parameters (e.g. bitrate, MIME type).

Annex F (informative):
Compatibility with ETSI TS 102 818 (V1.5.1)

In order to create a single XML definition suitable for hybrid radio use, the structure of the XML has been altered from that provided in the broadcast only version ETSI TS 102 818 (V1.5.1) [i.1]. Primarily this concerns the SI document, where the **ensemble** element has been replaced by the **services** element. When encoded using ETSI TS 102 371 (V3.1.1) [21] or later, the binary is compatible with that produced by the broadcast only version ETSI TS 102 371 (V1.3.1) [i.2].

Regarding the SI document, the changes listed in table F.1 have been made:

Table F.1: Changes to SI document

Element name	Changes	Reasons	Compatibility
serviceInformation	child element **ensemble** removed child element **services** added; child element **serviceGroups** added	restructure for hybrid use	compatible binary encoding [21]
	attribute **system** removed	defaults to DAB	no known operational use of non-default value; encoding for DRM restored by compatible binary encoding [21]
service	child element **serviceID** replaced by **bearer**	additional functionality for hybrid	domain removed by compatible binary encoding [21]
	child element **simulcast** removed	service following between broadcast systems is not an SPI function	no known operational use; no issues expected
	child element **epgLanguage** removed	functionality is available via **xml:lang**	no issues expected
	child element **CA** removed	obsolete	no known operational use; no issues expected
	attribute **format** removed	defaults to audio	no known operational use of non-default value; no issues expected
	attribute **bitrate** removed	functionality is available from new **bearer** child element	no known operational use; no issues expected
	attribute **extFormat** removed	obsolete	no known operational use; no issues expected
	child element **geolocation** added	additional functionality	no issues expected
link	attribute **url** renamed **uri**	clearer name	compatible binary encoding [21]

Regarding the PI document, the changes listed in table F.2 have been made.

Table F.2: Changes to PI document

Element name	Changes	Reasons	Compatibility
epg	child element **alternateSource** removed	functionality is available using RadioDNS	no known operational use; no issues expected
	attribute **system** removed	defaults to DAB	no known operational use of non-default value; encoding for DRM restored by compatible binary encoding [21]
serviceScope	attribute **id** changed from epg:contentIDType to bearerURI type	additional functionality for hybrid	domain removed by binary encoding
programme	child element **CA** removed	obsolete	no known operational use; no issues expected
	attribute **id** is now required	hybrid requirement for uniqueness	no issues expected
	attribute **bitrate** removed	obsolete	no issues expected
	child element **onDemand** added	additional functionality	no issues expected
programmeEvent	child element **CA** removed	obsolete	no known operational use; no issues expected
	attribute **id** is now required	hybrid requirement for uniqueness	no issues expected
	child element **onDemand** added	additional functionality	no issues expected
memberOf	attribute **id** is now required	hybrid requirement for uniqueness	no issues expected
genre	child element **name** removed child element **definition** removed	obsolete	no known operational use; no issues expected
bearer	attribute **id** changed from epg:contentIDType to bearerURI type	additional functionality for hybrid	domain removed by compatible binary encoding [21]
	attribute **trigger** removed	obsolete	no known operational use; no issues expected
	child element **geolocation** added	additional functionality	no issues expected
link	attribute **url** renamed **uri**	clearer name	compatible binary encoding [21]

Regarding the GI document, the changes listed in table F.3 have been made:

Table F.3: Changes to GI document

Element name	Changes	Reasons	Compatibility
epg	child element **alternateSource** removed	functionality is available using RadioDNS	no known operational use; no issues expected
	attribute **system** removed	defaults to DAB	no known operational use of non-default value; encoding for DRM restored by compatible binary encoding [21]
programmeGroup	attribute **id** is now required	hybrid requirement for uniqueness	no issues expected
memberOf	attribute **id** is now required	hybrid requirement for uniqueness	no issues expected
genre	child element **name** removed child element **definition** removed	obsolete	no known operational use; no issues expected
link	attribute **url** renamed **uri**	clearer name	compatible binary encoding [21]

Annex G (informative):
Converting DAB and DRM PTy to TV-Anytime genres

This is a very simple mapping from DAB and DRM programme type (PTy) codes to TV-Anytime genres, as used in the present document. Note that there may be more than one TV-Anytime genre suggested for each Pty code.

