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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: 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 DVB Project is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulators and others from around the world committed to designing open, interoperable technical specifications for the global delivery of digital media and broadcast services. DVB specifications cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993.

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).

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Introduction

The present document specifies an end-to-end Native IP broadcast system for DVB broadcast bearers. It relies as much as possible on existing DVB specifications and complements those where necessary. The Native IP broadcast system is built upon DVB-I for service discovery and program metadata, DVB-AVC and DVB-DASH for source coding and stream formatting and DVB-MABR, DVB-GSE and the physical layer specifications DVB-S2X, DVB-S2 and DVB-T2 for transport. DVB Native IP facilitates the integration of OTT and Broadcast technologies into an efficient and contemporary IP media distribution solution.

The Native IP specification addresses both consumer and professional applications.

1 Scope

The present document describes a Native IP end-to-end broadcast system based on existing DVB standards.

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 EN 302 307-1: "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications; Part 1: DVB-S2".

[2] ETSI EN 302 307-2: "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications; Part 2: DVB-S2 Extensions (DVB-S2X)".

[3] ETSI TS 102 755: "Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)".

[4] ETSI TS 102 606-1: "Digital Video Broadcasting (DVB); Generic Stream Encapsulation (GSE); Part 1: Protocol".

[5] ETSI TS 102 606-2: "Digital Video Broadcasting (DVB); Generic Stream Encapsulation (GSE); Part 2: Logical Link Control (LLC)".

[6] ETSI TS 102 606-3: "Digital Video Broadcasting (DVB); Generic Stream Encapsulation (GSE); Part 3: Robust Header Compression (RoHC) for IP".

[7] ETSI EN 301 192: "Digital Video Broadcasting (DVB); DVB specification for data broadcasting".

[8] ETSI TS 103 769: "Digital Video Broadcasting (DVB); Adaptive Media Streaming over IP multicast".

[9] ETSI TS 103 770: "Digital Video Broadcasting (DVB); Service Discovery and Programme Metadata for DVB-I".

[10] ETSI TS 101 154: "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcast and Broadband Applications".

[11] ETSI TS 103 285: "Digital Video Broadcasting (DVB); MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks".

[12] ETSI EN 303 560: "Digital Video Broadcasting (DVB); TTML Subtitling Systems".

[13] DVB Document A179r2: "Digital Video Broadcasting (DVB); Service discovery and delivery protocols for a DVB Home Broadcast system".

[14] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".

[15] ISO/IEC 13818-1: "Information technology -- Generic coding of moving pictures and associated audio information -- Part 1: Systems".

[16] ETSI TS 102 034: "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks".

[17] IETF RFC 6762: "Multicast DNS".

[18] IETF RFC 6763: "DNS-Based Service Discovery".

[19] IETF RFC 5328: "A UniformResourceName (URN) Namespace for the Digital Video Broadcasting Project (DVB)", A. Adolf and P. MacAvock".

[20] IETF RFC 1112: "Host Extensions for IP multicasting".

[21] IETF RFC 2464: "Transmission of IPv6 Packets over Ethernet Networks".

[22] IETF RFC 1952: "GZIP file format specification version 4.3".

[23] ISO 8601-1:2019: "Date and time - Representations for information interchange - Part 1: Basic rules".

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

[25] IETF RFC 1305: "Network Time Protocol (Version 3) Specification, Implementation and Analysis".

[26] IETF RFC 5651: "Layered Coding Transport (LCT) Building Block".

[27] ISO/IEC 23009-1:2022: "Information technology -- Dynamic adaptive streaming over HTTP (DASH) -- Part 1: Media presentation description and segment formats".

[28] EN 50585 (2014): "Communications protocol to transport satellite delivered signals over IP networks", (produced by CENELEC).

[29] IETF RFC 3629: "UTF-8, a transformation format of ISO 10646".

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] ISO/IEC 23001-7:2016: "Information technology -- MPEG systems technologies -- Part 7: Common encryption in ISO base media file format files".

[i.2] W3C® Recommendation: "XML Schema Definition Language (XSD) 1.1 Part 1: Structures".

[i.3] W3C® Recommendation: "XML Schema Definition Language (XSD) 1.1 Part 2: Datatypes".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

aggregator: any entity in charge of aggregating one or more bouquets of services

asset: any file object directly retrievable by NIP Clients through a URI

bootstrap process: initialization process for broadcast receivers joining a NIP broadcast network and learning about the topology of the network including the availability of channels, streams and services on those streams

bootstrap streams: any NIP stream according to the present document that is involved in the bootstrap or initialization process of receivers joining a NIP network and wanting to learn about the topology of the network

broadcast service: any NIP Service broadcast over a NIP compliant network as opposed to a service provided via OTT

broadcast service list: DVB-I Service List according to ETSI TS 103 770 [9] broadcast over a DVB-NIP Broadcast System and listing services available via broadcast or broadband

broadcast service list entry points: Service List Entry Points file broadcast via a DVB-NIP Broadcast System according to the present document

NOTE: The Broadcast Service List Entry Points file provides to a DVB-I client the list of all DVB-I Service Lists that are broadcast on a NIP network.

commercial operator: any entity in charge of providing one or more bouquets of services aggregating services and providing these free-to-air or against payment to end-users

connected device: any device, capable of receiving broadcast content and also connected to a terrestrial fixed or mobile broadband network or connected to a satellite network with return channel functionality providing access to the open internet

content preparation platform: all functions involved in the video encoding, encryption, key management and packaging of media assets for broadcast via a NIP compliant network

deployment model: refers to a logical grouping of receiver functions or features for a particular usage scenario

DVB-I Client: implementation of the client side of ETSI TS 103 770 [9]

NOTE: This may be integrated into the User Interface (UI) of a device such as a television or set-top box or part of an app on devices such as mobile phones or tablets.

DVB-NIP Broadcast System: content distribution system compliant with the present document

DVB-TS Broadcast Headend: all functions part of a traditional Transport Stream based DVB Head-end: Linear encoding into PES packets, DVB Multiplexing, DVB Conditional Access, etc.

headend: all functions involved in the editing of services before being broadcast

hybrid service: service consisting of components carried via a) broadcast and b) broadband means

media object: single externally addressable unit of packaged encoded media essence or related metadata to be conveyed via a multicast transport session or via a unicast transport session e.g. a presentation manifest or DASH segment identified by a URI

metadata: all data related to the description of the network: Channels and Streams, Services available on the Network: Service List Entry Points and Service Lists, Content within those services: Content Guide and Content Presentation

multicast gateway: As defined in clause 5.3.5 of ETSI TS 103 769 [8].

multicast rendezvous service: As defined in clause 5.3.9 of ETSI TS 103 769 [8].

multicast server: As defined in clause 5.3.3 of ETSI TS 103 769 [8].

NIP Client: software application, that includes the capability to select, decode, decrypt and display NIP Services

NIP Gateway: device including one or more broadcast reception frontends plus all functions required to interface with DVB-NIP Clients according to the present document

NIP Receiver: generic term for a reception device

NOTE: The NIP Receiver always includes at least one or more physical broadcast tuner/demodulator functions, capable of receiving streams according to the present document. The NIP receiver may additionally include some or all NIP Gateway functions as well as some or all NIP Client functions.

NIP Service: any service which is discovered using the mechanisms defined in the present document, and which is using DVB-DASH (ETSI TS 103 285 [11]) delivery via broadcast or broadband

NIP Service Aggregation Platform: all head-end components, cloud or on-premises, at the Technical Network Operator or at one or more Commercial Operator(s) involved in the compilation of signalling and metadata information for the correct operation of NIP broadcast services

NIP Service Identifier: URL of the NIP Service manifest

NIP Stream: Layer 2 packet stream consisting of a succession of GSE-Lite packets or TS/MPE sections

NIP Wall Clock: UTC time synchronized between head-end and NIP receivers

Over-The-Top (OTT): media service offered directly to viewers via the Internet. OTT bypasses cable, broadcast, and satellite television platforms

provider name: name of the provider of a DVB-I (ETSI TS 103 770 [9]) Service List in a human readable form

regular stream: any NIP Stream that carries NIP Services but does not carry information specifically required during the bootstrap process of receivers

regulator: entity in charge of defining rules for broadcasters and the editing of broadcast programs

NOTE: In the context of the present document, the regulator is considered a key source when defining regionally applicable Service Lists.

reserved_zero_future_use: when used in the clause defining the coded bit stream, indicates that the value may be used in the future for ETSI defined extensions

NOTE: All "reserved_zero_future_use" bits are set to "0".

RF Carrier: modulated radio frequency signal carrying one or more NIP Streams

RF Channel: logical subdivision of the RF broadcast spectrum

NOTE: In the context of satellite transmissions RF Channels are commonly called Transponders.

technical network operator: entity in charge of running the broadcast network

3.2 Symbols

Void.

3.3 Abbreviations

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

ABR	Adaptive Bit Rate
ALC	Asynchronous Layered Coding
API	Application Programming Interface
AV	Audio Visual

AVC	Advanced Video Coding
B2B	Business to Business
B2C	Business to Consumer
CA	Conditional Access
CDN	Content Delivery Network
CENC	Common ENCryption
CID	Context ID
CSR	Central Service Registry
DASH	Dynamic Adaptive Streaming over HTTP
DM	Deployment Model
DNS-SD	Domain Name System-Service Discovery
DRM	Digital Rights Management
DTT	Digital Terrestrial Television
DVB-CSA	DVB Common Scrambling Algorithm
DVB-HB	Digital Video Broadcasting - Home Broadcast
DVB-I	Digital Video Broadcasting - Internet
DVB-SI	Digital Video Broadcasting - Service Information
EPG	Electronic Programme Guide
ETSI	European Telecommunications Standards Institute
FDT	File Description Table
FEC	Forward Error Correction
FLUTE	File Delivery over Unidirectional Transport
FTA	Free-To-Air
GSE	Generic Stream Encapsulation
HbbTV	Hybrid broadcast broadband TeleVision
HD	High Definition
HEM	High Efficiency Mode
HLS	HTTP Live Streaming
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
IANA	Internet Assigned Numbers Authority
ID	Identifier
IDTV	Integrated Digital TV
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISI	Input Stream Identifier
ISO	International Standards Organization
ISP	Internet Service Provider
LAN	Local Area Network
LCD	Link Control Data
LCT	Layered Coding Transport
LLC	Link Layer Coding
MABR	Multicast Adaptive Bit Rate
MAC	Media Access Control
MPD	Media Presentation Description
MPE	MultiProtocol Encapsulation
MPEG	Moving Picture Experts Group
NCD	Network Control Data
NIC	Network Interface Card
NID	Network IDentifier
NIF	Network Information File
NIP	DVB Native IP
NIT	Network Information Table
NTP	Network Time Protocol
NVRAM	Non Volatile Random Access Memory
OTT	Over The Top
PES	MPEG Packetized Elementary Stream
PHY	PHYsical layer
PLP	Physical Layer Pipe
PTP	Precision Time Protocol

RF	Radio Frequency
RFC	Request For Comments
RoHC	Robust Header Compression
ROUTE	Real-time Object delivery over Unidirectional Transport
SIF	Service Information File
SLR	DVB-I Service List Registry
STB	Set-Top Box
TCP	Transmission Control Protocol
TOF	Time Offset File
TOI	Transport Object Identifier
TRP	TRansPonder
TS	MPEG Transport Stream
TSI	Transport Session Identifier
TTML	Timed Text Markup Language
UDP	User Datagram Protocol
UHD	Ultra High Definition
UI	User Interface
URI	Uniform Resource Identifier
URL	Universal Resource Locator
URN	Universal Resource Name
USB	Universal Serial Bus
UTC	Coordinated Universal Time
UTF-8	Unicode Transformation Format, 8 bit
VoD	Video on Demand
XML	eXtensible Markup Language

4 System Description

4.1 Overview

The present document describes a Native IP (NIP) Broadcast System based on existing DVB technologies that have been adapted and complemented for the requirements of network operators and broadcasters that want to leverage IP for the distribution of content.

It is designed to be applicable to DVB-S2X, DVB-S2 and DVB-T2 based broadcast networks.

The Native IP Broadcast System is an end-to-end IP-based system architecture that leverages DVB-I as a contemporary service discovery and programme metadata scheme, state-of-the-art Adaptive Bit Rate (ABR) video coding, packaging and delivery technologies as specified in DVB-DASH [11] and DVB-AVC [10] and multicast file transfer mechanisms as specified in DVB-MABR [8] for the distribution of audio-visual content.

The advantages of this approach are more flexibility, better integration with terrestrial IP infrastructures, the possibility to re-use streams coming from OTT cloud head-ends rather than having to purposely run a DVB-TS Broadcast Head-end for the sole distribution via traditional DVB broadcast networks, better compatibility with contemporary IP devices, such as smartphones, tablets, PCs, etc. and finally the option to use one and the same Native IP broadcast transmission to simultaneously address several very different B2B and B2C use cases.

Leveraging ABR technologies makes it possible to provide AV assets reliably not only directly to TV sets but also indirectly via gateway functions to any contemporary IP device. Such gateways may sit in provider and telecom networks or directly in consumer's homes as an extension to DVB Home Broadcast [13].

Using the mechanisms defined in DVB-MABR also makes it possible to provide fully and inherently hybrid services in a totally seamless manner with some service components being delivered via broadcast and others via OTT. All this being invisible to the end-user. Applications for this may be live television channels carrying Targeted Advertising wherein the live channel content is provided via broadcast and the Targeted Advertisements are being delivered invisibly via broadband, or services where the lesser watched representations are delivered via broadband and the most common representations/components are delivered via broadcast. All the content seamlessly blends in a single consistent presentation to the end-user.

The mass distribution of identical content is still best served via broadcast and by leveraging contemporary video technologies in a hybrid context, the best of IP unicast and IP multicast distribution can be seamlessly combined.

Finally, the continued use of broadcast technologies in large scale content distribution systems represents a non-negligible contribution by the television industry to making television sustainable and contributing to the preservation of scarce resources.

4.2 System Features

The DVB Native IP Broadcast System works in both connected and unconnected scenarios. In unconnected scenarios, i.e. without return path, some features are not available yet.

The core features of the Native IP solution are:

1. Carriage of real-time live linear television and radio services:
   - Real-time delivery of assets purely via broadcast.
   - Real-time delivery of assets in a fully hybrid manner some via broadcast and some via broadband.
   - Easier upgrade for the introduction of new audio and video codecs.
2. Professional and Consumer Usage Scenarios:
   - Delivered directly from the same head-end to - consumers' homes or indirectly - to CDN Edge Caches which make the content available via intermediate LAN or WAN fixed or mobile networks.
   - In professional environments, the possibility to store received content, i.e. "Live to VoD" service.
3. Extended Content Guide:
   - All the functionalities provided by DVB-I ETSI TS 103 770 [9].
4. Multiscreen support:
   - Addresses Native IP devices with or without built-in broadcast tuner.
5. Content protection:
   - Supports content protection with the same DRM solutions that are used on broadband networks (fully connected scenario).
   - Supports proprietary DRM solutions for unconnected client scenarios.
6. Targeted Advertising:
   - Uses the advantages of ABR for flexible ad replacement.
7. Accessibility services:
   - Supports EBU-defined subtitling.

5 Overall System Architecture

5.1 Introduction

The DVB Native IP (DVB-NIP) specification describes an end-to-end IP delivery architecture leveraging Internet content delivery technologies such as Adaptive Bit Rate (ABR) streaming also for broadcast applications. The DVB-NIP Broadcast System is made up of two major parts (see figure 5.3-1):

- All functions related to the Native IP Headend.

- All functions related to the Native IP broadcast reception and content consumption.

The overall system design and the headend functions are described in the present clause. The receiver functions are described in clause 6.

5.2 Layered System Design

5.2.1 General

The DVB-NIP Broadcast System relies on a layered system architecture.

At the top of the Native IP stack is a DVB-I based television service discovery and metadata layer according to ETSI TS 103 770 [9]. This layer is responsible for informing receivers about the various services available on the broadcast and broadband networks. DVB-NIP Services may be grouped into different DVB-I Service Lists coming from different Technical or Commercial Operators on the broadcast network. One or more such DVB-I Service List(s) may be present on each broadcast network. The DVB-I Service List Entry Points mechanism is used to announce all the different DVB-I Broadcast Lists available on the network.

Included in each DVB-I service list are DVB-DASH based services according to ETSI TS 103 285 [11]. DVB-DASH based services in DVB-NIP can be carried using the DVB-MABR defined FLUTE/ROUTE protocols via the DVB broadcast network as defined in ETSI TS 103 769 [8]. Alternatively, a receiver might fetch the same services using standard HTTP/HTTPS requests via the broadband network. In addition, some components or representations of the same DASH service may be carried via the broadcast network and others via the broadband network. All this shall happen invisibly to the end-user of such services.

DVB-NIP defines an Announcement Channel mechanism under clause 8.2 and signalling tables called the Network Information File (NIF) and the SIF (Service Information File) under clause 8.4. These two signalling tables enable all the previously mentioned DVB specifications to be run on a broadcast network consisting of several broadcast RF Channels and potentially one or more logical NIP Streams. The NIF provides information about the different Streams and their physical parameters on the broadcast network. The SIF provides information on the location of Services and metadata within those Streams. NIF plus SIF allow broadcast receivers to dynamically re-tune to the Streams and physical Channels carrying the different broadcast Services.

Signalling and A/V Services (using DVB-DASH ETSI TS 103 285 [11]) are carried on the broadcast RF Channel via IP multicast. DVB-NIP IP multicast sessions are carried using the GSE-Lite Profile as defined in clause D.2 of ETSI TS 102 606-1 [4] or Multiple Protocol Encapsulation as defined in ETSI EN 301 192 [7] at the Data Link Layer and DVB-S2X (ETSI EN 302 307-1 [1], ETSI EN 302 307-2 [2]), DVB-S2 (ETSI EN 302 307-1 [1]) and DVB-T2 (ETSI TS 102 755 [3]) at the Physical Layer. See figure 5.2.1-1.

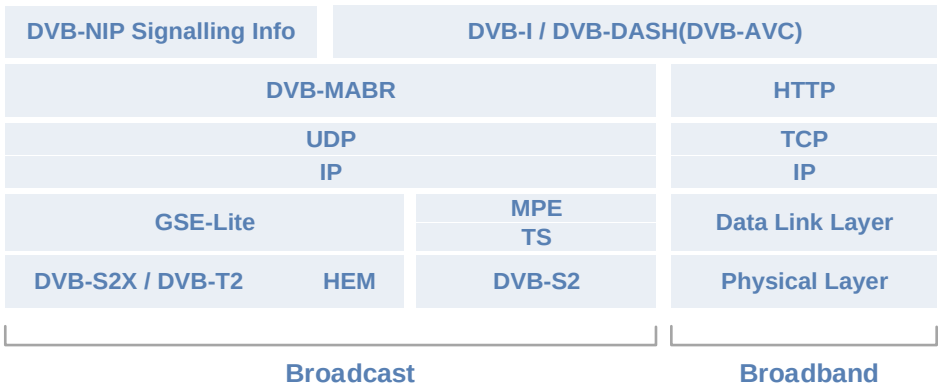


Figure 5.2.1-1: DVB-NIP protocol stack

5.2.2 Core DVB Specifications underlying NIP (informative)

The DVB-NIP Broadcast System is based on the following core DVB specifications. This list is purely informative and the exhaustive list is provided in clause 2.

- DVB-I (ETSI TS 103 770 [9]) provides the service discovery and programme metadata scheme for the DVB-NIP Broadcast System. DVB-NIP is designed in such a manner as to allow the re-use of unmodified DVB-I Clients. All features present in DVB-I are also available to DVB-NIP Clients. In particular DVB-I is used in DVB-NIP for announcing the media services that are available via broadcast and/or broadband.
- DVB-DASH (ETSI TS 103 285 [11]) and DVB-AVC (ETSI TS 101 154 [10]) are the underlying specifications for the coding, packaging and distribution of audio-visual services in the context of DVB-NIP.
- DVB-MABR (ETSI TS 103 769 [8]): DVB-NIP leverages the multicast object transport solution(s) provided by DVB-MABR for the carriage of file-based content, including segmented media.
- DVB-GSE (ETSI TS 102 606-1 [4]) and DVB-MPE (ETSI EN 301 192 [7]) are the two link layer protocols selected for the carriage of IP multicast datagrams in DVB-NIP. DVB-GSE is applied to the latest DVB physical layer specifications whereas MPE is used as an S2 compatible solution.
- DVB-S2X (ETSI 302 307-1 [1], ETSI 302 307-2 [2]), DVB-S2 (ETSI 302 307-1 [1]) and DVB-T2 (ETSI TS 102 755 [3]) may be used as the physical layer specifications in the context of an end-to-end DVB-NIP Broadcast System.

5.3 End-to-End System Architecture

The DVB-NIP Broadcast System is significantly different from traditional Transport Stream based broadcast architectures. Content sourcing in a NIP context is no longer from a dedicated DVB Encoding Platform but from the same Content Preparation and Hosting Platform that also source(s) OTT platforms. The OTT headend functions can run in the public cloud or on the premises of a Technical Network Operator or Commercial Operator. The interface between the OTT Content Preparation and Hosting Platform and the NIP platform is as described in clause 5.3.3.1 of the DVB-MABR specification ETSI TS 103 769 [8].

The NIP architecture consists at the top level of NIP Headend and NIP Receiver functions. These NIP Headend and NIP Receiver functions can be subdivided into smaller functions that may themselves be grouped again into logical entities. NIP Headend functions will be described hereunder in clause 5 and the NIP Receiver logical functions are described in clause 6.

Figure 5.3-1 shows the overall NIP architecture. Logical functions are represented as named boxes and these boxes may be nested in cases where a higher-level function is composed of several subfunctions.

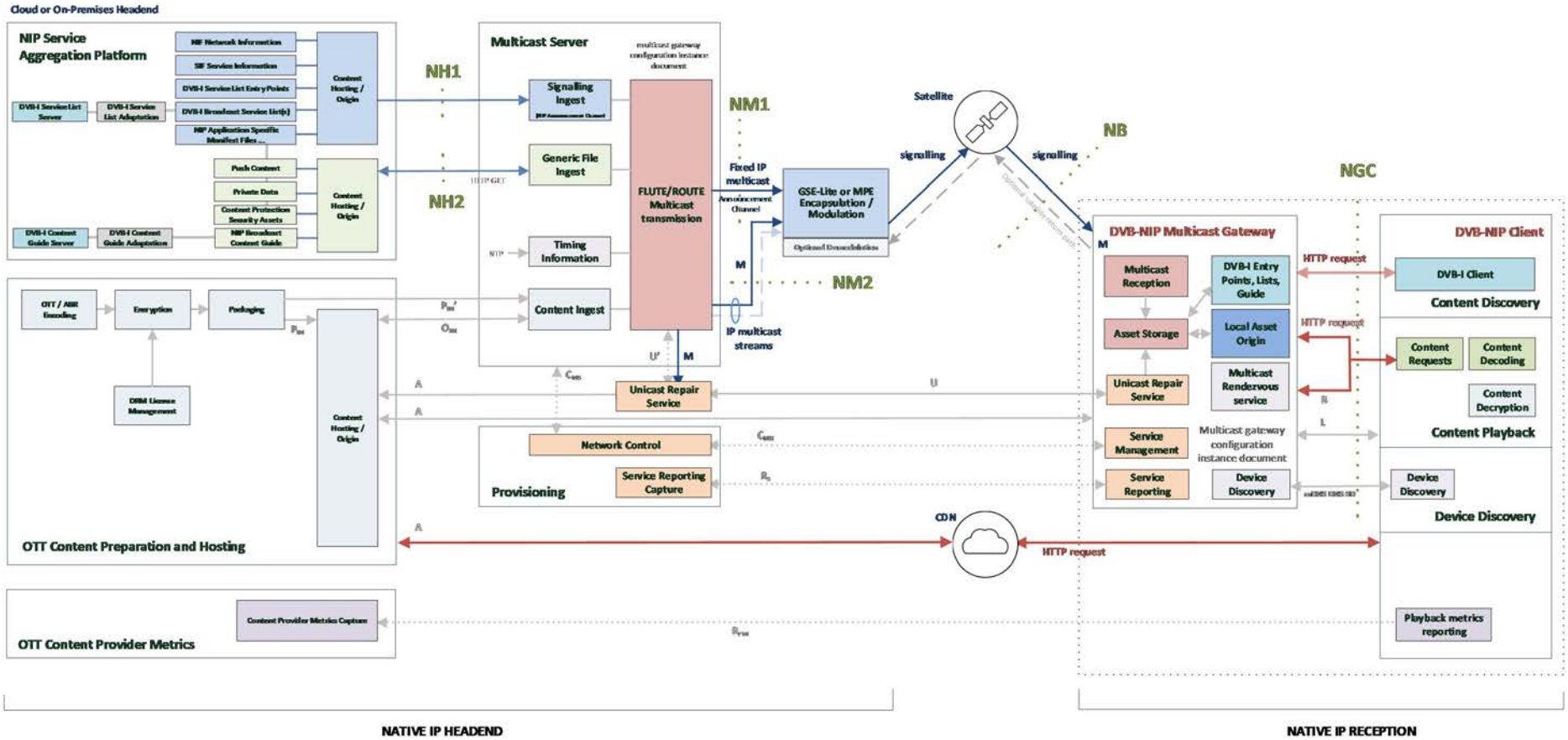


Figure 5.3-1: Architecture of the DVB-NIP Broadcast System

Figure 5.3-1 shows the overall NIP architecture. Logical functions are represented as named boxes and these boxes may be nested in cases where a higher-level function is composed of several lower-level functions.