PTy code	PTy name	TV-Anytime genre equivalents
0	Undefined	<none>
1	News	3.1.1 (Content.Non-fiction.News)
2	CurrentAffairs	3.1.1.16 (Content.Non-fiction.News.Current Affairs)
3	Information	1.2 (Intention.Information)
4	Sport	3.2 (Content.Sport)
5	Education	1.3 (Intention.Education) 3.1.3.6 (Content.Non-fiction.General Non-fiction.Education)
6	Drama	3.4 (Content.Fiction)
7	Culture	3.1.4 (Content.Non-fiction.Arts & Media)
8	Science	3.1.6 (Content.Non-fiction.Sciences)
9	Varied	3.1 (Content.Non-fiction)
10	PopMusic	3.6.4.1 (Content.Music and Dance.Pop-rock.Pop)
11	RockMusic	3.6.4 (Content.Music and Dance.Pop-rock)
12	EasyListening	3.6.3.2 (Content.Music and Dance.Background Music.Easy Listening)
13	LightClassical	3.6.1.5 (Content.Music and Dance.Classical.Light Classical)
14	SeriousClassical	3.6.1.2 (Content.Music and Dance.Classical.Classical)
15	OtherMusic	3.6 (Content.Music and Dance)
16	Weather	1.2.2 (Intention.Information.Pure Information) 3.1.1.13 (Content.Non-fiction.News/Weather forecasts)
17	Finance	1.2.2 (Intention.Information.Pure Information) 3.1.3.5 (Content.Non-fiction.General Non-fiction.Finance)
18	ChildrensProgrammes	4.2.1 (Intended Audience.Age Groups.Children)
19	SocialAffairs	3.1.3.2 (Content.Non-fiction.General Non-fiction.Social)
20	Religion	3.1.2.1 (Content.Non-fiction.Philospphies of Life.Religious Philosophies)
21	PhoneIn	2.1.8 (Format.Structured.Phone-in)
22	Travel	3.3.5(Content.Leisure/Hobby.Travel/Tourism)
23	Leisure	3.3 (Content.Leisure/Hobby)
24	JazzMusic	3.6.2 (Content.Music and Dance.Jazz)
25	CountryMusic	3.6.6 (Content.Music and Dance.Country and Western)
26	NationalMusic	3.6.9 (Content.Music and Dance.World/Traditonal/Ethnic/Folk Music)
27	OldiesMusic	3.6.3.5 (Content.Music and Dance.Background Music.Oldies)
28	FolkMusic	3.6.9 (Content.Music and Dance.World/Traditonal/Ethnic/Folk Music)
29	Documentary	3.1 (Content.Non-fiction) 2.1.4 (Format.Structured.Documentary)

Annex H (informative):
Extension of core SPI schema by use of namespacing

The present document provides a definition of Service and Programme Information which can be used across different platforms and can be distributed in diverse ways.
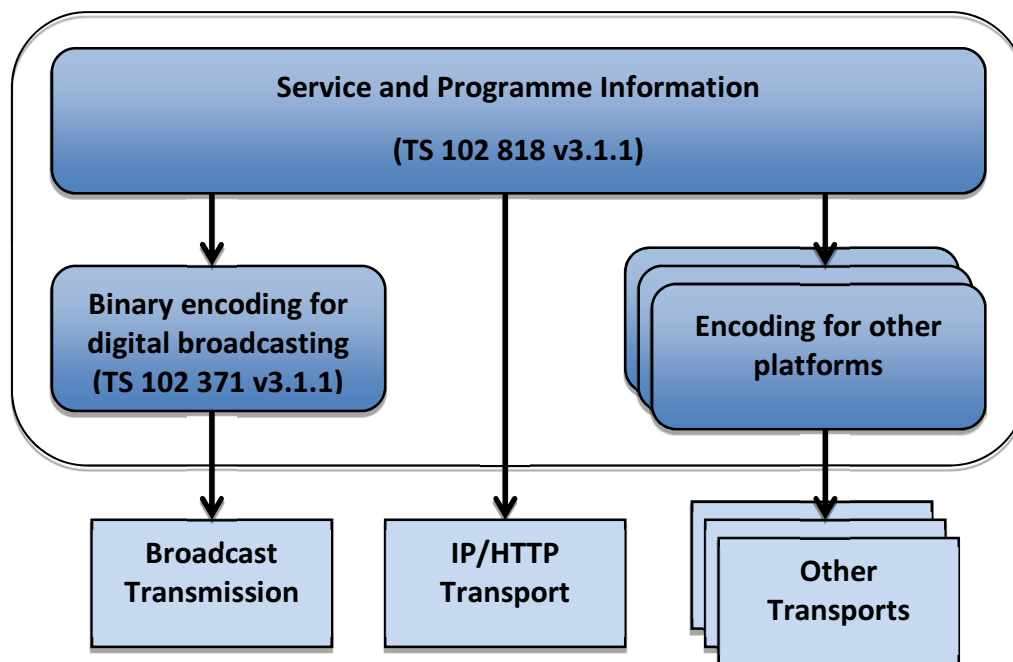
Figure H.1: Application of SPI to different platforms

To provide extensibility to allow the SPI core definition to be used by platforms that require additional metadata, the XML schema permits child elements and attributes from other namespaces to be added to the XML documents at appropriate points.

When extending the specification, any additional namespaces are declared in the usual manner with each having their own accessible XML schema for validation purposes.

For example, a platform provider wishes to use the core schema for its standardized elements, concepts and discovery methods. However, he requires some specific information to support the functionality of his own platform. To support these specific requirements, he can define its own XML schema document which is then used by service providers wishing to integrate with that platform.

If the platform provider makes his schema publicly available at the URL http://example.org/schemas/foo.xsd, the service provider may use the elements defined within, by declaring the schema and its namespace on the root element of the SI, PI or GI document.

```
<serviceInformation xmlns="http://www.worlddab.org/schemas/spi/31"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:foo="http://example.org/schemas/foo"
    xsi:schemaLocation="http://www.worlddab.org/schemas/spi/31
http://www.worlddab.org/schemas/spi/31/spi_31.xsd http://example.org/schemas/foo
http://example.org/schemas/foo.xsd"
    creationTime="2014-04-25T00:05:31+01:00" originator="Global Radio"
    xml:lang="en" version="1" >
```

The XML schema **schemaLocation** attribute is used to declare namespaces against XML schema within a document, as a set of whitespace-separated <namespace> <schema location> pairs. In the above example, the platform namespace and schema URL are added to the existing declaration of the SPI namespace and XSD name.

Each used element could define the new platform namespace each time it is used, however it is more compact to declare a namespace prefix and use that within the document. For the above example, the namespace prefix **foo** has been bound to the platform namespace.

One of the functions required by this example platform is its own means of adding an additional service identifier on a **service** element, as an attribute.

```
<service foo:id="caa8723.1" >
   ...
</service>
```

The platform provider's XML schema would define the format and type that this identifier would take, and provide a specification explaining its usage within the core SPI elements.

When this document is validated, it will be validated against the SPI XML schema, and any XML schema defined by extensions.
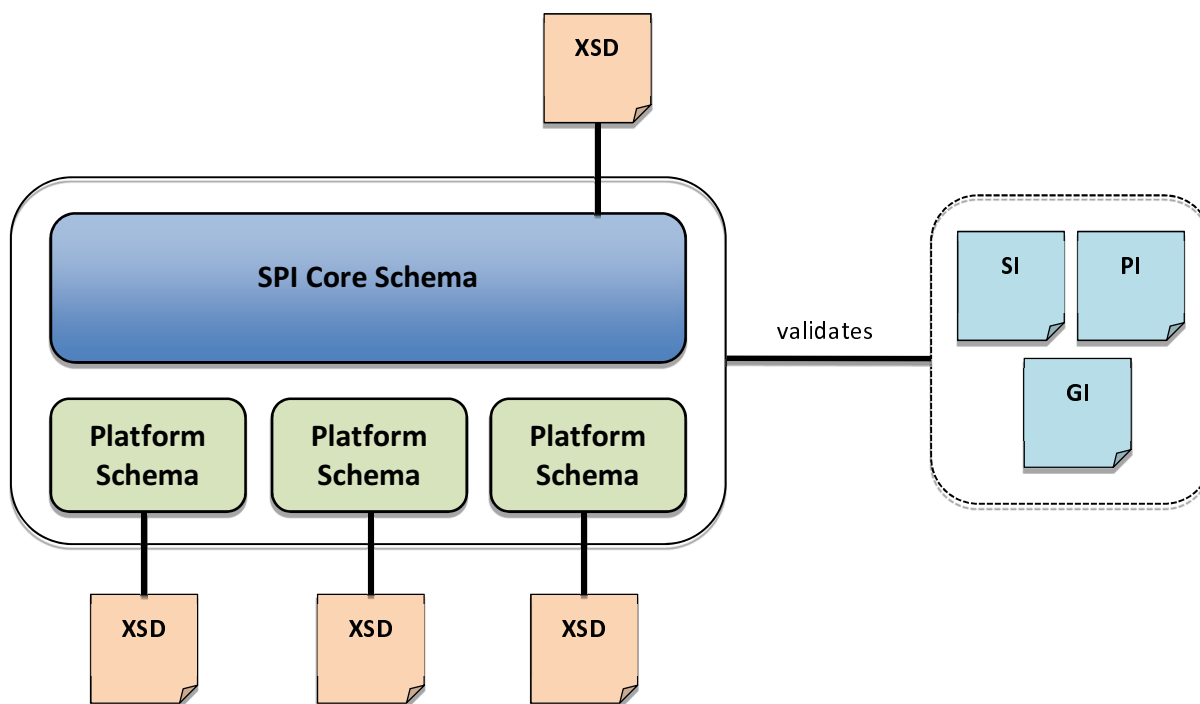

Figure H.2: Validation of SPI XML documents for different platforms

History

Document history		
V1.1.1	December 2002	Publication
V1.2.1	January 2005	Publication
V1.3.1	February 2006	Publication
V1.4.1	June 2008	Publication
V1.5.1	August 2013	Publication
V3.1.1	January 2015	Publication
V3.2.1	June 2019	Publication