5.4 NIP Headend Functions (informative)

The DVB-NIP Headend is made up of the following high-level functions (each with nested sub-functions):

1. The *OTT Content Preparation and Hosting platform* consists of media encoding, Content Encryption, Content Packaging and Content Hosting functions. It generally provides the same streams for over-the-top content delivery and, in the case of a DVB-NIP system, also for delivery via Native IP broadcasting. The OTT Content Preparation and Hosting platform can run at the premises of the broadcaster or can be run entirely in the cloud. It may be a single fully integrated and co-located headend, or it may comprise a collection of distributed headends, with each headend responsible for a few NIP Services. The OTT Content Preparation and Hosting platform interfaces with the Multicast server function at reference points **O_{in}**, **P_{in}** or **P_{in}'** as defined in clause 5.3.3.1 of ETSI TS 103 769 [8].

2. The *NIP Service Aggregation Platform* is responsible for:

   - The compilation of one or more DVB-I Service List(s).
   - The compilation of a list of DVB-I Service List Entry Points that is conveyed to NIP Gateways via the signalling channel and which helps DVB-I Clients select the corresponding DVB-I Service List that is to be used for receiving NIP services.
   - The creation of the NIF table which associates logical identification of streams and their physical parameters on the broadcast network.
   - The creation of the SIF table which associates services and metadata with their logical location on the broadcast network.
   - The compilation of the broadcast specific DVB-I Content Guide.

   The NIP Service Aggregation platform may be operator-specific or can be a shared system running in a private or public cloud.

3. The *Content Provider platform* deals with content acquisition, scheduling and monetisation. It is also in charge of collecting usage analytics from subscribers. It is not further described in the present document.

4. The *NIP Signalling Server* builds the multicast signalling channel specified in clause 8.2. The NIP Signalling Server gets the information from the NIP Service Aggregation platform and generates one or more multicast signalling channels. Each channel, on a fixed multicast IP address, is associated with a particular NIP Stream. The NIP Signalling Server may be a standalone unit or may be part of the modulator(s) generating the DVB-NIP-compliant broadcast stream(s). The NIP Signalling Server provides signalling information regarding the physical and logical parameters of NIP services as well as accurate system time information.

5. The *Multicast server* is specified in ETSI TS 103 769 [8] and is responsible for generating multicast transport sessions carrying one or more DVB-DASH Services. One Multicast server instance is associated with one logical NIP Stream. The Multicast server is responsible for managing, at any time, the bit rate allocation(s) across the generated multicast transport sessions.

6. The *Service Provisioning Platform* represents all operational support systems, handling the platform headend operation and service reporting from *Multicast Gateway* devices.

7. The *Encapsulation and Modulation* function handles the encapsulation of IP multicast datagrams into NIP Streams according to clause 7.3.4 and RF signal modulation according to the Physical Layer Specifications described in clause 7.2. If available, robust header compression as defined in clause 7.4 may be applied to incoming multicast signals.

5.5 NIP Reference Points

The following is a listing of logical reference points specific to the DVB-NIP Broadcast System as specified in the present document (see figure 5.3-1):

NH1: The interface between the Native IP Service Aggregation platform and the Native IP Signalling Server.

NH2: The interface between the Broadcast DVB-I Content Guide Asset File and the Multicast Server.

NM1: The interface between the NIP Signalling Server and the GSE/MPE Encapsulator/Modulator. This interface carries the IP multicast Announcement Channel.

NM2: The interface between the *Multicast Server* and the GSE/MPE Encapsulator/Modulator. This interface shall be compliant with reference point **M** interface as defined by DVB-MABR in ETSI TS 103 769 [8].

NB: Over-the-air interface carrying Native IP Broadcast physical and data link layer signals as specified in clause 7 of the present document. This interface carries the following network layer signals:

- The IP multicast transport sessions originating from the *Multicast Server* as defined in ETSI TS 103 769 [8] and according to clause 8.5 of the present document.
- The IP multicast Announcement Channel according to clause 8.2 of the present document.

NGC: The NIP Gateway to Client Interface specifies the interactions between the NIP Client functions and the NIP Gateway functions. This interface is specified in clauses 8.3, 8.5 and 11.1.

6 Receiver Deployment Models (informative)

6.1 Introduction

The present specification targets three receiver Deployment Models (DMs) in particular. This listing is not exhaustive, and industry can come up with other Deployments Models, but this particular logical grouping should help implementations of Native IP receivers. Other deployment models not described here may be added in subsequent releases of the present specification.

The intention is that the same DVB Native IP media distribution system can feed all three of the Deployment Models presented here with the same identical broadcast streams.

The first Deployment Model (DM1) represents a professional Business-to-Business (B2B) scenario with professional edge cache receivers installed at the edge of provider or telecom networks. These edge cache receivers are fed via the DVB broadcast network. Such edges may be telecom nodes for fixed and mobile networks, local CDN caches, broadcast transmitter nodes, caches on board of cruise ships and planes, hotspots in underserved areas etc. These nodes will feed DVB-I clients indirectly via respective intermediary public or private IP networks. Professional edge caches may rely only on a subset of the functions specified in the present document but can leverage the same transport and stream formats specified herein.

The second (DM2) and third (DM3) deployment models are Business-to-Consumer (B2C) oriented models.

The second deployment model DM2 is directly addressing next generation TV sets implementing Native IP broadcast reception capabilities as a part of their built-in broadcast stack. Such television sets provide access to Native IP delivered services as they do with DVB Transport Stream based systems, but leverage DVB-I functionality together with latest generation DASH delivery and contemporary video and audio coding technologies. These Native IP television sets enable a full hybridisation of television services with some service components being delivered via broadcast and some via broadband connectivity. Wherever the service components are sourced, this happens entirely invisibly to the end-user who only sees a consistent service presentation.

The third deployment scenario DM3 is for services provided directly to all-IP end-consumer devices at home. Such services will rely on a Native IP Gateway function being available at home. Such Native IP Gateway function may reside in an existing device (e.g. a television set according to DM2 feeding also other mobile devices at home) or may be a separate device such as a STB, antenna adapter, signal distribution component, ISP router, or a dedicated low-cost server device with broadcast reception functionality.

6.2 Generic Receiver Design

6.2.1 Introduction

This clause describes the generic virtual functions that are part of NIP Receivers. Not all receivers need to implement all functions. Receiver functions are there to describe and structure the receiver design. Some functions may be combined, or some functions may not exist at all in some receiver implementations. Clause 6.6 describes which receiver functions are mandatory, optional or not applicable in each of the Deployment Models (DMs) described in the present document.

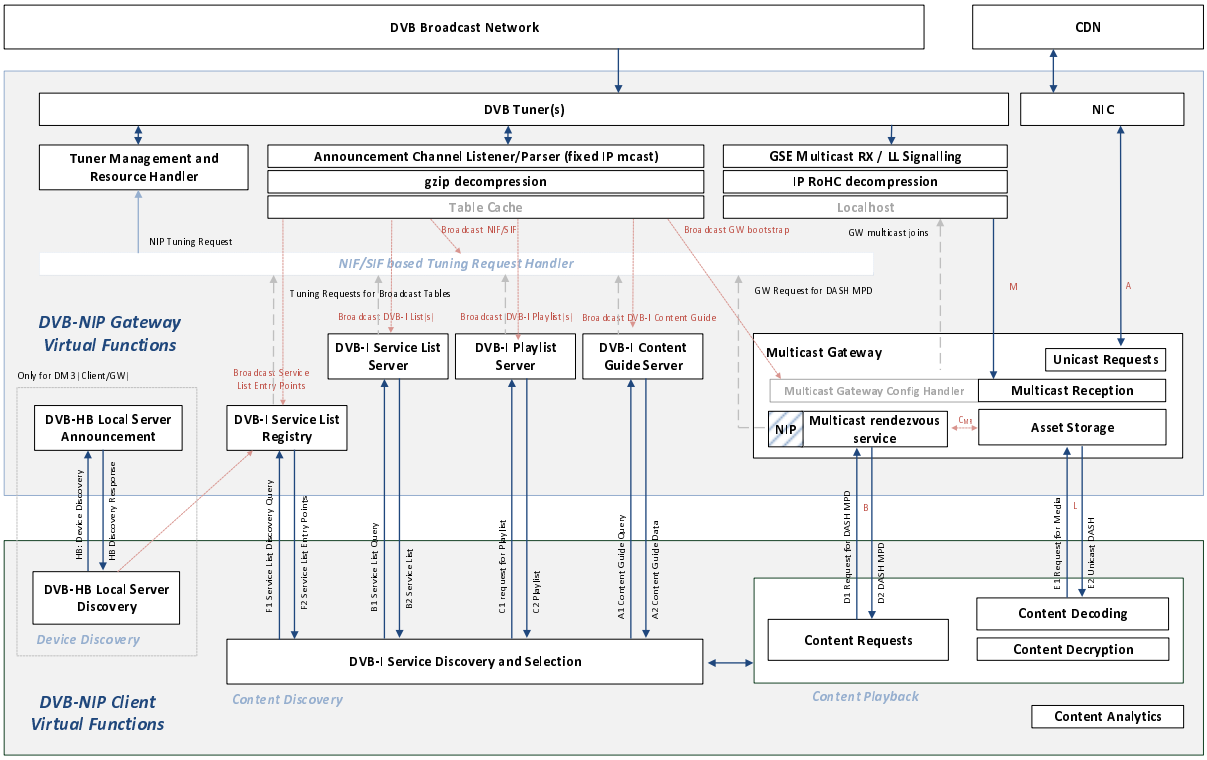


Figure 6.2.1-1: DVB-NIP Generic Receiver Architecture (informative)

Functionally NIP Receivers can be split into two parts: A high level NIP Gateway function and a high-level NIP Client function. The gateway function typically contains one or more DVB tuners that physically receive the NIP broadcast transmissions and forwards them onto a logical or physical IP network connection. The NIP Client function is typically an off-the shelves DVB-I Client and provides access to the actual content transmitted. Interactions between NIP Client and NIP Gateway functions are specified by DVB-I (ETSI EN 103 770 [9]).

6.2.2 NIP Gateway Functions

All NIP Gateways include the following sub-functions:

- Single or multiple DVB-S2/S2X/T2 tuner(s)/demodulator(s).
- The capability to receive at least one of the two: MPE via TS or GSE-Lite via GSE-HEM.
- The capability to receive IP multicast streams (with and without IP Robust Header Compression applied).
- The capability to receive and parse the NIP announcement channel.
- The capability to temporarily store assets received from the broadcast network.
- The capability to serve assets to clients using HTTP.
- The capability to connect to a broadband network to retrieve content assets or metadata.

Some NIP Gateways may additionally include the following sub-functions:

- The capability to announce themselves on the local network to which they may be connected.
- The capability to answer DVB-I Service List Entry Points Queries.
- The capability to be remotely configured.

6.2.3 NIP Client Functions

The NIP Client includes the following sub-functions:

- The capability to interact with a DVB-I Service List Entry Points Registry Server.
- The capability to interact with a DVB-I Service List Server.
- The capability to display a DVB-I Service List to the End User.
- The capability to select the most appropriate instance from a DVB-I List.
- The capability to discover a NIP Gateway.
- The capability to request and display NIP services.

6.3 Professional Edge Cache Receiver (DM1)

Professional Edge Cache Receivers according to the present document are deployed at the edge of telecom, CDN or broadcast networks or act as local wireless hotspots. They receive DVB-NIP formatted content from a broadcast network via multicast and make that content available locally to other networks (e.g. CDN, Fixed, Mobile, Wi-Fi® Hotspot or DVB networks), which in-turn indirectly feed IP clients wanting to access that content.

Professional Edge Cache Broadcast Receivers are installed when a massive distribution of identical content is required and where the large multiplication effect of broadcast technologies can bring considerable distribution gains.

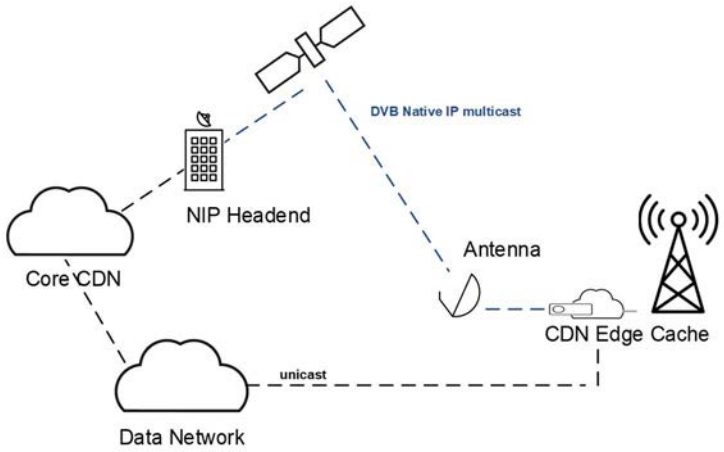


Figure 6.3-1: Example of a Professional Edge Cache receiver at the edge of a CDN network

Professional Edge Cache receivers generally feature multi-tuner front-ends for the parallel reception of multiple DVB-NIP Streams and extensive storage space to act as large local data caches. Professional Edge Caches generally act as local http/https web servers with reverse proxy functionality. The exact interaction between such proxies and clients, and the way that clients get re-directed to these caches is outside the scope of the present document. Clause 6.6 lists the functions that are mandatory, optional or not applicable for professional receiver implementations.

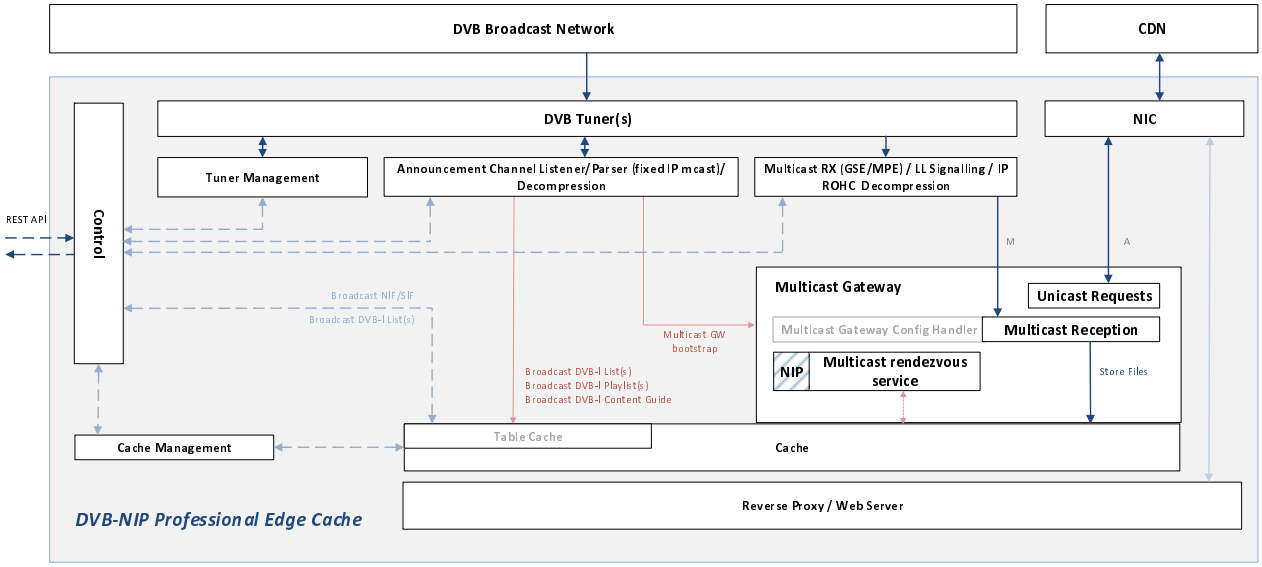


Figure 6.3-2: DVB-NIP DM1 Receiver Architecture (informative)

6.4 Integrated Native IP TV (DM2)

The same DVB-NIP broadcast streams that are built for feeding professional DM1 receivers can also be used for direct reception at home. The simplest reception solution for consumer applications under the present document is DM2. It refers to a fully integrated smart television set. Television sets according to DM2 might be capable of receiving, in addition to legacy Transport Stream (TS) based television services also, television transmissions that are carried natively in IP over the broadcast network. DM2 receivers may or may not be connected to a broadband network.

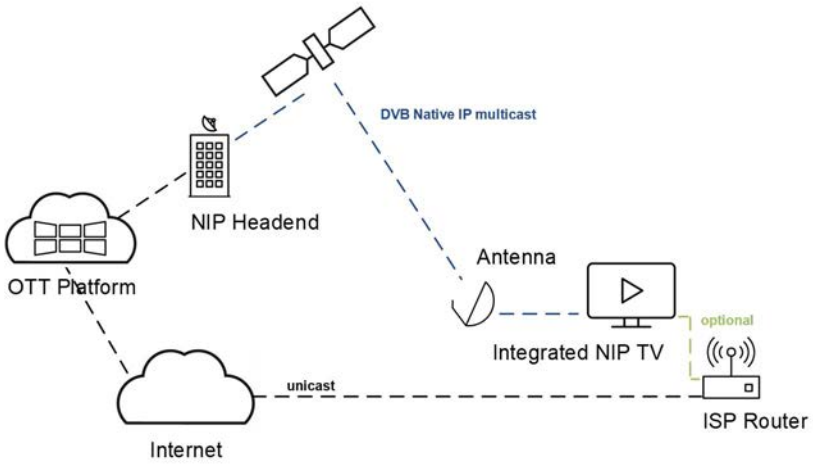


Figure 6.4-1: Simplified view of Deployment Model 2

DM2 television sets are capable of receiving via broadcast the same streams that are potentially made available also via OTT platforms and CDN distribution networks. They implement DVB-I and DVB-DASH defined mechanisms. These television sets are also able to seamlessly blend, in a fully hybrid manner, streams that are received via broadcast with streams that are delivered via OTT. As an example, a given DVB-I service may have some DVB-DASH representations and/or components that are available via broadcast and others that are only available terrestrially. Native IP television sets can indistinguishably present such services to end users as one and the same service.

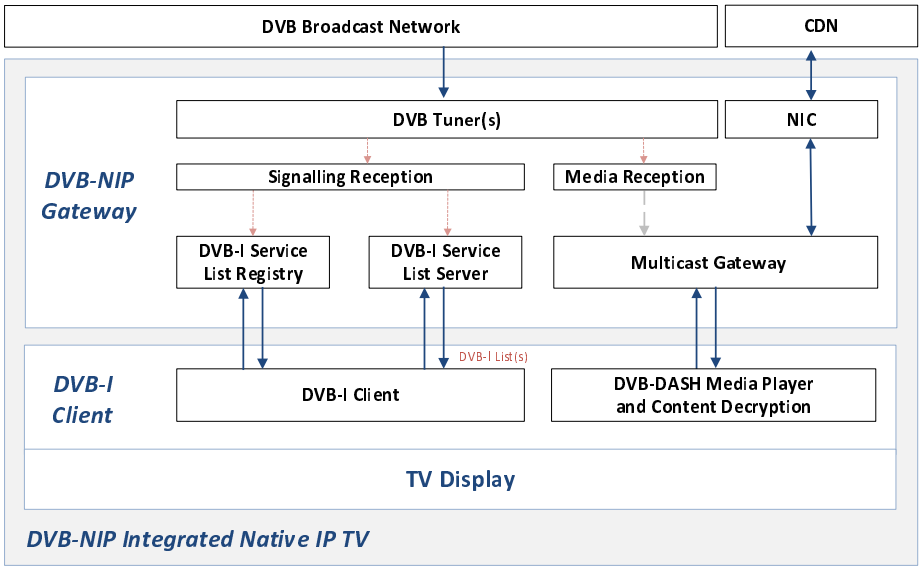


Figure 6.4-2: DVB-NIP DM2 Integrated Native IP TV Simplified Architecture (informative)

6.5 Home Gateway + IP Client (DM3)

Deployment Model 3 (DM3) is a split model in which the NIP Gateway and the NIP Client functions are implemented in separate devices.

The NIP Gateway may be an additional feature of an existing hardware device such as a TV set, a STB, an antenna multiswitch, etc. or may be a dedicated standalone Gateway device located on the local network. NIP Gateways may or may not be connected to a broadband network.

The NIP Client (typically a client implementing DVB-I according to ETSI TS 103 770 [9]) is generally a software application or component running on a tunerless smart IP device such as a tablet, smartphone, laptop, PC, IP media player, smart television set etc.

In order for a NIP Client and a NIP Gateway to discover themselves on the local network, DM3 implementations according to the present document make use of the Network Device Discovery Protocol mechanisms specified in clause 11.1.

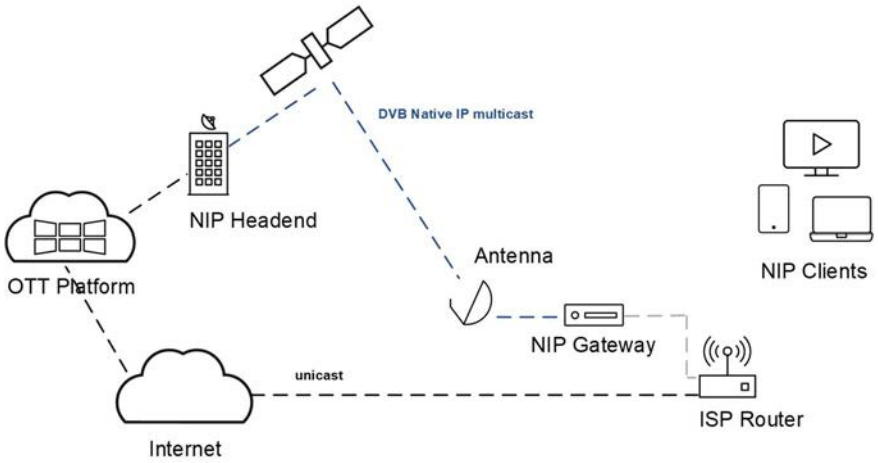


Figure 6.5-1: Simplified view of Deployment Model 3

In DM3 all interactions between the DVB-I client and the NIP provided DVB-I server functions are specified by DVB-I ETSI TS 103 770 [9]. The NIP specification has been designed such as to allow the use of standard unmodified DVB-I Clients also in a DVB-NIP Broadcast System.

A simplified view of the split NIP Client Gateway architecture is shown below:

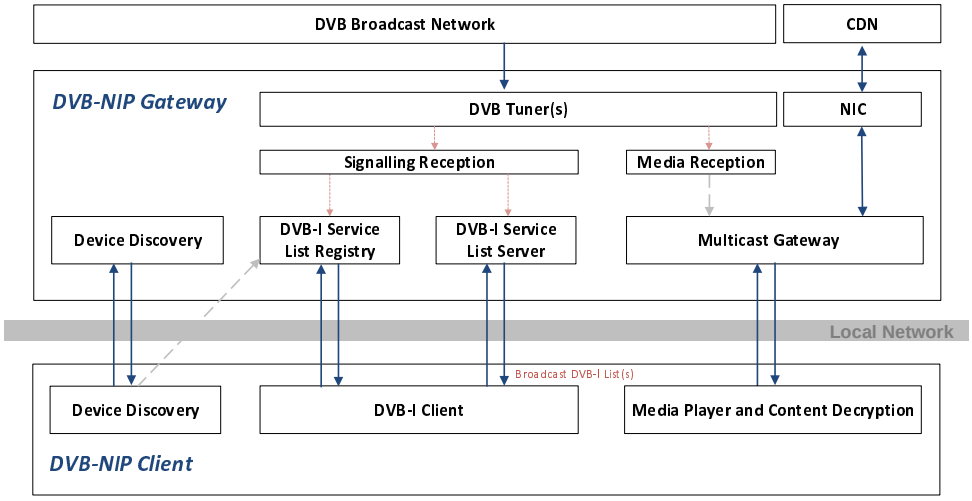


Figure 6.5-2: DVB-NIP DM3 Split Gateway Client simplified architecture (informative)

6.6 Receiver Configurations and Deployment Models

Depending on the specific deployment model, receiver configurations may require different functions and features to be implemented. Table 6.6-1 associates the receiver functions and the deployment models. At least "Mandatory" subsystems and functionalities need to be implemented in reception equipment to comply with the present document for a specific deployment model.

Table 6.6-1: Receiver Configurations and Deployment Models

Receiver configurations	DM1 NIP Edge Cache Receiver	DM2 Integrated NIP TV	DM3 NIP Gateway	DM3 NIP Client
DVB-NIP Functions or Features				
GSE-Lite for S2X and T2 receivers	M (see note 1)	M (see note 1)	M (see note 1)	NA
GSE-HEM mode for S2X and T2 reception	M (see note 1)	M (see note 1)	M (see note 1)	NA
MPE for S2 and T2	M (see note 2)	M (see note 2)	M (see note 2)	NA
LL signalling	M (see note 3)	M (see note 3)	M (see note 3)	NA
IP RoHC	M (see note 3)	M (see note 3)	M (see note 3)	NA
Multicast rendez-vous service	M	M	M	NA
Multicast gateway function	M	M	M	NA
Multicast GW, bootstrap and config file	M	M	M	NA
FLUTE and ROUTE reception	M	M	M	NA
Announcement Channel reception	M	M	M	NA
NIF Table	O	M	M	NA
SIF Table	O	M	M	NA
Device Discovery: mDNS	NA	NA	M	M(4)
Content Decoding	NA	M	NA	M
Content Decryption (connected)	NA	M	NA	M
M = Mandatory, O = Optional, NA = Not Applicable, ND = Not yet defined				
NOTE 1: Not mandatory for DVB-S2 Receivers implementing only Annex A. NOTE 2: Mandatory only for deployments supporting Annex A. NOTE 3: Not mandatory for receivers only supporting Annex A. NOTE 4: DM3 clients implement at least one of the Device Discovery Protocol clauses 11.1.2 and/or 11.1.3.				

Within the present document, a number of configurations and mechanisms are defined as "Optional". Configurations and mechanisms explicitly indicated as "optional", for a given deployment model, need not be implemented in the equipment to comply with the present document. Nevertheless, when an "Optional" mode or mechanism is implemented, it shall comply with the specification as given in the present document.

7 Native IP Carriage

7.1 Introduction

DVB Native IP is designed for deployment on top of the following physical layer systems:

- DVB-S2X (ETSI EN 302 307-2 [2], ETSI EN 302 307-1 [1]);
- DVB-S2 (ETSI EN 302 307-1 [1]); and
- DVB-T2 (ETSI TS 102 755 [3]).

The data link layer in DVB Native IP uses either:

- Generic Stream Encapsulation (GSE), ETSI TS 102 606-1 [4], ETSI TS 102 606-2 [5], ETSI TS 102 606-3 [6].
- Multi-Protocol Encapsulation ETSI EN 301 192 [7], clause 7.

In the case of GSE, the GSE-Lite profile of the GSE specification (ETSI TS 102 606-1 [4], Annex D) has been chosen for Native IP purposes. The particular modes and settings of the aforementioned layer 1 and layer 2 specifications to be used for DVB-NIP are described in detail in this clause.

7.2 Physical Layer: DVB-S2X, DVB-S2, DVB-T2

7.2.1 Overview

There is a high degree of commonality between DVB-S2X (ETSI EN 302 307-2 [2]), DVB-S2 (ETSI EN 302 307-1 [1]) and DVB-T2 (ETSI TS 102 755 [3]) with regards to the mode adaptation, but some settings for NIP purposes are specific to each physical layer system and hence related definitions are described separately in the following clauses 7.2.2 to 7.2.4.

The following mapping of data link layer protocols to physical layer systems applies:

- DVB-S2X: GSE (GSE-Lite profile)
- DVB-S2: MPE
- DVB-T2: GSE (GSE-Lite profile) and MPE

7.2.2 DVB-S2X

The entirety of DVB-S2X is defined by the two specifications ETSI EN 302 307-1 (DVB-S2, [1]) making up the core part and (ETSI EN 302 307-2 [2]) (DVB-S2X) making up the extension of and the difference to the core part. The whole physical layer system DVB-S2X can be deployed as defined by the two aforementioned specifications - with the attributes and restrictions described below:

System configurations (table 1, clause 4.3 of ETSI EN 302 307-2 [2]):

- The system configuration for Broadcast Services according to clause 4.3, table 1 of ETSI EN 302 307-2 [2] shall be used for consumer applications or applications targeting simultaneously both consumer and professional use cases. Alternatively, the system configuration for Professional Services according to clause 4.3, table 1 of ETSI EN 302 307-2 [2] shall be used for applications purely targeting professional use cases.

Mode adaptation (clauses 5.1 of ETSI EN 302 307-1 [1] and ETSI EN 302 307-2 [2], respectively):

- Physical layer slicing - see ETSI EN 302 307-1 [1], clause 5.1.5 - is applicable.
- Baseband Frame mode shall be set to High Efficiency Mode (HEM) for NIP, see ETSI EN 302 307-2 [2], clause 5.1.7. The following settings (binary indication for all) of the MATYPE-1 field of the BBHEADER have to be selected:

  TS/GS: 10 (GSE-HEM)

  NPD/GSE-Lite: 1 (GSE-Lite)
- Baseband frame mode shall be set to High Efficiency Mode (HEM) for NIP, see ETSI EN 302 307-2 [2], clause 5.1.7:

  MODE (EXORed with CRC-8): 0000 0001 (High Efficiency Mode, HEM)
- A single Input Stream of the format GSE-HEM is transmitted.
- Since NIP makes use of GSE and HEM, ETSI EN 302 307-2 [2], clause 5.1.7 including figure 1 is applicable.
- All other BBHEADER settings are set according to the definitions in ETSI EN 302 307-1 [1] and ETSI EN 302 307-2 [2].

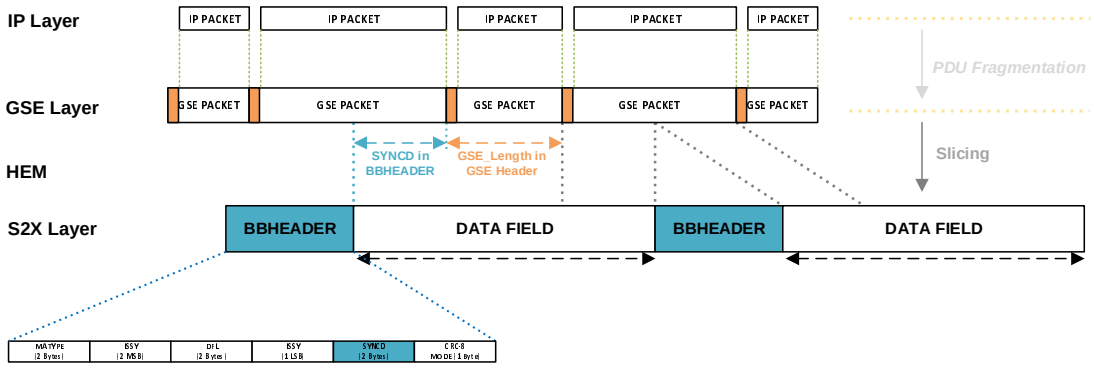


Figure 7.2.2-1: DVB-S2X High Efficiency Mode for GSE (based on figure 1 in ETSI EN 302 307-2 [2])

Due to the deployment of HEM and GSE-Lite for NIP, PDU fragmentation can't be used, i.e. the only packet segmentation approach applicable is physical layer slicing.

7.2.3 DVB-S2

DVB-S2 is defined by the specification ETSI EN 302 307-1 [1]. The whole physical layer system DVB-S2 can be deployed as defined by the aforementioned specification - with the following attributes and restrictions:

System configurations (table 1, clause 4.3 of ETSI EN 302 307-1 [1]):

- "Broadcast Services" is used for consumer applications or applications targeting simultaneously both, consumer and professional use cases. Alternatively, the system configuration "Professional Services" shall be used for applications purely targeting professional use cases.

Mode adaptation (clause 5.1 of ETSI EN 302 307-1 [1]):

- Physical layer slicing - see ETSI EN 302 307-1 [1], clause 5.1.5 - is applicable.
- The following setting (binary indication) of the MATYPE-1 field of the BBHEADER - see ETSI EN 302 307-1 [1], clause 5.1.6, table 3, has to be selected:

  TS/GS: 11 (Transport Stream)

- A single Input Stream of the format MPEG-2 Transport Stream with Constant Coding and Modulation (CCM) is transmitted. Accordingly, table 4 in ETSI EN 302 307-1 [1], clause 5.1.6, applies.
- All other BBHEADER settings are chosen according to the definitions in ETSI EN 302 307 [1].

7.2.4 DVB-T2

DVB-T2 is defined by ETSI TS 102 755 [3]. The whole physical layer system DVB-T2 can be deployed as defined by the aforementioned specifications - with the following attributes and restrictions:

System overview (clause 4.1 of ETSI TS 102 755 [3]):

- It is assumed that the receiver will always be able to decode one data PLP and its associated common PLP - if any - in parallel. See ETSI TS 102 755 [3], clause 4.1.

Mode adaptation (clause 5.1 of ETSI TS 102 755 [3]):

- Physical layer slicing is applicable, see ETSI TS 102 755 [3], clauses 5.1.0 and 5.1.8, figure 8.
- The following settings (binary indication for all) of the MATYPE-1 field of the BBHEADER have to be selected (see ETSI TS 102 755 [3], clause 5.1.7):

  TS/GS: 10 (GSE)

  NPD/GSE-Lite: 1 (GSE-Lite profile)

- Baseband frame mode shall be set to High Efficiency Mode (HEM) for NIP, see ETSI TS 102 755 [3], clauses 5.1.7 and 5.1.8:

  MODE (EXORed with CRC-8): 0000 0001 (High Efficiency Mode, HEM)

- Since NIP makes use of GSE and HEM, figure 8 as part of clause 5.1.8 in ETSI TS 102 755 [3] and related text is applicable.
- All other BBHEADER settings are chosen according to the definitions in ETSI TS 102 755 [3].

Due to the deployment of HEM and GSE-Lite for NIP, PDU fragmentation cannot be used, i.e. the only packet segmentation approach applicable is physical layer slicing.

As an alternative to DVB-GSE, DVB-MPE may be deployed as data link layer protocol on top of the MPEG2-Transport Stream. Mode adaptation settings are taken from those available in DVB-T2 ETSI TS 102 755 [3] for the Transport Stream.

7.3 Data link layer: GSE-Lite, MPE

7.3.1 Overview

Depending on the physical layer system deployed, either GSE (ETSI TS 102 606-1 [4], ETSI TS 102 606-2 [5], ETSI TS 102 606-3 [6]) with its GSE-Lite profile or MPE (ETSI EN 301 192 [7], clause 7) is used on the data link layer. Further details are outlined in clauses 7.3.2 and 7.3.3.

7.3.2 Generic Stream Encapsulation (GSE), GSE-Lite profile

On the data link layer, Generic Stream Encapsulation (GSE, ETSI TS 102 606-1 [4], ETSI TS 102 606-2 [5], ETSI TS 102 606-3 [6]) is used for NIP purposes in conjunction with the physical layer systems DVB-S2X (ETSI EN 302 307-1 [1] and ETSI EN 302 307-2) and DVB-T2 (ETSI TS 102 755 [3]). Of the two available GSE profiles, only the GSE-Lite profile (see ETSI TS 102 606-1 [4], Annex D) is used for DVB-NIP as defined by the present document.

Due to the deployment of HEM and GSE-Lite for NIP, PDU fragmentation cannot be used, i.e. the only packet segmentation approach applicable is physical layer slicing.

In order to avoid compatibility issues, it is recommended that NIP GSE Encapsulators / Modulators should not use the label re-use mode" (as defined in GSE standard ETSI TS 102 606-1 [4], clause 4.1.3).

7.3.3 Multi-Protocol Encapsulation (MPE)

On the data link layer, Multi-Protocol Encapsulation (MPE, ETSI EN 301 192 [7], clause 7) shall be used for NIP purposes in conjunction with the physical layer system DVB-S2 (ETSI EN 302 307-1 [1]) or DVB-T2 (ETSI TS 102 755 [3]).

The presence of a Multiprotocol data stream in a DVB Service shall be indicated in the program map section, according to ISO/IEC 13818-1 [15] of that service by setting the stream type to the value "0x0D". A given service shall not include more than one MPE PID. However more than one service carrying an MPE section stream may be present in a given Transport Stream according to ISO/IEC 13818-1 [15]. The table_id in the header of MPE sections shall be set to "0x3E".

LLC/SNAP is not used. Accordingly, the LLC_SNAP_flag field of the datagram section has the value "0" and the datagram section carries an IP datagram.

The MAC to IP mapping in NIP shall be as specified in IETF RFC 1112 [20] for IPv4 and IETF RFC 2464 [21] for IPv6 multicast addresses.

7.3.4 NIP Stream Definition

A DVB-NIP broadcast platform carries IP multicast data within NIP Streams. A NIP Stream is a succession of network layer IP packets that are carried via data link layer frames with no specific timing constraints. The data link layer for NIP shall be a GSE-Lite stream according to clause 7.3.2 or an MPE stream according to clause 7.3.3.

A NIP Stream is therefore identical to a GSE-Lite stream or an MPE stream.

In a single input stream DVB-S2X implementation a single GSE-Lite stream shall be carried in a single physical transponder/channel. In a multi-stream implementation, more than one GSE-Lite stream may be carried over a single physical transponder/channel. The same logic applies to single or multiple PLP DVB-T2 implementations.

In the context of DVB-S2 or DVB-T2 in MPE mode, the NIP Stream is carried using an MPE stream declared as the sole component of a DVB Service. A Transport stream may carry more than one DVB Service carrying each a single MPE stream.

The multicast data transmitted over the broadcast channel is generated primarily by the Multicast Server, but also the NIP Signalling Server associated to each NIP Stream. Every NIP Stream shall have only a single Multicast Server associated to it. The Multicast Server generates multicast transport sessions consisting each out of one or more multicast streams.

If on a given physical channel more than one logical Multicast Server function will have to be supported, then use shall be made of the multiple input stream / PLP mechanisms as defined in the corresponding physical layer standards.

A NIP Stream is uniquely identified by the following four parameters: NIPNetworkID, NIPCarrierID, NIPLinkID, NIPServiceID.

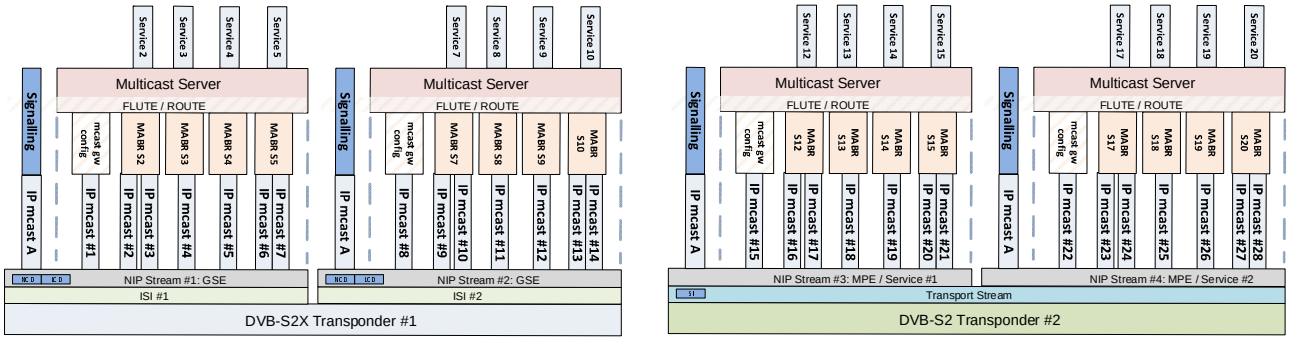


Figure 7.3.4-1: Example Illustration showing NIP Streams on GSE-Lite and MPE Transponders

7.4 Network Layer: IP RObust Header Compression (ROHC)

7.4.1 Introduction and Principles

DVB-NIP provides support for both uncompressed and compressed IP header transport. When IP header compression is used, the IP header compression scheme shall be ROHC-U as described in GSE-ROHC, ETSI TS 102 606-3 [6].

In the GSE-ROHC framework, multiple header compression profiles are defined. Each profile indicates a specific protocol combination, and the profile identifiers are allocated by the Internet Assigned Numbers Authority (IANA). For DVB-NIP, the profile '0x0002' is used for multicast streams.

In DVB-NIP, signalling information is carried through an announcement channel on a fixed IP multicast address and UDP port number. For the stable reception and fast acquisition of the announcement channel without additional processing, the announcement channel IP headers shall not be compressed.

When DVB-NIP is used in a backwards compatibility mode as described in Annex A using the MPE protocol as defined in ETSI EN 301 192 [7], IP ROHC shall not be applied.

7.4.2 ROHC channel mapping

The ROHC framework defines channels to identify the compressed packet flows. In a DVB-NIP system, a single ROHC channel shall be configured per GSE stream. Therefore, the Link ID can be mapped to a ROHC channel ID and the CID is managed separately for each GSE stream.

7.4.3 Context ID (CID) assignment

The CID can be assigned for each IP stream based on the combinations of upper layer protocols. An IP stream can be classified based on the IP address and port number. It can be considered as the same IP stream when the IP packet has the same combination of source IP address, destination IP address, source UDP port, and destination UDP port. For the same IP/UDP stream, the same CID can be assigned.

In ROHC, each ROHC channel can define three types of CID configuration: small CID, 1-byte large CID, and 2-byte large CID. Among these configurations, small CID and 1-byte large CID should be configured for DVB-NIP Systems as described in GSE-ROHC, ETSI TS 102 606-3 [6].

7.4.4 Transmission of Context Information

In the case of unidirectional links, if a receiver has no context information, the ROHC decompressor cannot recover the received packet header until it receives full context data. The context information and configuration parameters are sent in the ROHC-U descriptor or ROHC-U multicast descriptor.

Based on the GSE-ROHC specification ETSI TS 102 606-3 [6], the adaptation module at the transmitter constructs the ROHC-U descriptor or the ROHC-U multicast descriptor using configuration parameters and context information from the ROHC process. The adaptation module at the transmitter can use the previous configuration parameters and context information to transmit the ROHC-U descriptor or ROHC-U multicast descriptor periodically.

DVB-NIP supports the transmission method which sends context information separately from a compressed packet stream. The ROHC-U descriptor or ROHC-U multicast descriptor, including extracted context information, may be transmitted separately from the related ROHC packet flow, along with other signalling data. An updated ROHC-U descriptor or ROHC-U multicast descriptor shall be transmitted when the contained context information changes. The updated ROHC-U descriptor or ROHC-U multicast descriptor shall be sent prior to any GSE packets reflecting the change.

7.4.5 Link Layer Signalling

Generally, link layer signalling operates below the IP layer. In the receiver, link layer signalling can be obtained earlier than IP-level signalling such as announcement channel signalling.

Figure 7.4.5-1 shows the data link layer architecture and related identifiers on the transmission side of the DVB-NIP Broadcast System.

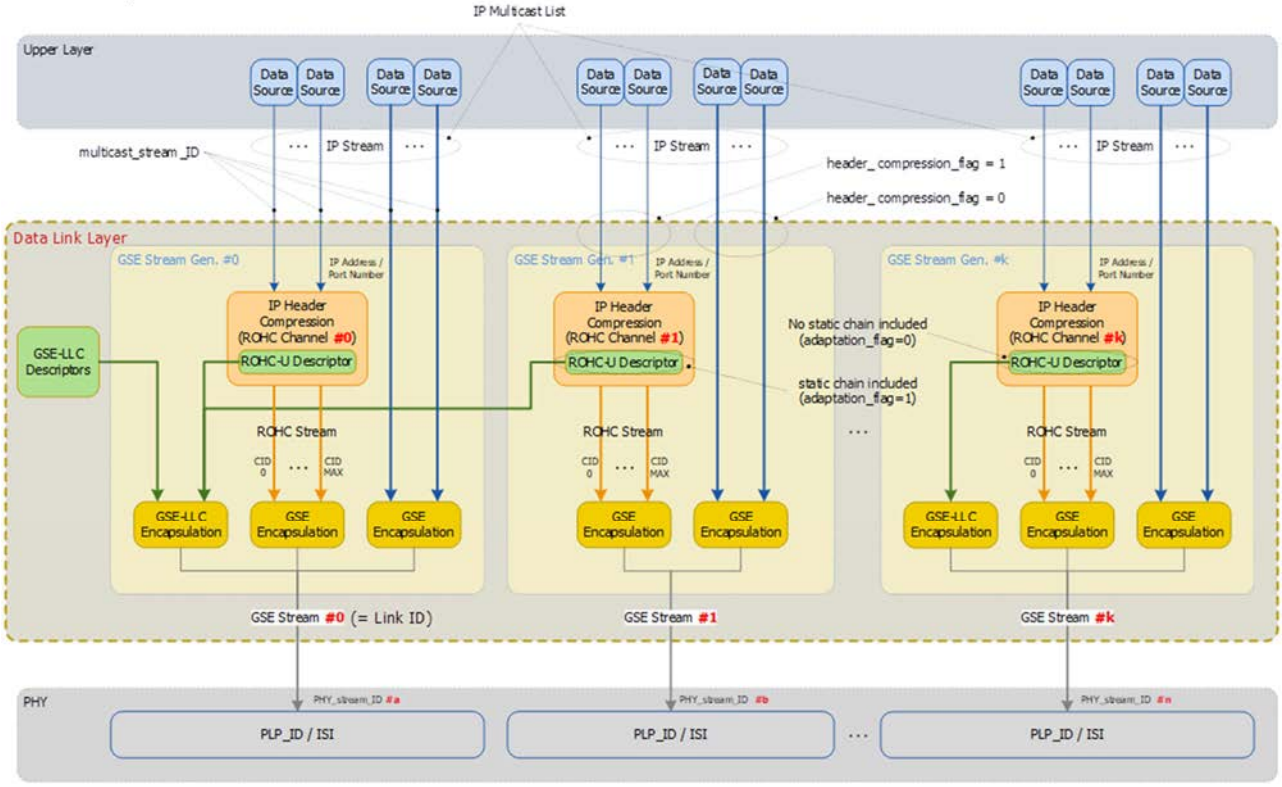


Figure 7.4.5-1: GSE layer architecture for DVB-NIP

NIP multicast IP streams are generated by both the Multicast Server and the NIP Signalling Server. These are shown as Data Sources in figure 7.4.5-1 and identified each by a Multicast Stream ID. IP Multicast Streams may or may not be compressed. IP multicast streams which are compressed (header_compression_flag=1) pass through the IP ROHC compression module associated to that GSE Stream also referred to as GSE Stream Generator in figure 7.4.5-1. All IP multicast streams destined for a given ISI or PLP are then encapsulated in the corresponding GSE Stream. In DVB-NIP the NIPLinkID and NIPCarrierID are related as described in clause 7.3.4. The link_id (as defined in GSE-LLC, ETSI TS 102 606-2 [5]) is identical to NIPLinkID. The NIPLinkIDs are mapped to PHY Stream IDs (as defined in clause 8.4.5.15 of ETSI EN 301 192 [7]) in the Link Layer. Both these identifiers are mapped to the PLP ID in the case of DVB-T2 (ETSI TS 102 755 [3]) or ISI in the case of DVB-S2 (ETSI EN 302 307-1 [1]) or DVB-S2X (ETSI EN 302 307-1 [1], ETSI EN 302 307-2 [2]) of the corresponding NIP Stream.

Link layer signalling shall be encapsulated into GSE-LLC packets as described in GSE-LLC, ETSI TS 102 606-2 [5]. The GSE-LLC packet can contain multiple descriptors.

7.4.6 Descriptors for the NIP system

To support the GSE layer structure above and multicast delivery, the following descriptors can be used for link layer signalling in an NIP system.

- IP Multicast List descriptor: This descriptor conveys a list of IPv4 multicasts carried in a physical link. This descriptor also provides additional information for processing the UDP/IPv4 packets carrying the multicasts in the DVB-GSE layer. This descriptor only provides information on UDP/IPv4 multicasts.
- IPv6 Multicast List descriptor: This descriptor conveys a list of IPv6 multicasts carried in a physical link. This descriptor also provides additional information for processing the UDP/IPv6 packets carrying the multicasts in the DVB-GSE layer. This descriptor only provides information on UDP/IPv6 multicasts.
- ROHC-U Multicast descriptor: This descriptor conveys configuration parameters for a ROHC channel which uses ROHC for IP as defined in ETSI TS 102 606-3 [6].
- ROHC-U descriptor: This descriptor conveys configuration parameters for the single CID of ROHC as defined in ETSI TS 102 606-3 [6].

7.4.7 Link Layer Signalling Example (informative)

Figure 7.4.7-1 shows the construction of link layer signalling using GSE-LLC.

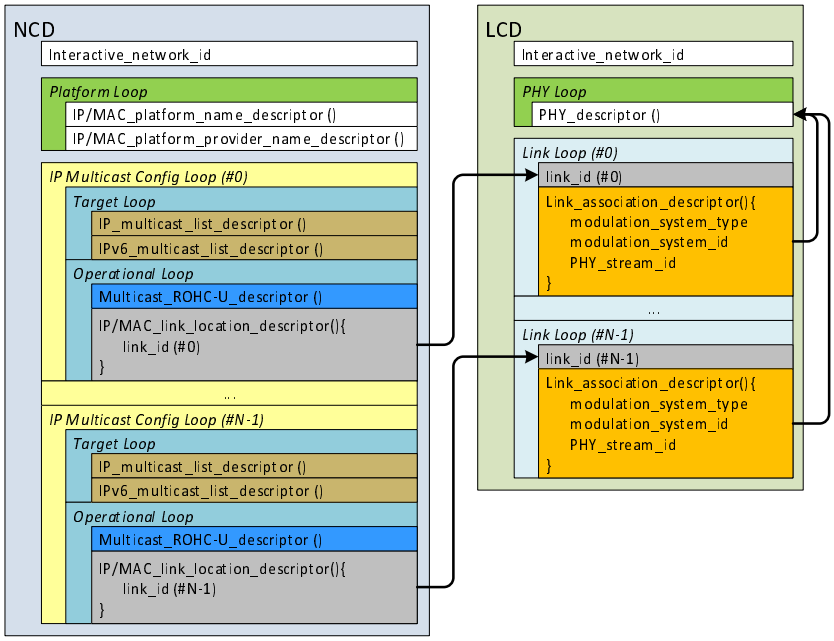


Figure 7.4.7-1: Mapping to LLC tables and lookup path for DVB-NIP

Multiple logical IP multicast configuration loops can be considered in a NCD record table. Each IP multicast configuration loop contains a target loop and an operational loop. Multiple descriptors can be configured in a target loop or operational loop. The IP multicast configuration loop can be constructed for each GSE stream. Each GSE stream can be identified by the link_id in the IP/MAC_link_location_descriptor.

In the target descriptor loop of NCD tables, the IP_multicast_list_descriptor can be configured. If IPv4 multicast and IPv6 multicast streams are conveyed together in the same GSE stream, both the IP_multicast_list_descriptor and the IPv6_multicast_list_descriptor can be contained in a target descriptor loop of NCD.

In an operational descriptor loop of NCD tables, ROHC-U_multicast_descriptor and IP/MAC_link_location_descriptor can be configured. In this case, because a single ROHC channel can be configured in a GSE stream, one Multicast_ROHC-U_descriptor is configured for a link_id. If no header compression is used in a GSE stream, Multicast_ROHC-U_descriptor is not contained in a descriptor loop.

Each link_id is mapped to the PHY_stream_id of each physical layer as configured in the LCD tables.

Figure 7.4.7-2 shows the relation between multicast_stream_id and rohc_flag in the NIP Gateway.

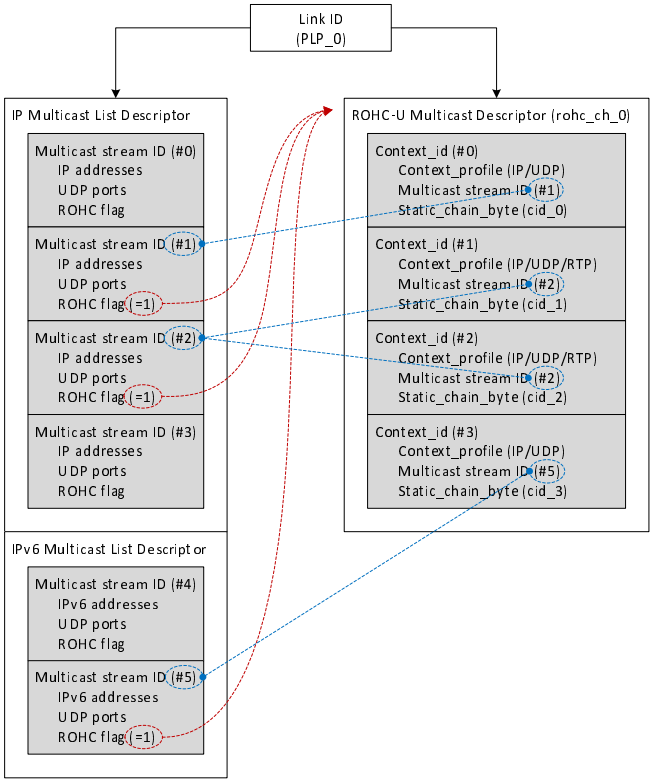


Figure 7.4.7-2: Multicast stream ID and ROHC flag mapping

The multicast stream ID is assigned to each IP/UDP stream based on IP addresses and UDP port numbers. If ROHC is applied to an IP stream, the header compression flag is set for that particular IP stream. Therefore, if the header compression flag is set in the IP Multicast list descriptor, the NIP Gateway needs to check the Multicast ROHC-U descriptor for the IP stream.

When ROHC is applied to an IP stream, the multicast stream ID is mapped to a context ID for each compressed stream. Therefore, the NIP Gateway can find the context information based on the combination of multicast stream ID and context ID.

7.5 Transport Layer: DVB-MABR

7.5.1 DVB-MABR Scope

NIP according to the present document relies on DVB-MABR for the transport of Media Objects. Every NIP Stream shall have a single Multicast Server function according to ETSI TS 103 769 [8] associated with it, generating all the multicast transport objects for that NIP stream. A single logical Multicast Server function shall not span more than one NIP Stream. A physical server instantiating multiple logical Multicast Server functions may however produce multicast sessions for more than one NIP Stream.

As a consequence of this, every NIP Stream - GSE-Lite or MPE - shall carry only a single multicast gateway configuration instance document as defined in clause 8.5.2.

All protocols defined in DVB-MABR ETSI TS 103 769 [8] for the transport of Media Objects via multicast are applicable to DVB-NIP under the restrictions depicted in clause 8.5.

7.5.2 Data Plane: DVB-MABR

DVB-MABR has been specified to be independent from the underlying transport protocol. ETSI TS 103 769 [8] specifies two multicast media transport protocols in its annexes.

- The FLUTE protocol specified in Annexes F and G of ETSI TS 103 769 [8] is based on 3GPP MBMS FLUTE and may be used for the carriage of NIP Streams.

- The ROUTE-based multicast media transport protocol specified in Annexes H and I of ETSI TS 103 769 [8] is based on ATSC 3.0 ROUTE and may be used for the carriage of NIP Streams.

8 Service Signalling Protocols

8.1 Signalling Overview

8.1.1 Introduction

DVB-NIP Signalling, as defined in the present document, relies on the concept of a broadcast Announcement Channel carrying signalling information under the form of XML Tables to NIP receivers. The Announcement Channel mechanism is defined under clause 8.2.

8.1.2 Signalling Data Structures

DVB-NIP signalling information is split across 6 tables. The purpose of these tables is to inform NIP receivers about:

1) The technical parameters required to access DVB-NIP services.

2) The availability of Service Lists, Services and content on the broadcast network and potentially via broadband.

The first table is called NIF: **Network Information File**. This table informs receivers about the logical identification of Streams and their physical parameters. It can be edited by the Technical Operator of the broadcast network providing an overall view of the entirety of a broadcast network or it can be edited by Commercial Operators present on that broadcast network and informing only about the Streams part of their own operations. The NIF table is carried on one or more so-called network Bootstrap Streams and is formatted as an XML file.

The second table is called SIF: **Service Information File**. This table informs receivers about the location of Services across the different NIP Streams and physical Transponders/Channels. It can be edited by the Technical Operator of the broadcast network providing an overall view of the entirety of a broadcast network or it can be edited by Commercial Operators present on that broadcast network and informing only about the location of services part of their own operations. The SIF table is carried on one or more so-called network Bootstrap Streams and is formatted as an XML file.

The third and fourth tables are related to the detailed technical operation of DVB-MABR in the context of NIP. The **Bootstrap Multicast Gateway Configuration Instance Document** is present in the announcement channel on each NIP Stream. It points to the DVB-MABR multicast session carrying the **Multicast Gateway Configuration Instance Document** as specified in DVB-MABR (ETSI TS 103 769 [8]). This latter table shall be present once on each NIP Stream and provides the link between service URLs and the IP multicast addresses in use on the broadcast Stream to convey the Services. It also provides information on other technical mechanisms available in DVB-MABR (ETSI TS 103 769 [8]) such as e.g. unicast repair mechanisms. Both tables are formatted as XML.

The fifth table is called the **DVB-I Service List Entry Points** table and provides information on the presence of DVB-I Service Lists across the broadcast network. This table is fully compliant with the DVB-I Service List Entry Points specification in ETSI TS 103 770 [9] and further described under clause 8.3.2. It is formatted as a dedicated broadcast XML file and lists the DVB-I Service Lists available.

Finally different **DVB-I Service Lists** may be provided by the Technical Operator of the network or Commercial Operators present on the network. These list the Services present on the broadcast network and provide the URLs required to access the services. DVB-I Service Lists are specified in ETSI TS 103 770 [9] and formatted as XML.

The definition and use of all these tables as defined in NIP is described in the corresponding sections below.

8.1.3 Service Delivery Model

A DVB-NIP broadcast network is made up of one or more RF Channels (called transponders in a satellite context). Each RF Channel can carry one or multiple Input Stream Identifiers (ISIs) as defined in DVB-S2X (ETSI EN 302 307-1 [1], ETSI EN 302 307-2 [2]) or one or more Physical Layer Pipes (PLPs) as defined in DVB-T2 (ETSI TS 102 755 [3]). Each input stream or physical layer pipe shall carry only a single NIP Stream encapsulated in GSE-Lite as defined under clause 7.3.2 or a single Transport Stream carrying one or more MPE streams as defined in clause 7.3.3 of the present document.

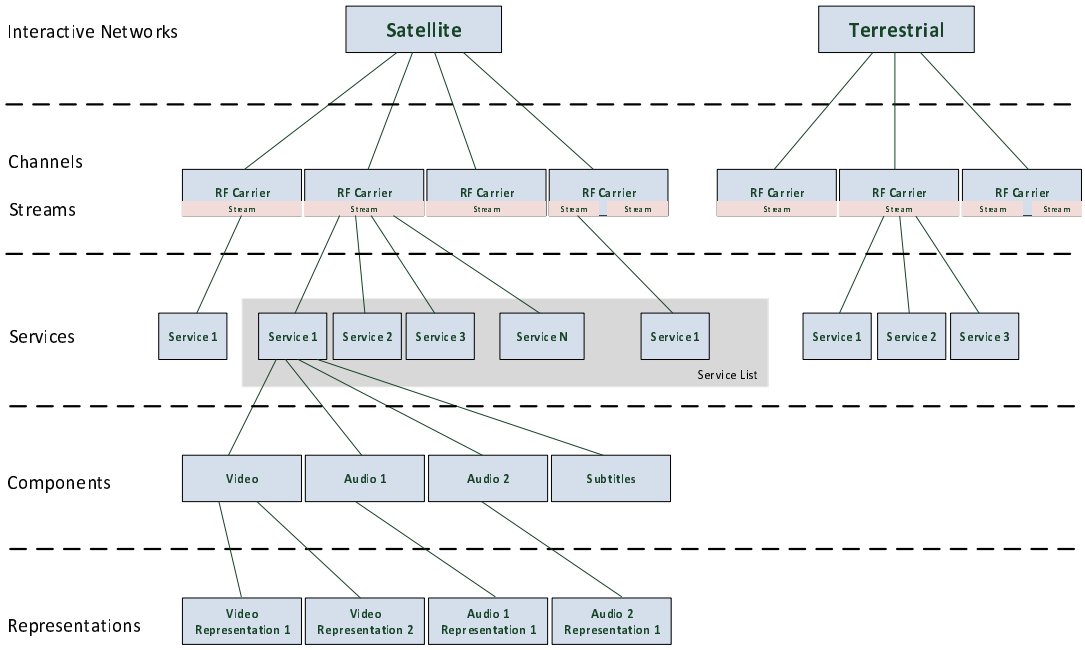


Figure 8.1.3-1: NIP Service Delivery Model

8.1.4 Bootstrap and Regular NIP Streams

8.1.4.1 Definition

DVB-NIP distinguishes two types of streams: so-called Bootstrap NIP Streams and Regular NIP Streams.

Bootstrap Streams participate in the bootstrap setup phase of receivers and shall carry NIF, SIF and DVB-I Service List Entry Points. If one or more of these documents are missing, the Stream cannot be considered as Bootstrap Stream, as the receiver will not be able to discover the entirety of services.

Regular Streams do not participate in the Bootstrap Process. The Bootstrap Process helps receivers joining a network to learn about the extent of the network and the physical location of all services on that network.

8.1.4.2 NIP Stream Identifiers

NIP Streams are identified by the following 4 parameters:

- NIPNetworkID identifying the network.
- NIPCarrierID identifying uniquely the RF Carrier within the network identified with NIPNetworkID.
- NIPLinkID identifying the NIP Stream in the context of DVB-GSE (ETSI TS 102 606-2 [5]) or in the context of DVB-S2 Professional services (ETSI EN 302 307-1 [1]).
- NIPServiceID identifying the NIP Stream in the context of DVB-MPE (ETSI EN 301 192 [7]).

Depending on the Data Link Layer, these respectively correspond to:

- For GSE-Lite encapsulated Streams:
  - NIPNetworkID = interactive_network_id as defined in ETSI TS 102 606-2 [5].
  - NIPCarrierID = modulation_system_id as defined in ETSI TS 102 606-2 [5].
  - NIPLinkID = link_id (see note 1) as defined in ETSI TS 102 606-2 [5].
  - NIPServiceID = 0 as not relevant in a GSE-Lite context.

NOTE 1: In the case of single link in GSE (such as the case of Single Input Stream or unique PLP), NIPLinkID = 0.

- For MPE over TS:
  - NIPNetworkID = original_network_id as defined in ETSI EN 300 468 [14].
  - NIPCarrierID = transport_stream_id as defined in ETSI EN 300 468 [14].
  - NIPLinkID = PHY_stream_id (see note 2) as defined in ETSI EN 301 192 [7].
  - NIPServiceID = service_id as defined in ETSI EN 300 468 [14].

NOTE 2: In the case of Single Input Stream or in the context of DVB-S2 Broadcast services (ETSI EN 302 307-1 [1]), NIP Link Id = 0.

8.1.5 Table Generation and Broadcast

DVB-NIP tables are generated as files by the NIP Service Aggregation Platform and broadcast from the NIP Headend. The Signalling Server function of a NIP Headend collects or generates the signalling information and converts it for multicast transmission via the broadcast Announcement Channel. Every NIP Stream shall carry an Announcement Channel on a fixed IP multicast address and port, as specified in clause 8.2.1 of the present document.

8.1.6 Signalling Broadcast Location

DVB-NIP tables are carried via the Announcement Channel mechanism described under clause 8.2. The Announcement Channel shall be present in every NIP Stream.

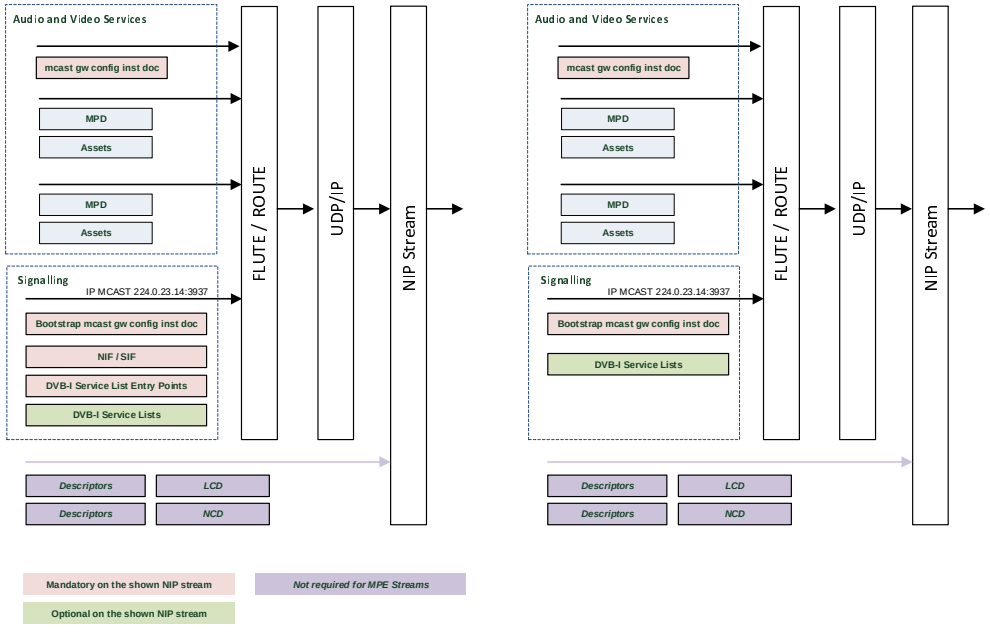


Figure 8.1.6-1: Signalling carriage in NIP Streams

Table 8.1.6-1 shows which DVB-NIP specified tables are mandatory on the Announcement Channel of the two different stream types as described in clause 8.1.4.

Table 8.1.6-1: Possible locations of DVB-NIP Tables

Table	Bootstrap Stream	Regular Stream
Bootstrap multicast gateway configuration instance document	M (see note)	M*1
NIP NIF	M	N.A.
NIP SIF	M	N.A.
DVB-I Broadcast Service List Entry Points	M	N.A.
DVB-I Broadcast Service Lists	A	A
DVB-I Playlists	O	O
NIP Time Offset Information	M	M
NIP Content Guide Manifest	O	N.A
NIP Service Guide Manifest	M	M
NIP Content Protection Assets Signalling Manifest	O	N.A
NIP Private Data Signalling Manifest	O	N.A
M: Mandatory, O: Optional, N.A.: Not Available, A: Alternative but requires one		
NOTE : The Bootstrap multicast gateway configuration instance document is only required for Streams carrying DVB-MABR content.		

Bootstrap Streams shall carry at least the following information: NIF, SIF and the DVB-I Service List Entry Points table in addition to the "bootstrap" multicast gateway configuration instance document which is mandatory on each NIP Stream carrying DVB-MABR information, as specified in clause C.2 of ETSI TS 103 769 [8].

8.1.7 Receiver Signalling Usage Sequence

8.1.7.1 Introduction

The clauses hereunder describe the different steps that a NIP receiver follows in order to gain access to NIP services.

8.1.7.2 Receiver Bootstrapping Mechanism

A NIP receiver, in idle mode, joining a NIP broadcast network initially tunes to the Bootstrap Stream and listens for the NIF, SIF tables and DVB-I Service List Service Entry Points document on the announcement channel of that stream.

A NIP Bootstrap Stream is identified thanks to:

- The NIP Stream identifiers as defined in clause 8.1.4.2.
- Satellite Orbital Position and West_East_flag (for satellite networks only).
- ProviderName.

The NIF/SIF tables inform the broadcast receiver about the location of NIP Services and other Assets available on the different physical channels of the broadcast network and how to access them through their technical parameters.

The NIP broadcast receiver then listens for the DVB-I Service List Entry Points Table. This table informs the receiver about all the DVB-I Service Lists broadcast as part of the current network.

The NIP receiver caches these 3 tables in its memory for later use.

8.1.7.3 Device Announcement and Discovery Mechanism

NIP receivers according to Deployment Model 3 (DM3) implement a functional split between the DVB-I Client rendering the services to end users and the NIP Gateway which receives the content from the broadcast network. NIP specifies two main mechanisms in clause 11.1 which allow both NIP Clients and NIP Gateways to announce and discover themselves while part of the same local network.

At the end of the discovery process, as specified in clause 11.1, the NIP Gateway provides the URL to the client through which the DVB-I Client can locally retrieve the DVB-I Service List Entry Points file from the Gateway.

8.1.7.4 DVB-I Service List Discovery Mechanism

DVB-I Clients contact the local DVB-I Service List Registry (SLR) function part of the NIP Gateway to get the DVB Service List Entry Points table. That table lists all the DVB-I Service Lists available on the broadcast network.

A DVB-I Client shall request from the NIP Gateway:

1) the entire list that the Gateway received via broadcast and containing all the URLs of all the DVB-I Service Lists; or

2) the DVB-I Client may also include as part of its request the DVB-I defined query parameters such as "TargetCountry", "regulatorListFlag", "Language", "Genre" and "ProviderName". In such a case the NIP Gateway shall compute and return only those DVB-I Service List Entry Points corresponding to the query parameters. This functionality means that the NIP Gateway has to implement a minimum amount of DVB-I (ETSI TS 103 770 [9]) syntax to be able to filter the DVB-I Service List Entry Points table based on query parameters.

8.1.7.5 DVB-I Service Discovery Mechanism

Once the DVB-I Client has received the entire or down-filtered list of DVB-I Service Lists available on the broadcast network it can itself or through interaction with the end-user select the DVB-I Service List to use for the selection of DVB-I Services.

The DVB-I Client will request the selected DVB-I Service List from the NIP Gateway. If the NIP Gateway does not have the list in its cache, it will retrieve the DVB-I Service List from the broadcast stream. To locate the corresponding Service List on the broadcast network:

- The NIP Gateway shall match the URL of the DVB-I Service List (originally from the DVB-I Service List Entry Points table) with the DVB-I Service List URLs in the SIF table.

- It will then, using the NIF table, tune to the physical channel to receive the corresponding DVB-I Service List.

To improve the user experience, it is recommended for NIP Gateways to pre-cache as many of the DVB-I tables as possible.

8.1.7.6 Service Tuning and Service Access Mechanism

Each time the end-user selects a broadcast service instance from the DVB-I Service List, the DVB-I Client function sends a request for the MPEG-DASH manifest to the NIP Gateway function. These instance requests are automatically sent to the Gateway due to the format of the URLs for such instances.

8.2 Signalling Carriage Description

8.2.1 Principles

Every NIP GSE-Lite/MPE stream according to the present document shall carry an announcement channel on a fixed IP multicast address, UDP port number. The announcement channel shall use the FLUTE or ROUTE protocol specified in Annexes F and G of DVB-MABR ETSI TS 103 769 [8] to carry the signalling information required for a Native IP system to operate.

The fixed IP multicast address and UDP number of the announcement channel shall never be compressed with the RoHC-U algorithm described in clause 7.4.

8.2.2 IP Multicast Address, Port and TSI

Signalling information shall be carried as document files in a FLUTE/ROUTE session with a well-known IP address, UDP port number and TSI (LCT) dedicated to this function.

The IP address has been registered by DVB (dvbservdsc) with IANA described in IETF RFC 5328 [19] and is 224.0.23.14 for IPv4 and FF0X:0:0:0:0:0:0:12D for IPv6.

The port number is 3937/udp.

The TSI Transport Session Identifier (LCT) value shall be set to 0.

The same IP multicast destination address shall be used in each GSE/MPE stream and care has to be taken at the headend that each GSE/MPE stream only carries the information relative to the stream in which it resides. The multicast announcement channel signalling stream only exists between the headend signalling server and the NIP Gateway Receiver function.

In addition, in order to allow NIP Gateways to detect a NIP stream change, the source IP address that carries the signalling information shall be unique for each NIP Stream.

8.2.3 Announcement Channel Structure

The Announcement Channel stream consists of a FLUTE/ROUTE session with TSI 0 using the IP multicast address and UDP port specified in clause 8.2.2.

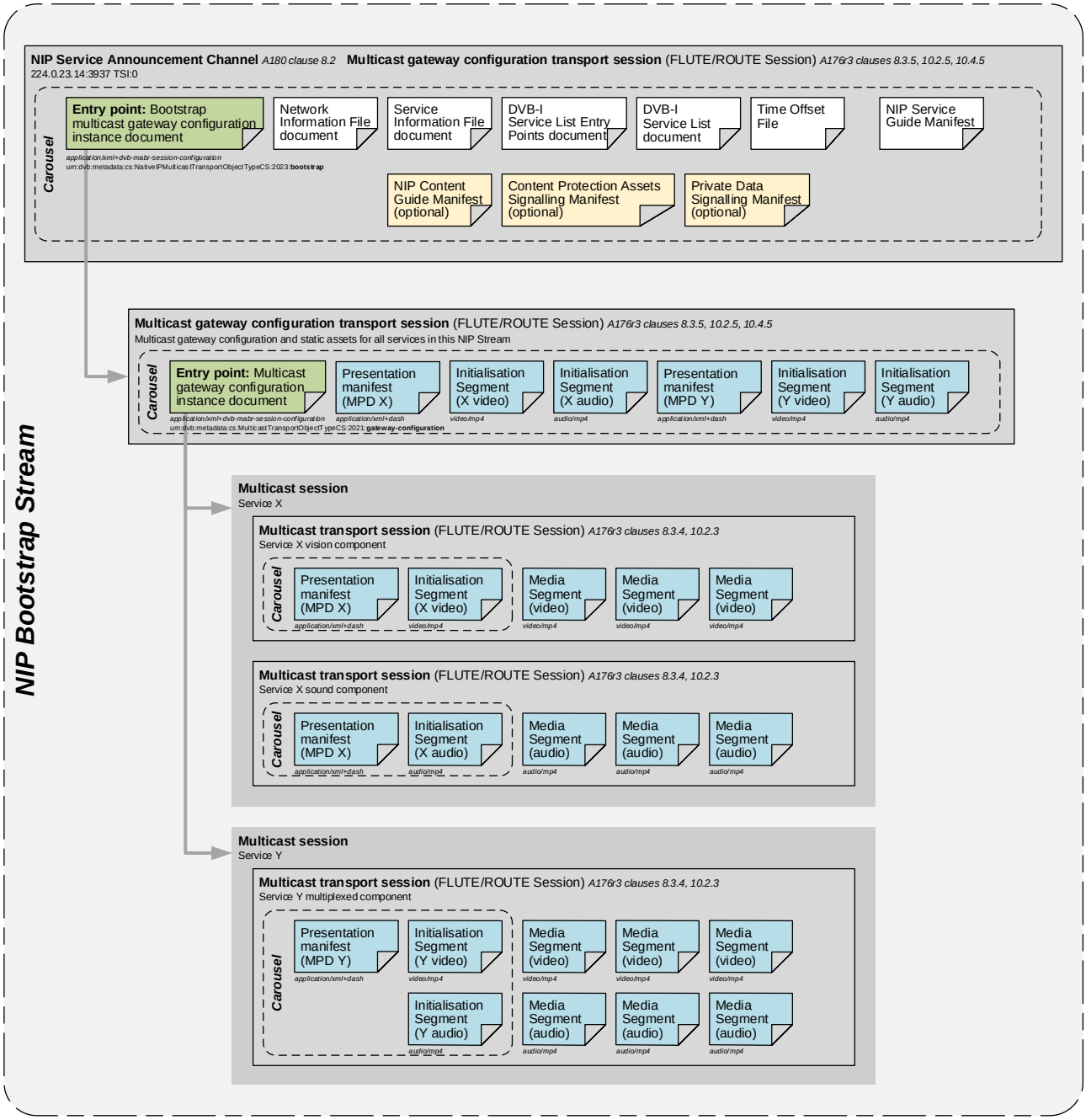


Figure 8.2.3-1: NIP Announcement Channel Example (Bootstrap Stream)

8.2.4 Announcement Channel FLUTE/ROUTE File Delivery Table

The announcement channel FLUTE/ROUTE session carries the mandatory File Delivery Table (FDT) as specified in DVB-MABR ETSI TS 103 769 [8]. The FDT is used to inform receivers about the files that are being transmitted and their associated metadata. FDT instances are sent in the same session as the files. The FDT itself shall always be sent in data packets with TOI=0. It is recommended to repeatedly transmit FDT instances at a rate sufficient to allow fast access for receivers to the signalling files carried in the announcement channel.

The FDT instance is an XML structure with a single root element "FDT-Instance". For each announcement channel document file declared there is a single file description entry in the FDT instance. Each entry is declared by the element "File". Each "File" element shall contain at least the attributes: "Content-Location", "TOI" and "Content-Type".

Content-Location: is used to convey the urn or url of the corresponding announcement channel document file. The urn encoding shall be according to table 8.2.5-1. The format of urls shall be according to clause 8.2.7.

Table 8.2.4-1: Content-Location Field Coding

Description	
Bootstrap multicast gateway configuration instance document	URN
NIP NIF	URN
NIP SIF	URN
Broadcast DVB-I Service List Entry Points	URN
Broadcast DVB-I Service Lists	URL
DVB-I Playlist	URL
NIP Content Guide Manifest	URL
NIP Service Guide Manifest	URN
NIP Content Protection Manifest	URN
NIP Private Data Signalling Manifest	URN
NIP Time Offset File	URN

TOI: The Transport Object Identifier (TOI) acts as a file identifier labelling packets in the session as belonging to the transmission of a given file object. When the object to be transported changes, the TOI value shall change also. Conversely as long as the object does not change, the TOI value stays the same. NIP implementations support TOI sizes of 16 and 48 bits.

Content-Type: Corresponds to the Media Type (MIME type) of the corresponding document. It shall allow to uniquely identify the announcement channel files being transmitted as belonging to a certain type. The allowed values for "Content-Type" in DVB-NIP are listed in clause 8.2.5.1.

The namespace declarations required for NIP compliant FDT implementations are:

```
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:sv="urn:3gpp:metadata:2009:MBMS:schemaVersion"
```

Below is an example instance of an FDT:

```
<?xml version="1.0" encoding="UTF-8"?>
<FDT-Instance xmlns="urn:IETF:metadata:2005:FLUTE:FDT"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:sv="urn:3gpp:metadata:2009:MBMS:schemaVersion" Expires="3911896521"
    FEC-OTI-FEC-Encoding-ID="0" FEC-OTI-FEC-Instance-ID="0"
    FEC-OTI-Maximum-Source-Block-Length="5500" FEC-OTI-Encoding-Symbol-Length="1380"
    FEC-OTI-Max-Number-of-Encoding-Symbols="5500">
    <File
        Content-Location="urn:dvb:metadata:cs:NativeIPMulticastTransportObjectTypeCS:2023:bootstrap"
        TOI="1" Content-Length="3619" Transfer-Length="3619"
        Content-Type="application/xml+dvb-mabr-session-configuration" Content-Encoding="null"
        Content-MD5="RSp42jQNEiCzyVwv1s+ocw==" FEC-OTI-FEC-Encoding-ID="0"
        FEC-OTI-FEC-Instance-ID="0" FEC-OTI-Maximum-Source-Block-Length="5500"
        FEC-OTI-Encoding-Symbol-Length="1380" FEC-OTI-Max-Number-of-Encoding-Symbols="5500">
        <sv:delimiter>0</sv:delimiter>
        <sv:delimiter>0</sv:delimiter>
    </File>
    <File Content-Location="urn:dvb:metadata:nativeip:NetworkInformationFile" TOI="2"
        Content-Length="1921" Transfer-Length="1921" Content-Type="application/xml+dvb-nip-nif"
        Content-Encoding="null" Content-MD5="e+Xyfr6uHYdpEp5lknB4bQ==" FEC-OTI-FEC-Encoding-ID="0"
        FEC-OTI-FEC-Instance-ID="0" FEC-OTI-Maximum-Source-Block-Length="5500"
        FEC-OTI-Encoding-Symbol-Length="1380" FEC-OTI-Max-Number-of-Encoding-Symbols="5500">
```

```
        <sv:delimiter>0</sv:delimiter>
        <sv:delimiter>0</sv:delimiter>
    </File>
    <File Content-Location="urn:dvb:metadata:nativeip:ServiceInformationFile" TOI="3"
        Content-Length="1213" Transfer-Length="1213" Content-Type="application/xml+dvb-nip-sif"
        Content-Encoding="null" Content-MD5="sPlXF4h8LVQtQL9GWzwNcQ==" FEC-OTI-FEC-Encoding-ID="0"
        FEC-OTI-FEC-Instance-ID="0" FEC-OTI-Maximum-Source-Block-Length="5500"
        FEC-OTI-Encoding-Symbol-Length="1380" FEC-OTI-Max-Number-of-Encoding-Symbols="5500">
        <sv:delimiter>0</sv:delimiter>
        <sv:delimiter>0</sv:delimiter>
    </File>
    <File Content-Location="urn:dvb:metadata:nativeip:TimeOffsetFile" TOI="4" Content-Length="510"
        Transfer-Length="510" Content-Type="application/xml+dvb-nip-tof" Content-Encoding="null"
        Content-MD5="tar7ro+jOKq68uhwmQLJjA==" FEC-OTI-FEC-Encoding-ID="0"
        FEC-OTI-FEC-Instance-ID="0" FEC-OTI-Maximum-Source-Block-Length="5500"
        FEC-OTI-Encoding-Symbol-Length="1380" FEC-OTI-Max-Number-of-Encoding-Symbols="5500">
        <sv:delimiter>0</sv:delimiter>
        <sv:delimiter>0</sv:delimiter>
    </File>
    <File Content-Location="http://dvb.gw/ses.com/dvbi/service_list_entry_point.xml" TOI="5"
        Content-Length="2571" Transfer-Length="2571" Content-Type="application/xml+dvb-i-slep"
        Content-Encoding="null" Content-MD5="0vJ2TFOiaKijdviPVgUZUA==" FEC-OTI-FEC-Encoding-ID="0"
        FEC-OTI-FEC-Instance-ID="0" FEC-OTI-Maximum-Source-Block-Length="5500"
        FEC-OTI-Encoding-Symbol-Length="1380" FEC-OTI-Max-Number-of-Encoding-Symbols="5500">
        <sv:delimiter>0</sv:delimiter>
        <sv:delimiter>0</sv:delimiter>
    </File>
    <sv:schemaVersion>4</sv:schemaVersion>
    <sv:delimiter>0</sv:delimiter>
</FDT-Instance>
```

Figure 8.2.4-1: Example FDT (File Delivery Table)

8.2.5 Announcement Channel Content

8.2.5.1 Signalling Data

The announcement channel carries the actual signalling documents required by NIP. Signalling information is carried as different XML formatted documents among which the following:

- Bootstrap multicast gateway configuration instance document.
- NIP Network Information File.
- NIP Service Information File.
- DVB-I Broadcast Service List Entry Points.
- DVB-I Broadcast Service Lists.
- DVB-I Playlists.
- NIP Time Offset Information.
- NIP Content Guide Manifest.
- NIP Service Guide Manifest.
- NIP Content Protection Manifest.
- NIP Private Data Signalling Manifest.

Table 8.2.5-1: Announcement Channel Document Media Types

Description	Media Type (Content-Type)	(Content-Location)	TOI	NIP Bootstrap Stream	NIP Regular Stream
Bootstrap multicast gateway configuration instance document	application/xml+dvb-mabr-session-configuration	urn:dvb:metadata:cs:NativeIPMulticastTransportObjectTypeCS:2023:bootstrap	Value in FDT	M	M
Multicast gateway configuration instance document	application/xml+dvb-mabr-session-configuration	urn:dvb:metadata:cs:MulticastTransportObjectTypeCS:2021:gateway-configuration	Value in FDT	M	M
NIP NIF	application/xml+dvb-nip-nif	urn:dvb:metadata:nativeip:NetworkInformationFile	Value in FDT	M	N.A.
NIP SIF	application/xml+dvb-nip-sif	urn:dvb:metadata:nativeip:ServiceInformationFile	Value in FDT	M	N.A.
Broadcast DVB-I Service List Entry Points	application/xml+dvb-i-slep	urn:dvb:metadata:nativeip:dvb-i-slep	Value in FDT	O	N.A.
Broadcast DVB-I Service Lists	application/vnd.dvb.dvbisl+xml	URI (as provided in DVB-I Service List Entry Points). URI format as specified in clause 8.2.7.	Value in FDT	M	O
Broadcast DVB-I Playlists	application/xml+dvb-i-pl	URI (described in DVB-I Service List). URI format as specified in clause 8.2.7.	Value in FDT	O	O
NIP Time Offset File	application/xml+dvb-nip-tof	urn:dvb:metadata:nativeip:TimeOffsetFile	Value in FDT	M	N.A.
NIP Content Guide Manifest	application/xml+dvb-nip-cgm	URI URI format as specified in clause 8.2.7.	Value in FDT	O	N.A
NIP Service Guide Manifest	application/xml+dvb-nip-sgm	urn:dvb:metadata:nativeip:ServiceGuide	Value in FDT	M	M
NIP Content Protection Manifest	application/xml+dvb-nip-cpm	Urn:dvb:metadata:nativeip:ContentProtectionAssets	Value in FDT	O	N.A
NIP Private Data Signalling Manifest	application/xml+dvb-nip-pds	urn:dvb:metadata:nativeip:PrivateDataSignalling	Value in FDT	O	N.A.
M: Mandatory, O: Optional, N.A.: Not Applicable					

8.2.5.2 Payload Data Updates

The semantics for any two "File" elements declaring the same "Content-Location" but differing "TOI" is that the element appearing in the FDT Instance with the greater FDT Instance ID is considered to declare a newer instance (e.g. version) of the same "File".

8.2.5.3 Payload Data Compression

As the signalling payload information consists of XML files which are verbose, payload data compression may be applied. If compression is applied it shall be signalled as part of the FDT. The attribute "Content-Encoding" shall be used as defined in DVB-MABR ETSI TS 103 769 [8]. When present its value indicates what decoding mechanisms shall be applied in order to obtain the media-type referenced by the Content-Type field.

Content-Encoding: specifies the content encoding applied to the corresponding announcement channel document.

8.2.6 Announcement Channel Repetition Rates

Table 8.2.6-1 lists the minimum repetition times for each table carried via the NIP announcement channel.

Table 8.2.6-1: Minimum table repetition rates

Description	Table Repetition Rate (at least once every x seconds)
Bootstrap multicast gateway configuration instance document	1
NIP NIF	10
NIP SIF	10
Broadcast DVB-I Service List Entry Points	10
Broadcast DVB-I Broadcast Service Lists	10
Broadcast DVB-I Playlists	10
NIP Time Offset File	30
NIP Content Guide Manifest	30
NIP Content Protection Manifest	30
NIP Private Data Signalling Manifest	30

8.2.7 URL Coding in NIP documents

URLs coded in NIP documents shall use the following syntax:

wherein the absolute path is used to store and locate documents at the level of the NIP Gateway.

NOTE: The domain name "dvb.gw" cannot be publicly resolved and is only meant to be used in the context of DVB-NIP table broadcasts.

It is recommended for the first part of the path to correspond to a string which allows to uniquely identify the originator of the content. For this reason, it is recommended to encode in that string the original targeted domain name of the content originator before the content was re-purposed for NIP transmission. (e.g. bbc.co.uk).

This URL coding applies to the transportObjectURI in the multicast gateway configuration instance document, the Content-Location field in the FDT, the URI encoding in the SIF document and the DASH instance NIP URIs in the DVB-I Service Lists.

Using the exact same format across all NIP documents will simplify matching of URLs between documents. The format will also harmonize the storage location of documents at the NIP Gateway.

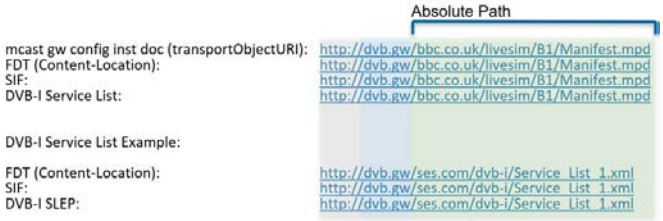


Figure 8.2.7-1: Example URLs in NIP documents

8.2.8 NIP Announcement Channel Document Storage Location

Each time the NIP Gateway tunes to the NIP Bootstrap Stream, all documents carried by the NIP Announcement Channel shall be cached or updated in the root folder of the NIP Gateway.

8.3 Service Discovery and Programme Metadata: DVB-I

8.3.1 Overview

DVB-NIP relies on DVB-I for Service Discovery and Program Metadata as specified in ETSI TS 103 770 [9].

A DVB-NIP broadcast network according to the present document shall carry at least one DVB-I Service List listing the services available on the broadcast network. Larger broadcast networks may carry several DVB-I Service Lists. DVB-I Service Lists may be provided by the Technical Operator of the network (e.g. the satellite or terrestrial network operator) and/or by one or more Commercial Operators present on that technical network. Typically, different commercial DVB-I Service Lists only carry a subset of the broadcast services available on that technical network.

8.3.2 DVB-I Broadcast List Discovery: Service List Entry Points

8.3.2.1 Principles

For DVB-NIP Receivers to discover all the DVB-I Service Lists available on the broadcast network, the DVB-I Service List Entry Points mechanism as specified in clause 5.3 of DVB-I ETSI TS 103 770 [9] shall be used.

The DVB-I Service List Entry Points mechanism is used to provide a table to NIP Receivers listing all DVB-I Service Lists of the given broadcast network. The DVB-I Service List Entry Points table shall always be broadcast as part of the signalling information on the bootstrap stream for that network.

A NIP Receiver therefore when tuned to the network bootstrap stream shall acquire the DVB-I Service List Entry Points table to learn about all the DVB-I Service Lists available on the actual network.

The broadcast of the Service List Entry Points table is mandatory even when only a single DVB-I Service List table is provided on that network.

Each DVB-I table available on the broadcast network is referenced in the Service List Entry Points file through a unique URL. By matching the URL for a given Service List with the URL in the SIF table, the receiver can physically locate this table on the broadcast network and tune to the given transponder to listen for that table on the Announcement Channel.

No recommendations are made in the present document as to when the receiver shall acquire a given DVB-I Service List table listed in the Service List Entry Points table. This is normally implementation dependent and may be done automatically at start-up or only when a given client on the network requests a particular table.

The Service List Entry Points table broadcast in a DVB-NIP system shall follow the XML schema defined in clause 5.3 of DVB-I ETSI TS 103 770 [9].

An example broadcast DVB-I Service List Entry Points table is shown below:

Listing 8.3.2.1-1: Example Broadcast List Entry Points Table

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE xml>
<!-- Example of ServiceListEntryPoint Table as broadcast over the announcement channel -->
<ServiceListEntryPoints xmlns="urn:dvb:metadata:servicelistdiscovery:2020" xmlns:xsi="http://www.w3.
org/2001/XMLSchema-instance" xsi:schemaLocation="urn:dvb:metadata: servicelistdiscovery:2020
../schemas/dvbi_service_list_discovery_v1.1.xsd" xmlns:dvbhbx="urn:dvb:metadata:dvbhb-
extensions:2021" xmlns:dvbisd="urn:dvb:metadata:servicediscovery:2020" xmlns:tva="urn:tva:metadata:2
019">

  <ServiceListRegistryEntity>
    <Name>Satellite Europe</Name>
  </ServiceListRegistryEntity>
  <ProviderOffering>
    <Provider>
      <Name>Provider A</Name>
    </Provider>
    <ServiceListOffering>
      <ServiceListName>Service List A1</ServiceListName>
      <ServiceListURI contentType="application/xml">
```

```
        <dvbisd:URI>http://dvb.gw/nip/servicelist_A1.xml</dvbisd:URI>
      </ServiceListURI>
    </ServiceListOffering>
    <ServiceListOffering>
      <ServiceListName>Service List A2</ServiceListName>
      <ServiceListURI contentType="application/xml">
        <dvbisd:URI>http://dvb.gw/nip/servicelist_A2.xml</dvbisd:URI>
      </ServiceListURI>
    </ServiceListOffering>
  </ProviderOffering>
  <ProviderOffering>
    <Provider>
      <Name>Provider B</Name>
    </Provider>
    <ServiceListOffering>
      <ServiceListName>Service List B1</ServiceListName>
      <ServiceListURI contentType="application/xml">
        <dvbisd:URI>http://dvb.gw/nip/servicelist_B1.xml</dvbisd:URI>
      </ServiceListURI>
    </ServiceListOffering>
  </ProviderOffering>
</ServiceListEntryPoints>
```

8.3.2.2 DVB-I Broadcast Service List Discovery: Service List Registry Function

The Broadcast DVB-I Service List Entry Points file is multicast as a pre-compiled file (listing all the DVB-I broadcast Service Lists on the actual network) within the DVB-NIP Announcement Channel on the bootstrap stream. It is used by the Service List Registry (SLR) function part of the NIP Gateway. The Service List Registry function shall act as a local DVB-I Service List Registry (SLR) as defined in clause 5.1.3.2 of ETSI TS 103 770 [9].

The local Service List Registry function receives the Service List Entry Points table from the broadcast network and exposes the table to DVB-I clients on the network. The local Service List Registry shall accept queries from DVB-I clients.

Queries from DVB-I clients to NIP Gateways may be issued with or without query parameters as specified in ETSI TS 103 770 [9]. Query parameters may take advantage of the DVB-I's client knowledge of location or other preferences. Query Parameters defined in ETSI TS 103 770 [9] are "TargetCountry", "regulatorListFlag", "Language", "Genre" and "ProviderName". Query parameters shall be used in queries in the order presented here and as defined in clause 5.1.3.2 of ETSI TS 103 770 [9].

8.3.3 DVB-I Broadcast Service Lists

8.3.3.1 Introduction

Services made available via DVB-NIP compliant broadcast networks shall be signalled using the DVB-I Service List mechanism specified in clause 5.5 of ETSI TS 103 770 [9]. All syntactical elements specified in ETSI TS 103 770 [9] are also available in NIP. In a DVB-NIP compliant broadcast network, DVB-I service lists are compiled by the Technical Operator of the network and/or one or many Commercial Operators on that network. DVB-I Service Lists shall be broadcast on the NIP Announcement Channel as defined in clause 8.2. DVB-I Service Lists may be broadcast on any stream part of the broadcast network. The physical location of the stream carrying a particular DVB-I Service List can be found from the NIF and SIF tables described in clause 8.4.

DVB-I Service Lists broadcast on a DVB-NIP network contain services that have at least one representation or service component available on the broadcast network.

8.3.3.2 NIP Service Instances in DVB-I Service Lists

NIP Broadcast Services shall be declared in DVB-I Service Lists as Service instances according to 5.5.4 of ETSI TS 103 770 [9].

NIP Service declarations shall use the DVB-I declared "DASHDeliveryParametersType" as defined in clause 5.5.18.6 of ETSI TS 103 770 [9]. The URL within the "URIbasedLocation" shall point towards the manifest file of the service.

NIP Services are uniquely identified through their manifest URL. The manifest URL therefore acts as the **NIP Service Identifier**. The presence of a NIP Service on a broadcast network is defined by the declaration of the NIP Service Identifier in the Service Information File (SIF). Matching of the Service URL between the URL declared in the DVB-I Service List instance and the URL declared in the SIF does not take into account the optional query parameters.

The manifest of the service shall declare all representations and components of a particular service. At least one of these representations or components shall be available via broadcast and some may only be available via broadband delivery. All broadcast representations and inherent broadcast components of a service shall be broadcast within the same NIP Stream as the service manifest.

In operational situations where a particular service representation, e.g. a UHD 4K version of a service made available via broadcast, cannot be conveyed via the same NIP Stream as the other representations then it shall be declared as a different service with a separate service entry in the DVB-I broadcast Service List. The downside of this is that automatic switching between ABR representations is no longer possible.

NOTE: A DASH instance without the "dvb.gw" prefix means that the service is accessible to a DVB-I Client only via broadband.

The listing below shows an example of a NIP DVB-I broadcast list:

Listing 8.3.3.2-1: Example of NIP DVB-I broadcast list

```
<?xml version="1.0" encoding="utf-8"?>

<ServiceList xmlns="urn:dvb:metadata:servicediscovery:2019"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:tva="urn:tva:metadata:2019"
version="201115104525" xsi:schemaLocation="urn:dvb:metadata:servicediscovery:2019 ../dvbi_v1.0.xsd">
   <Name>Germany FTA</Name>
   <ProviderName>SES</ProviderName>
   <RegionList version="1">
   </RegionList>
   <LCNTableList>
   </LCNTableList>

   <Service version="1">
      <UniqueIdentifier>tag:ses.com,2019:DasErste.DasErste</UniqueIdentifier>
      <!-- NIP Broadcast Instance HD and below-->
      <ServiceInstance priority="1">
         <DisplayName>Das Erste HD</DisplayName>
         <SourceType>urn:dvb:metadata:source:dvb-dash</SourceType>
         <DASHDeliveryParameters>
            <UriBasedLocation contentType="application/dash+xml">
               <URI>https://dvb.gw/ard.de/dash/live/manifestDasErste.mpd</URI>
            </UriBasedLocation>
         </DASHDeliveryParameters>
      </ServiceInstance>
      <ServiceName>Das Erste HD</ServiceName>
      <ProviderName>ARD</ProviderName>
      <RelatedMaterial xsi:type="tva:RelatedMaterialType">
         <tva:HowRelated href="urn:dvb:metadata:cs:HowRelatedCS:2019:1001.2"/>
         <tva:MediaLocator>
            <tva:MediaUri contentType="image/jpeg">http://www.tv-
            logo.com/images/logo/ard_das_erste.jpg </tva:MediaUri>
         </tva:MediaLocator>
      </RelatedMaterial>
      <ServiceType href="urn:dvb:metadata:cs:ServiceTypeCS:2019:linear"/>
   </Service>

   <Service version="1">
      <UniqueIdentifier>tag:ses.com,2019:ZDF_HD.ZDF_HD</UniqueIdentifier>
      <!-- NIP Broadcast Instance HD and below-->
      <ServiceInstance priority="1">
         <DisplayName>ZDF HD</DisplayName>
         <SourceType>urn:dvb:metadata:source:dvb-dash</SourceType>
         <DASHDeliveryParameters>
            <UriBasedLocation contentType="application/dash+xml">
               <URI>https://dvb.gw/zdf.de/dash/live/manifestZDF.mpd</URI>
            </UriBasedLocation>
         </DASHDeliveryParameters>
      </ServiceInstance>
      <ServiceName>ZDF HD</ServiceName>
      <ProviderName>ZDF</ProviderName>
      <RelatedMaterial xsi:type="tva:RelatedMaterialType">
         <tva:HowRelated href="urn:dvb:metadata:cs:HowRelatedCS:2019:1001.2"/>
```

```
        <tva:MediaLocator>
           <tva:MediaUri contentType="image/jpeg">http://www.tv-logo.com/images/logo/zdf_de.jpg
           </tva:MediaUri>
        </tva:MediaLocator>
      </RelatedMaterial>
      <ServiceType href="urn:dvb:metadata:cs:ServiceTypeCS:2019:linear"/>
   </Service>

</ServiceList>
```

8.3.4 DVB-I Related Materials

DVB-I Related Materials refers to:

- Logos associated to the DVB-I Broadcast Service Lists themselves as listed in the DVB-I Service Lists Entry Points document.
- Logos of the services listed in DVB-I Service Lists.

Logos associated to DVB-I PlaylistsDVB-I Related Materials may be carried in one or more dedicated multicast transport sessions identified by:

- @serviceClass="urn:dvb:metadata:nativeip:dvb-i-slep-sl-related-material".
  - Refer to clause 9.5.2.1 for the explanation of @serviceClass usage in the context of NIP.
- The Content-Type and Content-Location in the FDT shall be as follows:

Description	Media Type (Content-Type)	(Content-Location)	TOI
Broadcast DVB-I Related Material	application/gzip+dvb-i-rm	urn:dvb:metadata:nativeip:dvb-i-slep-sl-related-material	Value in FDT

NIP Gateways shall join all sessions labelled with the service class above and cache the data carried in these sessions.

8.4 Broadcast Network Signalling: NIF and SIF

8.4.1 Overview

The main purpose of Broadcast Network Signalling is to describe the broadcast network with its logical streams and their physical channel parameters and the location of services across those streams. DVB-NIP defines two tables that describe the broadcast network:

- NIF: The Network Information File provides logical and physical parameters of declared streams and channels of the broadcast network.
- SIF: The Service Information File, provides information about the location of DVB-I Service List(s), Service manifest files, interactive applications and other metadata (e.g. DVB-I Content Guide) within the logical streams on the broadcast network.

As mentioned in clause 8.1 (Signalling Overview) both NIF and SIF files shall always be present on bootstrap streams. Any stream broadcasting a NIF/SIF couple shall also carry the relevant DVB-I Service List Entry Points .xml file.

8.4.2 Network Information File (NIF) Definition

8.4.2.1 NIF Purpose

The Network Information File (NIF) describes the broadcast network. It provides information about the logical streams and physical parameters of the different RF Channels in a particular broadcast network. In that sense it is comparable to the function of the NIT in traditional DVB systems.

The NIF table also provides information on the location of bootstrap streams that help DVB-NIP receivers in the initial configuration phase.

A NIF is identified thanks to its NIPNetworkID, as specified in clause 8.1.4.2.

It is mandatory that NIF identified with the same NIPNetworkID shall be identical on any Channel of a Broadcast Network conveying such NIF.

As an option, NIF may declare Channels from any other Broadcast Network.

8.4.2.2 Network Information File

8.4.2.2.1 NIF Schema Declaration

```
<?xml version="1.0" encoding="UTF-8"?>

<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:ns="urn:dvb:metadata:nativeip:2023"
xmlns:mpeg7="urn:tva:mpeg7:2008" targetNamespace="urn:dvb:metadata:nativeip:2023"
elementFormDefault="qualified">
      <xs:import namespace="urn:tva:mpeg7:2008" schemaLocation="tva_mpeg7.xsd"/>
      <xs:element name="NetworkInformationFile" type="ns:NetworkInformationFileType"/>
   …
</schema>
```

8.4.2.2.2 NetworkInformationFileType

```
<xs:complexType name="NetworkInformationFileType">
   <xs:sequence>
      <xs:element name="VersionUpdate" type="xs:dateTime"/>
      <xs:element name="NIFType">
         <xs:simpleType>
            <xs:restriction base="xs:string">
            <xs:enumeration value="Physical Network"/>
            <xs:enumeration value="Commercial Operator"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="ActualBroadcastNetwork" type="ns:BroadcastNetworkType"/>
      <xs:element name="OtherBroadcastNetwork" type="ns:BroadcastNetworkType" minOccurs="0"
maxOccurs="unbounded"/>
   </xs:sequence>
</xs:complexType>
```

Table 8.4.2.2.2-1: Network Information File Fields

Name	Semantic Definition	Constraints
`VersionUpdate`	Used to provide the version number of the NIF. It indicates the date/time of modification of the latest NIF. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ).	Mandatory
`NIFType`	Indicates the scope of the NIF. Only two possible values: • "Physical Network" indicates that the present NIF describes the complete physical broadcast network. Such NIF is generated by the Technical Network Operator or the Regulator. • "Commercial Operator" indicates that the present NIF describes streams carrying content for a specific Bouquet, as defined in ETSI EN 300 468 [14]. Such NIF is generated by the Commercial Network Operator or the Content Aggregator.	Mandatory
`ActualBroadcastNetwork`	Structure describing all NIP Streams of the Broadcast Network carrying the present NIF.	Mandatory

Name	Semantic Definition	Constraints
OtherBroadcastNetwork	Structure describing all NIF required parameters of any other Broadcast Networks. There can be as many OtherBroadcastNetwork structures as: • Different NIPNetworkID. • Different orbital position. • Different network type.	Optional 0 .. ∞

8.4.2.2.3 BroadcastNetworkType

```
<xs:complexType name="BroadcastNetworkType">
   <xs:sequence>
      <xs:element name="NetworkType">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="Satellite"/>
               <xs:enumeration value="Terrestrial"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="NetworkName" type="xs:string"/>
      <xs:element name="NIPNetworkProviderName" type="sd:ProviderName"/>
      <xs:element name="SatellitePosition" type="ns:SatellitePositionType" minOccurs="0"/>
      <xs:element name="NIPNetworkID">
         <xs:simpleType>
            <xs:restriction base="xs:unsignedShort">
               <xs:minInclusive value="1"/>
               <xs:maxInclusive value="65280"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="NIPStream" type="ns:NIPStreamType" maxOccurs="unbounded"/>
   </xs:sequence>
</xs:complexType>
```

Table 8.4.2.2.3-1: Broadcast Network Fields

Name	Semantic Definition	Constraints
NetworkType	Indicates the type of broadcast network. Only two possible values: • Satellite for S2/S2X. • Terrestrial for DVB-T2.	Mandatory
NetworkName	The name of the network in a human readable form as Multilingual_Network_Name_descriptor as specified in ETSI EN 300 468 [14]. Multiple service list names can be specified as long as they have different @xml:lang values.	Mandatory
NIPNetworkProviderName	The name of the provider of this broadcast network. Refers to ProviderName as specified by DVB-I (ETSI TS 103 770 [9]). The operator of the NIF is the NIPNetworkProviderName declared in the Actual Broadcast Network. Formatted in a human readable form.	Mandatory
SatellitePosition	only mandatory for NetworkType = "Satellite".	Optional
NIPNetworkID	• If LinkLayerFormat = "GSE-Lite", then this tag refers to interactive_network_id as specified in ETSI TS 102 606-2 [5]. Value in Decimal, between 1 and 65 280 (0xFF00). • If LinkLayerFormat = "TS", then this tag refers to original_network_id as specified in ETSI EN 300 468 [14]. Value in decimal, between 1 and 65 280 (0xFF00). These values correspond to the original_network_id/network_id registered at DVB Services Sàrl.	Mandatory
NIPStream	Structure describing logical identifiers, physical parameters of a NIP Stream.	Mandatory 1 .. ∞

8.4.2.2.4 SatellitePositionType

```
<xs:complexType name="SatellitePositionType">
   <xs:sequence>
      <xs:element name="OrbitalPosition">
         <xs:simpleType>
            <xs:restriction base="xs:double">
               <minInclusive value="0.0"/>
               <maxInclusive value="180.0"/>
            </xs:restriction>
         </xs:simpleType>
      <:xs:element>
      <xs:element name="West_East_flag">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="West"/>
               <xs:enumeration value="East"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
</complexType>
```

Table 8.4.2.2.4-1: Satellite Position Fields

Name	Semantic Definition	Constraints
OrbitalPosition	Value in degrees, from 0,0° to 180,0°.	Mandatory
West_East_flag	Indicates if the satellite position is in the western or eastern part of the orbit.	Mandatory

8.4.2.2.5 NIPStreamType

```
<xs:complexType name="NIPStreamType">
   <xs:sequence>
      <xs:element name="LinkLayerFormat">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="GSE-Lite"/>
               <xs:enumeration value="TS"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="NIPStreamProviderName" type="sd:ProviderName"/>
         <xs:element name="NIPCarrierID">
            <xs:simpleType>
               <xs:restriction base="xs:positiveInteger">
               <xs:maxInclusive value="65535"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="NIPLinkID">
         <xs:simpleType>
            <xs:restriction base="xs: nonNegativeInteger">
               <xs:minInclusive value="0"/>
               <xs:maxInclusive value="65535"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="NIPServiceID">
         <xs:simpleType>
            <xs:restriction base="xs:unsignedShort">
               <xs:minInclusive value="0"/>
               <xs:maxInclusive value="65535"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="BootstrapStream" minOccurs="0">
         <xs:complexType>
            <xs:sequence>
               <xs:element name="BootstrapType">
                  <xs:simpleType>
                     <xs:restriction base="xs:string">
                        <xs:enumeration value="Physical Network"/>
                        <xs:enumeration value="Commercial Operator"/>
```

```
                  </xs:restriction>
               </xs:simpleType>
            </xs:element>
            <xs:element name="Status">
               <xs:simpleType>
                  <xs:restriction base="xs:string">
                     <xs:enumeration value="Active"/>
                     <xs:enumeration value="Not Active"/>
                     <xs:enumeration value="Deprecated"/>
                  </xs:restriction>
               </xs:simpleType>
            </xs:element>
         </xs:sequence>
      </xs:complexType>
   </xs:element>
   <xs:choice>
      <xs:element name="DVBS2_NIPDeliveryParameters"type="ns:DVBS2_NIPDeliveryParametersType"/>
      <xs:element name="DVBS2X_NIPDeliveryParameters"
type="ns:DVBS2X_NIPDeliveryParametersType"/>
      <xs:element name="DVBT2_NIPDeliveryParameters" type="ns:DVBT2_NIPDeliveryParametersType"/>
   </xs:choice>
</xs:sequence>
</xs:complexType>
```

Table 8.4.2.2.5-1: NIP Stream Fields

Name	Semantic Definition	Constraints
LinkLayerFormat	Describes the data link layer as: • "GSE-Lite": transmission as specified in DVB GSE (ETSI TS 102 606-1 [4]). • "TS": transmission based on MPEG-2 TS, conveying MPE services and/or MPEG/PES services.	Mandatory
NIPStreamProviderName	The name of the operator of the NIPStream. It refers to ProviderName as specified by DVB-I (ETSI TS 103 770 [9]). It is possible that the NIPStreamProviderName differs from NIPNetworkProviderName. Formatted in a human readable form following the constraints specified in clause 8.7.	Mandatory
NIPCarrierID	If LinkLayerFormat = "GSE-Lite", then this tag refers to modulation_system_id as specified in ETSI TS 102 606-2 [5]. Value in Decimal, between 1 and 65 535 (0xFFFF). If LinkLayerFormat = "TS", then this tag refers to transport_stream_id as specified in ETSI EN 300 468 [14]. Value in Decimal, between 1 and 65 535 (0xFFFF).	Mandatory
NIPLinkID	If LinkLayerFormat = "GSE-Lite", then this tag refers PHY_stream_id as specified in clause 7.4.5 of present document. Value in Decimal, between 0 and 65 535 (0xFFFF). For a single link in GSE (such as single input stream or single plp), this tag shall be set to "0". If LinkLayerFormat = "TS", then this tag refers to PHY_stream_id as specified in clause 8.4.5.15 of ETSI EN 301 192 [7]. Value in Decimal, between 0 and 65 535 (0xFFFF). For a single input stream, this tag shall be set to "0".	Mandatory
NIPServiceID	If LinkLayerFormat = "TS", this tag refers to service_id, as specified in ETSI EN 300 468 [14], of the MPE service. Value in Decimal, between 1 and 65 535 (0xFFFF). If LinkLayerFormat = "GSE-Lite", this tag is not used and shall be set to "0".	Mandatory
BootstrapStream	If present, the declared Stream carries the following documents: NIF, SIF, DVB-I Service List Entry Points.	Optional 0 .. ∞
BootstrapType	Indicates the scope of the NIF carried by the declared Bootstrap Stream. Two possible values: • "Physical Network" indicates that the NIF describes the complete physical broadcast network. • "Commercial Operator" indicates that the NIF describes streams carrying content for a specific Bouquet, as defined in ETSI EN 300 468 [14].	Mandatory

Name	Semantic Definition	Constraints
Status	Describes the bootstrap status as: • "Active": bootstrap stream in operation. • "Not Active": bootstrap stream not in operation (maintenance or not activated, yet). • "Deprecated": this is not a bootstrap stream anymore.	Mandatory
DVBS2_NIPDeliveryParameters	Structure providing stream physical parameters as specified in clause 8.4.2.2.6.1.	Mandatory
DVBS2X_NIPDeliveryParameters	Structure providing stream physical parameters as in clause 8.4.2.2.6.2.	Mandatory
DVBT2_NIPDeliveryParameters	Structure providing stream physical parameters as specified in clause 8.4.2.2.6.3.	Mandatory

8.4.2.2.6 DeliveryParametersTypes

8.4.2.2.6.1 DVBS2_NIPDeliveryParametersType

```
<xs:complexType name="DVBS2_NIPDeliveryParametersType">
   <xs:sequence>
      <xs:element name="Frequency" type="xs:positiveInteger"/>
      <xs:element name="Polarization" type="string"/>
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="horizontal"/>
               <xs:enumeration value="vertical"/>
               <xs:enumeration value="left circular"/>
               <xs:enumeration value="right circular"/>
            </xs:restriction>
         </xs:simpleType>
      <xs:element name="Modulation_Type" type="string"/>
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="QPSK"/>
               <xs:enumeration value="8PSK"/>
               <xs:enumeration value="16APSK"/>
               <xs:enumeration value="32APSK"/>
            </xs:restriction>
         </xs:simpleType>
      <xs:element name="Roll_off">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="0.35"/>
               <xs:enumeration value="0.25"/>
               <xs:enumeration value="0.20"/>
            </xs:restriction>
         </xs:simpleType>
      <xs:element name="SymbolRate" type="positiveInteger"/>
      <xs:element name="FEC">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="1/2"/>
               <xs:enumeration value="2/3"/>
               <xs:enumeration value="3/4"/>
               <xs:enumeration value="5/6"/>
               <xs:enumeration value="7/8"/>
               <xs:enumeration value="8/9"/>
               <xs:enumeration value="3/5"/>
               <xs:enumeration value="4/5"/>
               <xs:enumeration value="9/10"/>
            </xs:restriction>
         </xs:simpleType>
      <xs:element name="scrambling_sequence_index" minOccurs="0">
         <xs:simpleType>
            <xs:restriction base="xs:int">
               <xs:minInclusive value="0"/>
               <xs:maxInclusive value="262143"/>
            </xs:restriction>
         </xs:simpleType>
         </xs:element>
      <xs:element name="input_stream_identifier" type=" unsignedByte">
   </xs:sequence>
</xs:complexType>
```

Table 8.4.2.2.6.1-1: DVBS2_NIP Delivery Parameter Fields

Name	Semantic Definition	Constraints
Frequency	The carrier frequency expressed in units of 10 kHz.	Mandatory
Polarization	Polarization of the transmitted signal. It shall be set with one over the 4 following values, as specified in clause 6.2.13.2 of ETSI EN 300 468 [14]: • horizontal • vertical • left circular • right circular	Mandatory
Modulation_Type	Specifies the modulation scheme. It shall be set with one of the four following values: • QPSK • 8PSK • 16APSK (for Professional Services) • 32APSK (for Professional Services)	Mandatory
Roll_off	Roll-off factor shall be set with one of the 3 following values, as specified in clause 6.2.13.2 of ETSI EN 300 468 [14]: • 0,35 • 0,25 • 0,20	Mandatory
SymbolRate	Symbol rate value is coded in kS/s.	Mandatory
FEC	FEC value shall be set with one over the 9 following values, as specified in clause 6.2.13.2 of ETSI EN 300 468 [14]: • 1/2 • 2/3 • 3/4 • 5/6 • 7/8 • 8/9 • -/5 • -/5 • 9/10	Mandatory
scrambling_sequence_index	This element, when present, carries the index of the DVB-S2 physical layer scrambling sequence as defined in clause 5.5.4 of ETSI EN 302 307-1 [1].	
input_stream_identifier	Carries the DVB-S2 input_stream_identifier (ISI) as defined in clause 6.2.13.3 of ETSI EN 300 468 [14].	Mandatory

8.4.2.2.6.2 DVBS2X_NIPDeliveryParametersType

```
<xs:complexType name="DVBS2X_NIPDeliveryParametersType">
   <xs:sequence>
      <xs:element name="receiver_profiles">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="Broadcast services"/>
               <xs:enumeration value="Professional services"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="S2X_mode">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="S2X"/>
               <xs:enumeration value="S2X channel bonding"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="Frequency" type="positiveInteger" />
      <xs:element name="Polarization">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="horizontal"/>
               <xs:enumeration value="vertical"/>
               <xs:enumeration value="left circular"/>
               <xs:enumeration value="right circular"/>
```

```
            </xs:restriction>
         </xs:simpleType>
      </xs:element>     <xs:element name="Roll_off">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="0.35"/>
               <xs:enumeration value="0.25"/>
               <xs:enumeration value="0.20"/>
               <xs:enumeration value="0.15"/>
               <xs:enumeration value="0.10"/>
               <xs:enumeration value="0.05"/>
            </xs:restriction>
         </xs:simpleType>
      <xs:element name="SymbolRate"  type="positiveInteger"/>
      <xs:element name="scrambling_sequence_index" minOccurs="0">
         <xs:simpleType>
            <xs:restriction base="xs:int">
               <xs:minInclusive value="0"/>
               <xs:maxInclusive value="262143"/>
            </xs:restriction>
         </xs:simpleType>
         </xs:element>
      <xs:element name="input_stream_identifier" type:"unsignedByte"/>
   </sequence>
</complexType
```

Table 8.4.2.2.6.2-1: DVBS2X_NIP Delivery Parameters Fields

Name	Semantic Definition	Constraints
receiver_profiles	This field indicates which receiver profiles are targeted by the stream. It shall be set to one of the following values: • Broadcast services • Professional services	Mandatory
S2X_mode	This field indicates in which DVB-S2X mode the stream is operated. It shall be set to one of the following values: • S2X • S2X channel bonding	Mandatory
Frequency	The carrier frequency expressed in units of 10 kHz.	Mandatory
Polarization	Polarization of the transmitted signal. It shall be set with one of the 4 following values, as specified in clause 6.2.13.2 of ETSI EN 300 468 [14]: • horizontal • vertical • left circular • right circular	Mandatory
Roll_off	Roll-off factor shall be set with one of the 6 following values, as specified in clause 6.4.6.5 of ETSI EN 300 468 [14]: • 0,35 • 0,25 • 0,20 • 0,15 • 0,10 • 0,05	Mandatory
SymbolRate	Symbol rate value is coded in kS/s.	Mandatory
scrambling_sequence_index	This element, when present, carries the index of the DVB-S2X physical layer scrambling sequence as defined in clause 5.5.4 of ETSI EN 302 307-2 [2].	Optional
input_stream_identifier	Carries the DVB-S2 input_stream_identifier (ISI) as defined in clause 6.4.6.5 of ETSI EN 300 468 [14].	Mandatory
NOTE: In the context of NIP the DVB-S2X TS_GS_S2X_mode has to be set to GSE High Efficiency Mode.		

8.4.2.2.6.3 DVBT2_NIPDeliveryParameters

8.4.2.2.6.3.1 DVB_T2NIPDeliveryParametersType

```
<xs:complexType name="DVBT2_NIPDeliveryParametersType">
   <xs:sequence>
      <xs:element name="plp_id">
         <xs:simpleType>
            <xs:restriction base="xs:unsignedShort">
               <xs:minInclusive value="0"/>
               <xs:maxInclusive value="255"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="T2_system_id">
         <xs:simpleType>
            <xs:restriction base="xs:unsignedShort">
               <xs:minInclusive value="1"/>
               <xs:maxInclusive value="65535"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="long_T2_system_delivery_descriptor"
type="ns:long_T2_system_delivery_descriptorType" minOccurs="0"/>
   </xs:sequence>
</xs:complexType>
```

Table 8.4.2.2.6.3.1-1: DVBT2_NIP Delivery Parameters Fields

Name	Semantic Definition	Constraints
plp_id	It identifies uniquely a PLP within T2_System as specified in clause 6.4.6.3 of ETSI EN 300 468 [14].	Mandatory
T2_system_id	It identifies uniquely the T2 system within the DVB network as specified in clause 6.4.6.3 of ETSI EN 300 468 [14].	Mandatory

8.4.2.2.6.3.2 long_T2_system_delivery_descriptorType

```
<xs:complexType name="long_T2_system_delivery_descriptorType">
   <xs:sequence>
      <xs:element name="SISO_MISO">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="SISO"/>
               <xs:enumeration value="MISO"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="bandwidth">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="8 MHz"/>
               <xs:enumeration value="7 MHz"/>
               <xs:enumeration value="6 MHz"/>
               <xs:enumeration value="5 MHz"/>
               <xs:enumeration value="10 MHz"/>
               <xs:enumeration value="1.712 MHz"/>
            </xs:restriction>
         </xs:simpleType>
      <xs:element name="guard_interval">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="1/32"/>
               <xs:enumeration value="1/16"/>
               <xs:enumeration value="1/8"/>
               <xs:enumeration value="1/4"/>
               <xs:enumeration value="1/128"/>
               <xs:enumeration value="19/128"/>
               <xs:enumeration value="19/256"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
```

```
      <xs:element name="transmission_type">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="2k"/>
               <xs:enumeration value="8k"/>
               <xs:enumeration value="4k"/>
               <xs:enumeration value="1k"/>
               <xs:enumeration value="16k"/>
               <xs:enumeration value="32k"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="other_frequency_flag" type="xs:boolean"/>
      <xs:element name="tfs_flag" type="xs:boolean"/>
      <xs:element name="cell_idType">
         <xs:complexType>
            <xs:sequence>
               <xs:element name="cell_id">
                  <xs:simpleType>
                     <xs:restriction base="xs:unsignedShort">
                        <xs:minInclusive value="0"/>
                        <xs:maxInclusive value="65535"/>
                     </xs:restriction>
                  </xs:simpleType>
               </xs:element>
               <xs:element name="centre_frequency">
                  <xs:simpleType>
                     <xs:restriction base="xs:double">
                        <xs:minInclusive value="10"/>
                        <xs:maxInclusive value="42949672950"/>
                     </xs:restriction>
                  </xs:simpleType>
               </xs:element>
               <xs:element name="cell_id_extension" minOccurs="0">
                  <xs:simpleType>
                     <xs:restriction base="xs:unsignedShort">
                        <xs:minInclusive value="0"/>
                        <xs:maxInclusive value="65535"/>
                     </xs:restriction>
                  </xs:simpleType>
               </xs:element>
               <xs:element name="transposer_frequency" minOccurs="0">
                  <xs:simpleType>
                     <xs:restriction base="xs:double">
                        <xs:minInclusive value="10"/>
                        <xs:maxInclusive value="42949672950"/>
                     </xs:restriction>
                  </xs:simpleType>
               </xs:element>
            </xs:sequence>
         </xs:complexType>
      </xs:element>
   </xs:sequence>
</complexType>
```

Table 8.4.2.2.6.3.2-1: long_T2_system delivery descriptor Fields

Name	Semantic Definition	Constraints
SISO_MISO	Indicates one of the following modes: • SISO • MISO	Mandatory
bandwidth	Indicates one of the following bandwidth values: • 8 MHz • 7 MHz • 6 MHz • 5 MHz • 10 MHz • 1,712 MHz	Mandatory

Name	Semantic Definition	Constraints
guard_interval	Indicates one of the following guard interval values: • 1/32 • 1/16 • 1/8 • 1/4 • 1/128 • 19/128 • 19/256	Mandatory
transmission_type	Indicates the FFT size of the signals transmitted within the associated cell. One of the following modes: • 2k • 8k • 4k • 1k • 16k • 32k	Mandatory
other_frequency_flag	This flag shall be set according to clause 6.4.6.3 of ETSI EN 300 468 [14].	Mandatory
tfs_flag	This flag shall be set according to table 138 of ETSI EN 300 468 [14].	Mandatory
cell_id	Uniquely identifies a cell_id. Value in decimal, between 0 and 65 535. Cell_id = 0, indicates that no cell_id.	Mandatory
centre_frequency	The carrier frequency expressed in units of 10 kHz.	Mandatory
cell_id_extension	Identifies a sub-cell within a cell.	Optional
transposer_frequency	Indicates the centre frequency that is used by a transposer in the sub-cell indicated. Shall be set according to clause 6.4.6.3 of ETSI EN 300 468 [14].	Optional

8.4.2.2.7 NIF Example

The following NIF.xml example depicts a Satellite Technical Operator declaring:

- 2 NIP Streams belonging to the same NIPNetworkID. One of them is declared as Bootstrap Stream.
- 1 NIP Stream, on the same orbital position but with different NIPNewtorkID.
- 1 NIP Streams, declared as a Bootstrap, from another orbital position.

```
<?xml version="1.0" encoding="UTF-8"?>
<NetworkInformationFile xmlns:tva="urn:tva:metadata:2019"
xmlns:dvbisd="urn:dvb:metadata:servicediscovery:2023" xmlns="urn:dvb:metadata:nativeip:2023"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:dvb:metadata:nativeip:2023 ../dvbnip.xsd">

   <VersionUpdate>2021-12-20T23:00:00Z</VersionUpdate>
   <NIFType>Physical Network</NIFType>

   <ActualBroadcastNetwork>
      <NetworkType>Satellite</NetworkType>
      <NetworkName>SES</NetworkName>
      <NIPNetworkProviderName>SES</NIPNetworkProviderName>
      <SatellitePosition>
         <OrbitalPosition>019.2</OrbitalPosition>
         <West_East_flag>East</West_East_flag>
      </SatellitePosition>
      <NIPNetworkID>1</NIPNetworkID>
      <NIPStream>
         <LinkLayerFormat>GSE-Lite</LinkLayerFormat>
         <NIPStreamProviderName>ARD</NIPStreamProviderName>
         <NIPCarrierID>1021</NIPCarrierID>
         <NIPLinkID>0</NIPLinkID>
         <NIPServiceID>0</NIPServiceID>
         <DVBS2X_NIPDeliveryParameters>
            <receiver_profiles>Broadcast services</receiver_profiles>
            <S2X_mode>S2X</S2X_mode>
            <Frequency>1152300</Frequency>
            <Polarization>horizontal</Polarization>
            <Roll_off>0.25</Roll_off>
            <SymbolRate>22000</SymbolRate>
```

```
            <input_stream_identifier>0</input_stream_identifier >
         </DVBS2X_NIPDeliveryParameters>
      </NIPStream>
      <NIPStream>
         <LinkLayerFormat>TS</LinkLayerFormat>
         <NIPCarrierID>1028</NIPCarrierID>
         <NIPLinkID>0</NIPLinkID>
         <NIPServiceID>100</NIPServiceID>
         <NIPStreamProviderName>SES</NIPStreamProviderName>
         <BootstrapStream>
            <BootstrapType>Physical Network</BootstrapType>
            <Status>Active</Status>
         </BootstrapStream>
         <DVBS2_NIPDeliveryParameters>
            <Frequency>1162700</Frequency>
            <Polarization>vertical</Polarization>
            <Modulation_Type>8PSK</Modulation_Type>
            <Roll_off>0.25</Roll_off>
            <SymbolRate>30000</SymbolRate>
            <FEC>5/6</FEC>
            <input_stream_identifier>0</input_stream_identifier>
         </DVBS2_NIPDeliveryParameters>
      </NIPStream>
   </ActualBroadcastNetwork>
   <OtherBroadcastNetwork>
      <NetworkType>Satellite</NetworkType>
      <NetworkName>SKY Deutschland</NetworkName>
      <NIPNetworkProviderName>SKY</NIPNetworkProviderName>
      <SatellitePosition>
         <OrbitalPosition>019.2</OrbitalPosition>
         <West_East_flag>East</West_East_flag>
      </SatellitePosition>
      <NIPNetworkID>133</NIPNetworkID>
      <NIPStream>
         <LinkLayerFormat>TS</LinkLayerFormat>
         <NIPStreamProviderName>SKY</NIPStreamProviderName>
         <NIPCarrierID>9</NIPCarrierID>
         <NIPLinkID>0</NIPLinkID>
         <NIPServiceID>1339</NIPServiceID>
         <DVBS2_NIPDeliveryParameters>
            <Frequency>1117100</Frequency>
            <Polarization>horizontal</Polarization>
            <Modulation_Type>8PSK</Modulation_Type>
            <Roll_off>0.20</Roll_off>
            <SymbolRate>22000</SymbolRate>
            <FEC>3/4</FEC>
            <Input_stream_identifier>0</Input_stream_identifier>
         </DVBS2_NIPDeliveryParameters>
      </NIPStream>
   </OtherBroadcastNetwork>
   <OtherBroadcastNetwork>
      <NetworkType>Satellite</NetworkType>
      <NetworkName>Eutelsat</NetworkName>
      <NIPNetworkProviderName>Eutelsat</NIPNetworkProviderName>
      <SatellitePosition>
         <OrbitalPosition>013.0</OrbitalPosition>
         <West_East_flag>East</West_East_flag>
      </SatellitePosition>
      <NIPNetworkID>318</NIPNetworkID>
      <NIPStream>
         <LinkLayerFormat>GSE-Lite</LinkLayerFormat>
         <NIPStreamProviderName>Eutelsat</NIPStreamProviderName>
         <NIPCarrierID>500</NIPCarrierID>
         <NIPLinkID>0</NIPLinkID>
         <NIPServiceID>0</NIPServiceID>
         <BootstrapStream>
            < BootstrapType >Physical Network</ BootstrapType >
            <Status>Active</Status>
         </BootstrapStream>
         <DVBS2X_NIPDeliveryParameters>
            <receiver_profiles>Broadcast services</receiver_profiles>
            <S2X_mode>S2X</S2X_mode>
            <Frequency>1129600</Frequency>
            <Polarization>horizontal</Polarization>
            <Roll_off>0.25</Roll_off>
            <SymbolRate>27500</SymbolRate>
            <Input_stream_identifier>0</Input_stream_identifier>
         </DVBS2X_NIPDeliveryParameters>
```

```
      </NIPStream>
   </OtherBroadcastNetwork>
</NetworkInformationFile>
```

8.4.3 Service Information File (SIF) Definition

8.4.3.1 SIF Purpose

The Service Information File (SIF) describes, for each stream identified logically, the location of:

- DVB-I Service Lists;
- Service manifests;
- DVB-I Playlists;
- DVB-I Content Guide Sources;
- Interactive Applications not linked directly to a particular service.

The SIF is one of the three mandatory tables to be broadcast on a Bootstrap Stream.

The SIF is broadcast by the operator, in charge of the Broadcast Stream. The SIF is identified through the Provider Name as defined in clause 3.1.

The operator can be:

- a Technical Network Operator;
- a Commercial Operator;
- an Aggregator;
- a Regulator.

The SIF lists, for each logically identified NIP Stream, the URLs of all Services carried by the Broadcast Network.

For each NIP Stream declared in the SIF, there shall be a corresponding entry in the NIF table carried on the same Bootstrap Stream.

The SIF table operated by an Operator on one Broadcast Network, can be broadcast on one, at least, or several NIP streams, but shall be identical on all these NIP Streams at any time.

8.4.3.2 Service Information File

8.4.3.2.1 SIF Schema Declaration

```
<?xml version="1.0" encoding="UTF-8"?>

xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:ns="urn:dvb:metadata:nativeip:2023"
xmlns:mpeg7="urn:tva:mpeg7:2008" targetNamespace="urn:dvb:metadata:nativeip:2023"
elementFormDefault="qualified">
   <xs:import namespace="urn:tva:mpeg7:2008" schemaLocation="tva_mpeg7.xsd"/>
   <xs:element name="ServiceInformationFile" type="ns:ServiceInformationFileType"/>
   …
</xs:schema>
```

8.4.3.2.2 ServiceInformationFileType

```
<xs:complexType name="ServiceInformationFileType">
      <xs:sequence>
         <xs:element name="VersionUpdate" type="xs:dateTime"/>

         <xs:element name="NIPNetworkProviderName" type="sd:ProviderName" />
         <xs:element name="BroadcastMediaStream" type="ns:BroadcastMediaStreamType" minOccurs="1"
maxOccurs="unbounded"/>
      </xs:sequence>
</xs:complexType>
```

Table 8.4.3.2.2-1: Service Information File Fields

Name	Semantic Definition	Constraints
`VersionUpdate`	Used to provide the version number of the SIF. It indicates the date/time of modification of the latest SIF. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ).	Mandatory
`NIPNetworkProviderName`	The name of the provider of this broadcast network. The name of the provider of this Service Information File (SIF). Refers to ProviderName as specified by DVB-I (ETSI TS 103 770 [9]). This provider operates the NIP Stream conveying this SIF. Formatted in a human readable form. Multiple values for the provider name can be specified as long as they have different `@xml:lang` values.	Mandatory
`BroadcastMediaStream`	Structure of streams carrying content described by the present SIF.	Mandatory 1 .. ∞
NOTE: All NIP streams declared in SIF BroadcastMediaStream have to be declared in the co-located NIF.		

8.4.3.2.3 BroadcastMediaStreamType

```
<xs:complexType name="BroadcastMediaStreamType">
   <xs:sequence>
      <xs:element name="NIPNetworkID">
         <xs:simpleType>
            <xs:restriction base="xs:unsignedShort">
               <xs:minInclusive value="1"/>
               <xs:maxInclusive value="65280"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="NIPCarrierID">
         <xs:simpleType>
            <xs:restriction base="xs:positiveInteger">
               <xs:maxInclusive value="65535"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="NIPLinkID">
         <xs:simpleType>
            <xs:restriction base="xs: nonNegativeInteger">
               <xs:maxInclusive value="65535"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="NIPServiceID">
         <xs:simpleType>
            <xs:restriction base="xs:unsignedShort">
               <xs:minInclusive value="0"/>
               <xs:maxInclusive value="65535"/>
            </xs:restriction>
         </xs:simpleType>
      </xs:element>
      <xs:element name="BroadcastMedia">
         <xs:complexType>
            <xs:sequence>
               <xs:element name="URI" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
               <xs:element name="InteractiveApplications" type="ns:InteractiveApplicationsType"
minOccurs="0" maxOccurs="unbounded"/>
            </xs:sequence>
         </xs:complexType>
      </xs:element>
   </xs:sequence>
</xs:complexType>
```

Table 8.4.3.2.3-1: Broadcast Media Stream Fields

Name	Semantic Definition	Constraints
NIPNetworkID	If LinkLayerFormat = "GSE-Lite", then this tag refers to interactive_network_id as specified in ETSI TS 102 606-2 [5]. Value in Decimal, between 1 and 65 280 (0xFF00). If LinkLayerFormat = "TS", then this tag refers to original_network_id as specified in ETSI EN 300 468 [14]. Value in Decimal, between 1 and 65 280 (0xFF00). These values correspond to the original_network_id/network_id registered at DVB Services Sàrl.	Mandatory
NIPCarrierID	If LinkLayerFormat = "GSE-Lite", then this tag refers to S2_system_id or T2_system_id as specified in ETSI TS 102 606-2 [5]. Value in Decimal, between 1 and 65 535 (0xFFFF). If LinkLayerFormat = "TS", then this tag refers to transport_stream_id as specified in ETSI EN 300 468 [14]. Value in Decimal, between 1 and 65 535 (0xFFFF).	Mandatory
NIPLinkID	If LinkLayerFormat = "GSE-Lite", then this tag refers to refers PHY_stream_id as specified in clause 7.4.5 of present document. Value in Decimal, between 0 and 65 535 (0xFF). For a single input stream or single plp, this tag shall be set to "0". If LinkLayerFormat = "TS", then this tag refers to Input Stream Identifier as specified in clause 6.2.13.3 of ETSI EN 300 468 [14], for DVB-S2 (ETSI EN 302 307-1 [1]). Value in Decimal, between 0 and 65 535 (0xFF). For a single input stream, this tag shall be set to "0".	Mandatory
NIPServiceID	If DataLinkFormat = "TS", this tag refers to ServiceID, as specified in ETSI EN 300 468 [14], of the MPE service carrying the BroadcastMedia or InteractiveApplications. Value in Decimal, between 1 and 65 535 (0xFFFF). If DataLinkFormat = "GSE-Lite", this tag is not used and can be set to "0".	Mandatory
BroadcastMedia	Structure describing the URL of Services and/or Interactive Applications carried by the declared NIP Stream broadcast on the current stream.	Mandatory
URI	Any Media Content URL such as: • …/DVB-I_ServiceList.xml • …/DVB-I_ContentGuideSC.xml • …/Service_manifest.mpd • …/Service_manifest.m3u8 • etc. This URL shall point to the local NIP Gateway with the Local Network Domain "dvb.gw" as specified in clause 8.3.2.3.	Optional 0 .. ∞
InteractiveApplications	structure describing interactive applications parameters carried by the NIP stream.	Optional 0 .. ∞

8.4.3.2.4 Interactive Applications signalling structure

Interactive applications signalled in a SIF are specific to operators, identified with their ProviderName, e.g.: HbbTV OpApp.

Such signalling cannot be used to declare interactive applications linked to a NIP Service, as such mechanism is specified by DVB-I (ETSI TS 103 770 [9]).

```
<xs:complexType name="InteractiveApplicationsType">
   <xs:sequence>
      <xs:element name="ApplicationType">
         <xs:simpleType>
            <xs:restriction base="xs:string">
               <xs:enumeration value="HbbTV"/>
               <xs:enumeration value="MHP"/>
               <xs:enumeration value="MHEG5"/>
               <xs:enumeration value="Proprietary"/>
            </xs:restriction>
         </xs:simpleType>
      <xs:element name="ApplicationID" type="Integer" />
      <xs:element name="ApplicationURI" type="xs:string" />
   </xs:sequence>
</xs:complexType>
```

Table 8.4.3.2.4-1: Service Information File Fields

Name	Semantic Definition	Constraints
ApplicationType	ApplicationType as defined in ETSI EN 300 468 [14] or any Proprietary application type.	Mandatory
ApplicationID	Application_id as defined in ETSI EN 300 468 [14] or Proprietary application identifier.	Mandatory
ApplicationURI	Interactive application URL This URL shall point to the local NIP Gateway and shall be labelled the Local Network Domain as dvb.gw/.	Mandatory

8.4.3.4.5 SIF Example

The following SIF.xml example depicts a Satellite Technical Operator declaring:

- 9 broadcast streamed services over 3 NIP streams, from 3 different Providers
- 3 DVB-I Service Lists over 2 NIP Streams
- 1 DVB-I Content Guide Source
- 1 HbbTV OpApp

```
<?xml version="1.0" encoding="utf-8"?>

<?xml version="1.0" encoding="UTF-8"?><ServiceInformationFile xmlns="urn:dvb:metadata:nativeip:2023"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:tva="urn:tva:metadata:2019"
xmlns:dvbisd="urn:dvb:metadata:servicediscovery:2023">
xsi:schemaLocation="urn:dvb:metadata:nativeip:2023 ../dvbnip.xsd">

<VersionUpdate>2021-12-20T22:00:00Z</VersionUpdate>


<NIPNetworkProviderName>SES</NIPNetworkProviderName>
   <BroadcastMediaStream>
      <NIPNetworkID>1</NIPNetworkID>
      <NIPCarrierID>1028</NIPCarrierID>
      <NIPLinkID>0</NIPLinkID>
      <NIPServiceID>100</NIPServiceID>
      <BroadcastMedia>
         <URI>http://dvb.gw/ses.com/SES_1_ServiceList_A.xml</URI>
         <URI>http://dvb.gw/ses.com/SES_1_ServiceList_B.xml</URI>
         <URI>http://dvb.gw/ses.com/SES_1_ContentGuide.xml</URI>
         <URI>https://dvb.gw/ses.com/1/CNN_International_Europe.mpd</URI>
      </BroadcastMedia>
   </BroadcastMediaStream>

   <BroadcastMediaStream>
      <NIPNetworkID>1</NIPNetworkID>
      <NIPCarrierID>1021</NIPCarrierID>
      <NIPLinkID>0</NIPLinkID>
      <NIPServiceID>0</NIPServiceID>
      <BroadcastMedia>
         <URI>https://dvb.gw/ARD-digital.de/live-streaming/ARD_ServiceList.xml</URI>
```

```
        <URI>https://dvb.gw/ARD-digital.de/live-streaming/WDR_Fernsehen_Köln.mpd</URI>
        <URI>https://dvb.gw/ARD-digital.de/live-streaming/WDR Studio_Bonn.mpd</URI>
        <InteractiveApplications>
           <ApplicationType>HbbTV</ApplicationType>
           <ApplicationID>12</ApplicationID>
           <ApplicationURI>https://dvb.gw/ARD_Op_App_ait.xml</ApplicationURI>
        </InteractiveApplications>
     </BroadcastMedia>
  </BroadcastMediaStream>

  <BroadcastMediaStream>
     <NIPNetworkID>133</NIPNetworkID>
     <NIPCarrierID>9</NIPCarrierID>
     <NIPLinkID>0</NIPLinkID>
     <NIPServiceID>1339</NIPServiceID>
     <BroadcastMedia>
        <URI>https://dvb.gw/sky.de/livestreaming/sky_one.mpd</URI>
        <URI>https://dvb.gw/sky.de/livestreaming/sky_one.m3u8</URI>
        <URI>https://dvb.gw/sky.de/livestreaming/sky_comedy.mpd</URI>
        <URI>https://dvb.gw/sky.de/livestreaming/sky_comedy.m3u8</URI>
        <URI>https://dvb.gw/sky.de/livestreaming/sky_sport.mpd</URI>
        <URI>https://dvb.gw/sky.de/livestreaming/sky_sport.m3u8</URI>
     </BroadcastMedia>
  </BroadcastMediaStream>

</ServiceInformationFile>
```

8.5 DVB-MABR Adaptation and Signalling

8.5.1 Introduction

The present document relies on the DVB Multicast ABR specification (ETSI TS 103 769 [8]) for transporting ABR-coded Media Objects via multicast streaming over the DVB-NIP Broadcast System.

Figure 8.5.1-1, extracted from ETSI TS 103 769 [8] represents the DVB MABR simplified architecture. This clause describes a unidirectional deployment model and depicts signalling arrangements between the Multicast Server and the Multicast Gateway.

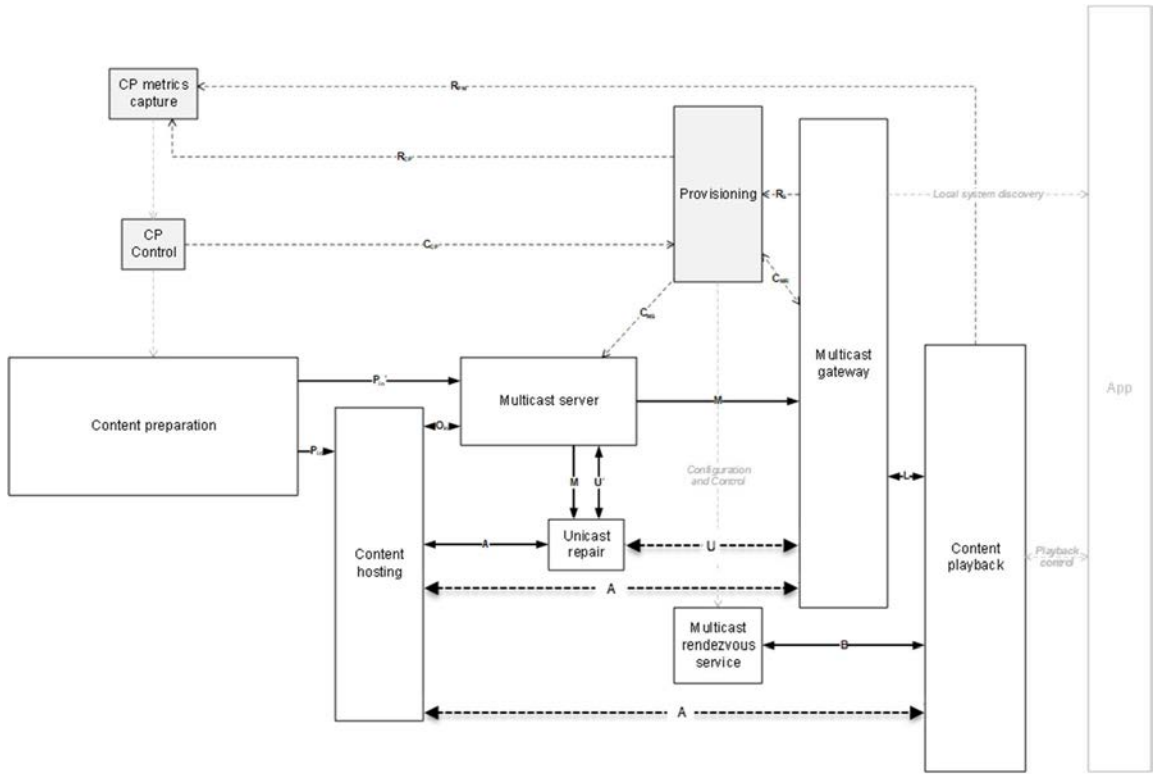


Figure 8.5.1-1: Simplified DVB-MABR reference architecture

The unidirectional deployment models defined in clauses 6.2 and 6.3 of ETSI TS 103 769 [8] are applicable to DVB-NIP.

- Clause 6.2 of ETSI TS 103 769 [8] corresponds to Deployment Model DM3 as described in clause 6.5 of the present document.
- Clause 6.3 of ETSI TS 103 769 [8] corresponds to Deployment Model DM2 as described in clause 6.4 of the present document.

Reference point A is optional meaning that the Multicast Gateway may not be able to access the Content hosting function through a bidirectional (unicast) access network. Similarly, the Content playback function may not be able to access the Content hosting function via reference A. Reference point CMR is not available in the absence of a bidirectional (unicast) access network.

8.5.2 Multicast Gateway Configuration

8.5.2.1 General

The Multicast Gateway is configured through at least one of the four methods defined in clause 10.1.2 of ETSI TS 103 769 [8]. In unidirectional NIP deployments, the Multicast Gateway configuration shall be provided through either the in-band method or the just-in-time method.

The multicast gateway configuration instance document is specified in clause 10.2.1.2 of ETSI TS 103 769 [8].

In the present document, the multicast session itself is identified by the *PresentationManifestLocator URL (the URL of the manifest)*.

A multicast session is associated with a NIP Service that is also identified by the @serviceIdentifier attribute (clause 10.2.2 of ETSI TS 103 769 [8]) that shall correspond to the DVB-I service `UniqueIdentifier` as specified in clause 5.5.2. of ETSI TS 103 770 [9].

As specified in clause 7.5, the *multicast gateway configuration instance document* signals only information about the multicast transport sessions carried over the same NIP Stream (see clause 7.3.4).

As a consequence, as stated in clause 8.3.5 and clause 10.1.2 of ETSI TS 103 769 [8], there shall be one *multicast gateway configuration transport session* and one *multicast gateway configuration instance document* per NIP Stream.

8.5.2.2 Bootstrapping: Bootstrap Multicast Gateway Configuration Instance Document

The multicast gateway configuration instance document is transported over a specific multicast gateway configuration transport session as specified in clause 8.3.5 of ETSI TS 103 769 [8]. The characteristics of this specific transport session are declared in the "bootstrap" multicast gateway configuration instance document depicted in clause 10.2.5 of ETSI TS 103 769 [8]. The present document shall be carried as part of the NIP Gateway signalling information on the Announcement Channel specified in clause 8.2 of the present document.

An example of a "bootstrap" multicast gateway configuration instance document is shown below:

```
<?xml version="1.0" encoding="UTF-8"?>

<MulticastGatewayConfiguration xmlns="urn:dvb:metadata:MulticastSessionConfiguration:2019"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" validityPeriod="P1D">

       <MulticastGatewayConfigurationTransportSession transportSecurity="integrityAndAuthenticity">
            <TransportProtocol
protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE"
protocolVersion="1"/>
            <EndpointAddress>
               <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
               <NetworkDestinationGroupAddress>232.98.1.1</NetworkDestinationGroupAddress>
               <TransportDestinationPort>9999</TransportDestinationPort>
               <MediaTransportSessionIdentfier>1</MediaTransportSessionIdentfier>
         </EndpointAddress>
            <BitRate maximum="200000"/>
      </MulticastGatewayConfigurationTransportSession>
</MulticastGatewayConfiguration>
```

8.5.3 DVB-MABR Operation and Workflow

The *NIP Gateway* shall instantiate a *Multicast Gateway* and *Multicast Rendezvous Service* as specified in clause 7.2 of ETSI TS 103 769 [8] and these instantiations shall be compliant with the following specification.

The *NIP Gateway* shall follow the mode of operation specified in clause 7.2 of ETSI TS 103 769 [8]. The following description takes precedence over the steps described in clause 7.2 of ETSI TS 103 769 [8] in case of conflicting statements.

Figure 8.5.3-1 is an adaptation of figure 7.2-1 from ETSI TS 103 769 [8] with the *NIP Gateway* featuring a co-located *Multicast Gateway* and *Multicast Rendezvous Service*, and the *NIP Client* featuring a co-located *DVB-I Client* and *Content playback* function.

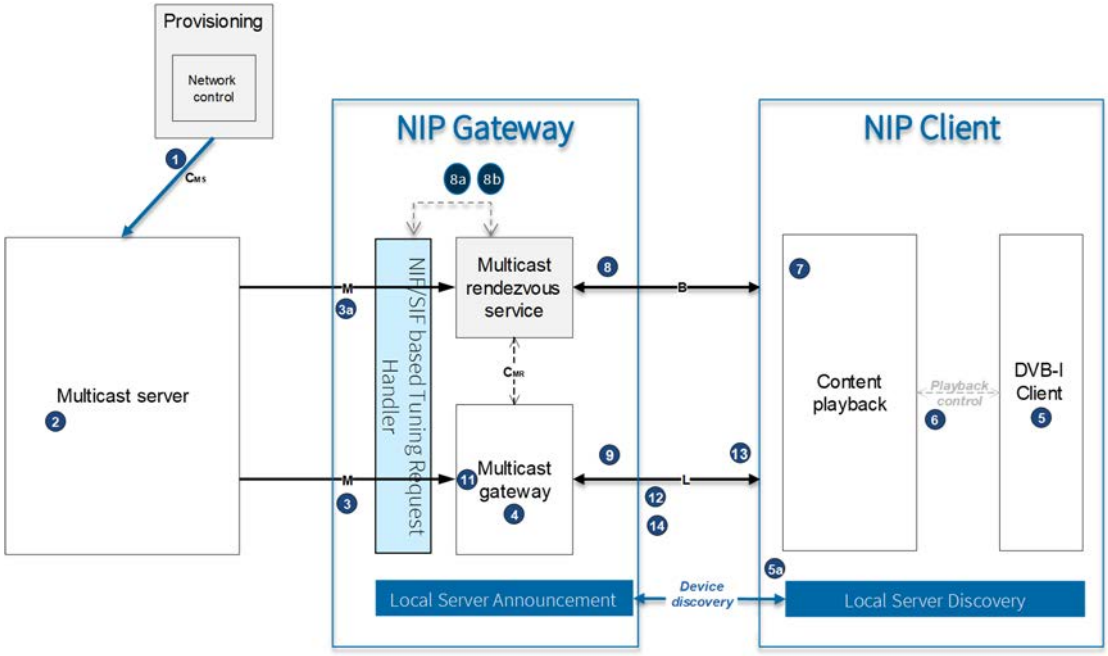


Figure 8.5.3-1: Co-located deployment workflow

The steps are as follows:

1) The *Network control* subfunction configures the *Multicast server* with the current provisioned set of multicast sessions. The *Multicast* server producing the multicast gateway configuration instance document shall take *into account the constraints defined in clause 8.5.2 above.*

2) The *Multicast server* acquires the presentation manifest and media segments, per the corresponding step in clause 7.2 of ETSI TS 103 769 [8].

3) The *Multicast server* sends the presentation manifest(s) as well as the media segments over the NIP *Broadcast Network* according to the multicast server configuration. Each NIP Stream conveys one multicast gateway configuration instance document describing the presentation manifests and all media segments carried on that NIP Stream.

   a) The *Multicast server* also sends the multicast gateway configuration instance document in a dedicated multicast gateway configuration transport session at reference point **M**, per the corresponding step in clause 7.2 of ETSI TS 103 769 [8].

   b) The *Multicast server may* send the manifest and segment initialization files over the dedicated multicast gateway configuration transport session at reference point **M**.

4) The *Multicast gateway* is active and discoverable by the *NIP Client* (see clause 11.1).

   a) The *NIP Client* may discover the *NIP Gateway* by means of local system discovery (see clause 11.1). It can associate the IP address and port number with the *Multicast Rendezvous Service*.

b) The DVB-I Service List Entry Points and the DVB-I Service Lists shall be exposed by the *NIP Gateway* (see clause 8.3) and are therefore accessible by the DVB-I Client.

c) The *NIP Gateway* shall be capable of handling the associations between this DVB-I Service List, the Service manifest URLs and the Service Information file (SIF) described in clause 8.4.3.

5) Once a service has been selected from the DVB-I Service List (ETSI TS 103 770 [9]) exposed by the *NIP Gateway* (see clause 8.3), the *DVB-I Client* obtains the URL of the presentation manifest listed in the selected DVB-I service instance.

a) The presentation manifest URL shall refer to the *Multicast Rendezvous Service* co-located with the Multicast Gateway.

b) The URL shall follow the following syntax (the serviceId parameter is optional).
http[s]://<NIP Gateway host name>:<Multicast Rendezvous Service port number>//>://<manifest path>/<manifest name>[?serviceId=<DVB-I service identifier>] according to clause 8.2.7.

6) The *NIP Client* launches the *Content playback* function (i.e. the media player) with the presentation manifest URL.

a) The URL shall refer to the *Multicast Rendezvous Service* co-located with the *Multicast Gateway*.

b) The URL may include the optional request query parameters specified in clause 7.5.1 of ETSI TS 103 769 [8].

c) The URL may optionally include the DVB-I service identifier as an additional query parameter as specified in step 5b above. For example:
"https://mylocalIPaddress/media.bbc.co.uk/simulcast/bbc-one/scotland/HDmanifest.mpd?serviceId= tag:bbc?co.uk:2021-12:bbc-one:scotland".

NOTE 1: The *DVB-I Client* may get the presentation manifest either directly from the DVB-I Service instance (*NIP Service Identifier*) as indicated in the previous step or by any other means.

7) The *Content playback* function resolves the host name (if any) of the *Multicast Rendezvous Service*.

NOTE 2: In the case where a domain name is to be resolved, it is assumed that the lookup is processed through a suitable mDNS server located in the *NIP Gateway* conforming to clause 11.1.3.2.

8) The *Content playback* function sends an HTTP(S) request to the *Multicast Rendezvous Service* over reference point **B** with the presentation manifest URL corresponding to the selected DVB-I service instance.

a) The *Multicast Rendezvous Service* relies on the Service Information File (SIF: see clause 8.4) to check whether the service is provided via broadcast (the SIF and NIF tables associate the MPD URL with a NIP Stream on a physical RF Carrier).

i. The *Multicast Rendezvous Service* shall compute the NIP Service Identifier from the received requested manifest URL according to the following:

- Starts the URL with the received URL scheme and adds the prefix "dvb.gw".

- Adds the original manifest path without any parameters:

<original scheme>://dvb.gw/<original targeted domain name>/<manifest path>/<manifest name>

Assuming the following received request, from the client, example: "https://mylocalIPaddress/media.bbc.co.uk/simulcast/bbc-one/scotland/HDmanifest.mpd?serviceId= tag:bbc.co.uk:2021-12:bbc-one:scotland", The NIP Service Identifier is composed with the path part extracted from after the third '/' character without the query string parameter, and add the prefixed "dvb.gw": https://dvb.gw/media.bbc.co.uk/simulcast/bbc-one/scotland/HDmanifest.mpd.

ii. If there is no entry matching the NIP Service Identifier in the SIF table then the *Multicast Rendezvous Service* shall return 404 (Not Found).

b) The *Multicast Rendezvous Service* shall check whether the *NIP Gateway* is tuned to the right channel.

i. The *NIP Gateway* checks the Network Information File and tunes to the correct NIP Stream if necessary (i.e. not already tuned to).

c) The *Multicast Rendezvous Service* may locate and read the multicast gateway configuration instance document to locate the multicast configuration entry related to the service corresponding to the NIP Service Identifier.

i. The *Multicast Rendezvous Service* may match the NIP Service Identifier (computed during step 8a) with the `PresentationManifestLocator` element attached to the multicast sessions/services.

ii. Alternatively, the *Multicast Rendezvous Service* may match the DVB-I Service identifier (possibly present in the received request URL (see step 5).

iii. If a match is found then the *Multicast Rendezvous Service* may compile a just-in-time multicast gateway configuration instance document according to clause 7.5.2.1 of ETSI TS 103 769 [8].

d) The *Multicast Rendezvous Service* shall redirect the request received at reference point **B** to reference point **L** of the co-located *Multicast Gateway* by means of an HTTP redirect if the corresponding service is present as part of the Service Information File per step 8a) and if the *NIP Gateway* is rightly tuned per step 8b).

i. The URL shall refer to the co-located *Multicast Gateway* according to clause 7.5.2.1 of ETSI TS 103 769 [8].

ii. The URL may include some of the optional fields specified in clause 7.5.2.1 of ETSI TS 103 769 [8].

https://dvb.gw:8088/B456789B5CC4FF/media.bbc.co.uk/simulcast/bbc-one/scotland/HDmanifest.mpd

iii. The URL may include the DVB-I Service identifier as a query string parameter as shown in step 5).

9) The *Content playback* function follows the redirect and requests the presentation manifest from the *Multicast Gateway* per clause 7.2 of ETSI TS 103 769 [8].

10) Void: This step is not required in the context of a DVB-NIP Broadcast System.

11) The *Multicast Gateway* receives the HTTP request from the *Content playback* function for the presentation manifest. The *Multicast gateway* shall check its *Content storage* cache and return the presentation manifest if it is present in the cache.

NOTE 3: The cache key used to index content in the *Content storage* subfunction is implementation specific. but the NIP service identifier defined below may, for example, be used for this purpose.

a) The *Multicast Gateway* shall internally construct a URL called the NIP Service Identifier from the presentation manifest request URL according to the following:

- Starts the URL with the received URL scheme and targeted domain name.
- Adds the original manifest path without any parameters.

<original scheme>:///<manifest path>/<manifest name>

Assuming the received request with a session identifier (i.e. token): "*https://dvb.gw:8088/media.bbc.co.uk/simulcast/bbc-one/scotland/HDmanifest.mpd?* serviceId= tag:bbc.co.uk:2021-12:bbc-one:scotland", the *NIP Service Identifier* is composed with the path part extracted from after the third '/' character without the query string parameter: https://media.bbc.co.uk/simulcast/bbc-one/scotland/HDmanifest.mpd.

b) If the requested presentation manifest is not present in *Content storage* cache, the *Multicast gateway* shall retrieve it from the *Content hosting* function via unicast bidirectional access at reference point **A** (if present in the deployment) according to table 8.5.3-1.

c) If the requested presentation manifest file is not present in the *Content storage* cache, assuming the Multicast Gateway is tuned to the correct NIP Stream (see step 8.b), the *Multicast gateway* inspects the current multicast gateway configuration instance document to check if the *NIP Gateway* is already subscribed to the corresponding multicast transport sessions.

i. The *Multicast Gateway* may match the NIP Service Identifier (computed during step 11a) with the URL in the `PresentationManifestLocator` element attached with the multicast session corresponding entry.

ii. Alternatively, the *Multicast gateway* may match the DVB-I Service identifier (possibly present in the received request as a query string parameter) with the DVB-I Service identifier attached with the multicast session corresponding entry.

iii. Alternatively, the *Multicast gateway* reads the Multicast Gateway Configuration Instance Document dedicated to the service and received as part of the requested URL (as depicted in clause 7.5.2.1 of ETSI TS 103 769 [8]).

iv. If a matching is successful then the *Multicast gateway* shall subscribe to all relevant multicast transport session(s) according to the configuration (if not already done).

NOTE 4: At this stage, the *Multicast gateway* should be receiving media files (including manifest and segments). In case that the requested objects are not yet available, the *Multicast gateway* has several options depending on the availability of a unicast access as expressed in table 8.5.3-1 below.

v. If/when no matching is possible then the service is not supposed to be delivered by multicast/broadcast. The *Multicast gateway* should rely on the unicast access, if existing, to downstream the manifest and possibly further related media elements.

NOTE 5: At this stage, the unicast access should exist because the *Multicast Rendezvous Service* has redirected the original request to the co-located *Multicast gateway* due to the presence of the corresponding service in the Service Information File (as explained in step 8d). The *Multicast Gateway* has several options depending on the availability of a unicast access as expressed in table 8.5.3-1.

Table 8.5.3-1: Manifest request processing options

Not in cache AND tuned to the right channel	NIP Gateway Unicast available	NIP Gateway NO Unicast (by design or by error)
Multicast session configured in the multicast gateway configuration instance document.	The *Multicast gateway* forwards the request over the unicast access. If `UnicastRepairParameters` element (see clause 10.2.3.12 in ETSI TS 103 769 [8]) is present the URL is computed according to clause 10.2.3.13 of ETSI TS 103 769 [8]. Otherwise, the URL is <original scheme>://<original targeted domain name>/<optional session ID>/<manifest path>/<manifest name>	The *Multicast gateway* waits an implementation-specific time period for the manifest to be received and cached) and returns error *404 (Not Found)* if the waiting period expires.
Multicast session not configured in the multicast gateway configuration instance document.	The *Multicast gateway* forwards the request over reference point **A**. The request URL is <original scheme>://<original targeted domain name>/<optional session ID>/<manifest path>/<manifest name>	The *Multicast rendezvous service* returns error *404 (Not Found)* according to clause 7.5.2.2 in ETSI TS 103 769 [8].

12) The *Multicast gateway* returns the presentation manifest back to the *Content playback* function via reference point **L**, per clause 7.2 of ETSI TS 103 769 [8].

13) The *Content playback* function requests a media segment (or presentation manifest) at reference point **L** per clause 7.2 of ETSI TS 103 769 [8].

14) The *Multicast gateway* receives the HTTP(S) request for a media segment. The *Multicast gateway* shall check its *Content storage* cache and return the requested media object if it is present in the cache.

NOTE 6: The cache key used to index content in the *Content storage* subfunction is implementation-specific, but the NIP Service Identifier defined in step 11a above may, for example, be used for this purpose.

a) The *Multicast gateway* shall internally construct the NIP Service Identifier from the media segment request URL received at reference point **L** in order to locate the corresponding associated multicast session configuration elements as described in clause 10.2.2 of ETSI TS 103 769 [8].

i. If the URL includes a session token then the *Multicast gateway* shall associate the segment request with the NIP Service Identifier corresponding to the most recent presentation manifest request at reference point **L** including the same session token.

ii. If the URL does not contain a session token, then the *Multicast gateway* shall assume the segment request path contains the related manifest request path. According to the step 11a:

<original scheme>://<original targeted domain name>/<manifest path>/<segment path>

For example, assuming the following manifest request has been processed previously:

https://dvb.gw:8088/media.bbc.co.uk/simulcast/bbc-one/scotland/Hdmanifest.mpd

The corresponding multicast session identifier would be the following:

https://media.bbc.co.uk/simulcast/bbc-one/scotland/Hdmanifest.mpd

Further related segment requests over reference point **L** shall correspond to the following:

https://dvb.gw:8088/media.bbc.co.uk/simulcast/bbc-one/scotland/<segment path>

For example:

https://dvb.gw:8088/media.bbc.co.uk/simulcast/bbc-one/scotland/segment/HD/237.m4s

b) If the requested media segment is not in cache, the *Multicast gateway* shall retrieve it from the *Content hosting* function via unicast bidirectional access at reference point **A** (if present in the deployment) according to table 8.5.3-2.

Table 8.5.3-2: Media segment processing options

Not in cache	NIP Gateway Unicast available	NIP Gateway No Unicast (by design or by error)	
		NIP Client No Unicast	NIP Client Unicast available
Multicast session configured in the multicast gateway configuration instance document.	The *Multicast gateway* forwards the request over the unicast access. If `UnicastRepairParameters` element (see clause 10.2.3.12 in ETSI TS 103 769 [8]) is present the URL is computed according to clause 10.2.3.13 of ETSI TS 103 769 [8]. Otherwise, the URL is <original scheme>://<original targeted domain name>/<optional session ID>/<manifest path>/<manifest name>.	The *Multicast gateway* waits an implementation-specific time period for the media segment to be received and cached and returns error *404 (Not Found)* if the waiting period expires.	The *Multicast gateway* waits an implementation-specific time period for the media segment to be received and cached and returns error *404 (Not Found)* if the waiting period expires. Or The *Multicast gateway* redirects (codes 302 or 307) the request to the *Content hosting* function (see clause 7.3 step 14 of ETSI TS 103 769 [8]. The request URL is <original scheme>://<original targeted domain name>/<optional session ID>/<manifest path if no session ID >/<segment path>/<segment name>.
Multicast session not configured in the multicast gateway configuration instance document.	The *Multicast gateway* forwards the request over reference point **A**. The request URL is *<original scheme>://<original targeted domain name>/<optional session ID>/<manifest path if no Session ID>/<segment path>/segment name>*.	The *Multicast gateway* returns error *404 (Not Found).*	The *Multicast gateway* returns error *404 (Not Found)*.

i. If the requested media segment is not present in the *Content storage* cache, the *Multicast gateway* shall match the NIP session identifier (computed during step 14a) with the URL in the `PresentationManifestLocator` element of a multicast session declared in the current multicast gateway configuration.

ii. Alternatively, the *Multicast gateway* may match the DVB-I Service identifier (if present in the received media segment request as a query string parameter) with the @serviceIdentifier attribute of a multicast session in the current multicast gateway configuration.

iii. If matching is successful, the *Multicast gateway* shall subscribe to all relevant multicast transport session(s) declared by the matched multicast session (if this is not already the case).

NOTE 7: At this stage, the *Multicast gateway* should be receiving media objects (including the presentation manifest and media segments). However, it may take time to populate the *Asset storage* cache due to acquisition latency. The *Multicast gateway* has several options depending on the availability of unicast access to a *Content hosting* function via reference point **A**, as expressed in table 8.5.3-2.

iv. If/when no matching is possible then the service is not delivered by multicast/broadcast. The *Multicast gateway* should rely on the unicast access at reference point **A** (if available in the deployment) to acquire the requested media segments.

NOTE 8: At this stage, the unicast access exists because the *Multicast rendezvous service* has redirected the original request to the co-located *Multicast gateway* due to the presence of the corresponding service in the Service Information File (as explained in step 8). The *Multicast gateway* has several options depending on the availability of unicast access, as expressed in table 8.5.3-2.

8.6 Time Synchronization

8.6.1 NIP Wall Clock

8.6.1.1 EXT_TIME Header Extension

The Multicast Server shall broadcast its current time using the Network Time Protocol (NTP) format as specified in IETF RFC 1305 [25]. The NTP time shall be delivered in the EXT_TIME LCT extension header of LCT packets as defined in section 5.2.2 of IETF RFC 5651 [26].

EXT_TIME shall provide Sender Current Time (SCT) where both SCT-High and SCT-Low are set.

To ensure a consistent end-user experience, all head-end functions shall be synchronized via NTP or PTP servers with an accuracy to within 500 ms of UTC.

8.6.1.2 Carriage of Timing Information

EXT_TIME shall be included in each LCT packet with TOI=0. These packets are used to carry the File Delivery Table (FDT).

To be clear all FLUTE/ROUTE transport sessions in NIP shall convey the NTP UTC reference time, not only FLUTE/ROUTE sessions carrying NIP Announcement Channel data.

Receivers shall use the NTP information received from the current FLUTE/ROUTE transport session to calculate the expiration time (Expires) of the FDT.

8.6.1.3 Global Time Reference

NTP time as carried by the NIP Announcement Channel FLUTE/ROUTE carousel of the bootstrap stream shall be used as the global time reference.

8.6.2 Local Time Offset

8.6.2.1 Time Offset File

The Time Offset File (TOF) is used to convey all possible time offset values and date saving flags and related parameters.

8.6.2.2 TOF Schema Declaration

```
<?xml version="1.0" encoding="UTF-8"?>

<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:ns="urn:dvb:metadata:nativeip:2023"
xmlns:mpeg7="urn:tva:mpeg7:2008" targetNamespace="urn:dvb:metadata:nativeip:2023"
elementFormDefault="qualified">
      <import namespace="urn:tva:mpeg7:2008" schemaLocation="tva_mpeg7.xsd"/>
      <xs:element name="TimeOffsetFile" type="ns:TimeOffsetFileType"/>
   …
</xs:schema>
```

8.6.2.3 TimeOffsetFileType

```
<xs:complexType name="TimeOffsetFileType">
   <xs:sequence>
      <xs:element name="VersionUpdate" type="xs:dateTime"/>
      <xs:element name="country_code">
        <xs:simpleType>
         <xs:restriction base= "xs:string">
            <xs:pattern value="[A-Z][A-Z][A-Z]"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
      <xs:element name="country_region_Id" minOccurs="0">
         <xs:simpleType>
            <xs:restriction base= "xs:nonNegativeInteger" >
               <xs:minInclusive value="0"/>
               <xs:maxInclusive value="63" />
            </xs:restriction>
         </xs:simpleType>
        </xs:element>
      <xs:element name="local_time_offset_polarity" type="xs:boolean"/>
      <xs:element name="local_time_offset_value">
            <xs:simpleType>
            <xs:restriction base= "xs:nonNegativeInteger">
               <xs:minInclusive value="0"/>
               <xs:maxInclusive value="43119"/>
            </xs:restriction>
         </xs:simpleType>
        </xs:element>
      <xs:element name="time_of_change" type="xs:dateTime" minOccurs="0"/>
      <xs:element name="next_time_offset_value" type="xs:nonNegativeInteger" minOccurs="0"/>
    </xs:sequence>
</xs:complexType>
```

Table 8.6.2.4-1: Time_Offset Fields

Name	Semantic Definition	Constraints
VersionUpdate	Used to provide the version number of the TOF. It indicates the date/time of modification of the latest TOF. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ).	Mandatory
country_code	As specified in local_time_offset_descriptor in clause 6.2.20 of ETSI EN 300 468 [14].	Mandatory
country_region_Id	As specified in local_time_offset_descriptor in clause 6.2.20 of ETSI EN 300 468 [14].	Optional
local_time_offset_polarity	As specified in local_time_offset_descriptor in clause 6.2.20 of ETSI EN 300 468 [14].	Mandatory
local_time_offset_value	Contains offset time from UTC time in seconds.	Mandatory

Name	Semantic Definition	Constraints
time_of_change	UTC time of change, if applicable, formatted in Zulu time format.	Optional
next_time_offset_value	Contains next offset time from UTC time in seconds.	Optional

8.6.2.4 TOF Example

```
<?xml version="1.0" encoding="UTF-8"?>
<TimeOffsetFile xmlns="urn:dvb:metadata:nativeip:2022" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xsi:schemaLocation="urn:dvb:metadata:nativeip:2022 ../TimeOffsetFile.xsd">
      <VersionUpdate>2021-12-20T23:00:00Z</VersionUpdate>
      <country_code>FRA</country_code>
      <local_time_offset_polarity>0</local_time_offset_polarity>
      <local_time_offset_value>3600</local_time_offset_value>
      <time_of_change>2022-03-26T03:00:00Z</time_of_change>
      <next_time_offset_value>7200</next_time_offset_value>
</TimeOffsetFile>
```

8.6.3 Time Synchronization between DVB-I Client and NIP Gateway

The NIP Gateway shall expose the NIP Wall Clock via http://dvb.gw/time.

The default time format shall be xs:dateTime as defined in W3C XML Schema Part 2 [i.3].

The following additional queries shall be supported:

- iso: time value formatted according to ISO time code as defined in ISO/IEC 8601-1 [23].
- xsdate: time value formatted according to xs:dateTime as defined in W3C XML Schema Part 2 [i.3].
- ms: time value with millisecond precision.

EXAMPLE:

  - http://dvb.gw/time?xsdate&ms
  - 2023-06-07T13:00:51.561Z

8.7 IP Layer Identification of RF Carriers

8.7.1 Object

In order for a NIP Gateway to ascertain the reception of a given RF Transport Carrier (e.g. a particular satellite transponder), information about the actually tuned to RF Carrier has to be available to NIP Receivers. For this reason, network operators shall insert the following information into all NIP Streams at least every 250ms not to slow down the tuning process.

8.7.2 NIP Actual Carrier Information ALC/LCT Session

The information about the actually tuned to NIP Carrier shall be provided in a dedicated ALC/LCT session with the following characteristics:

IPv4 Address: 224.0.23.14

IPv6 Address: FF0X:0:0:0:0:0:0:12D

UDP Port Number: 3937/udp

TSI (Transport Session Identifier): 1

The fixed IP Address and UDP Port number are identical to the IP Address and UDP Port number of the NIP Announcement Channel. However the NIP Actual Carrier Information (NACI) is carried in a different TSI.

8.7.3 NIP Actual Carrier Information Format

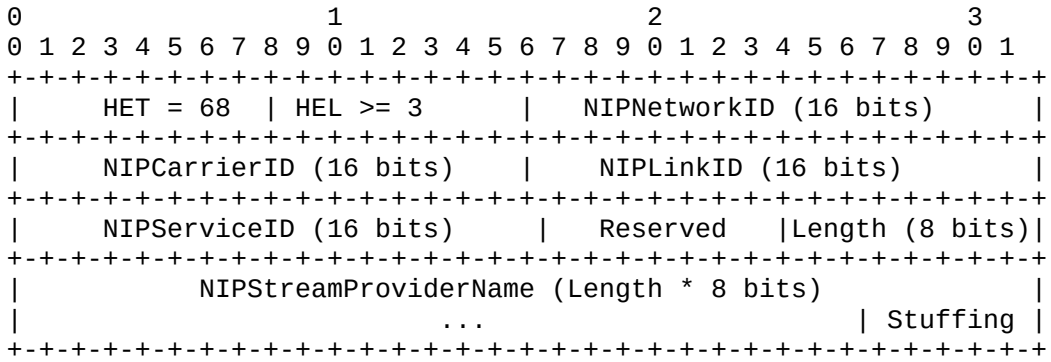
NIP Actual Carrier Information shall be provided in the EXT_NACI extension header of LCT packets. The EXT_NACI is a Protocol Instantiation specific (PI-specific) LCT extension defined with Header Extension Type (HET) = 68.

The ALC/LCT packet carrying the NIP Actual Carrier Information extension (EXT_NACI) shall not have any payload.

Transport Object Identifier (TOI): 0

ALC FEC Payload ID: 0

The format of the NIP Actual Carrier Information Extension shall be as follows:



Length: length of the NIPStreamProviderName in Bytes. Length shall be set to 0 if no NIPStreamProviderName is provided.

NIPStreamProviderName: as defined in clause 8.4.2. This field shall contain UTF-8 encoded characters according to IETF RFC 3629 [29].

Stuffing: required to align the extension on 32 bits. The HEL value shall be set accordingly.

9 Application and Presentation Layer

9.1 Audio and Video Coding Standards

9.1.1 Overview

DVB-NIP only requires a single mandatory system format for the carriage of audio-visual presentations: MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks ETSI TS 103 285 [11].

Audio Video Coding and Packaging for Native IP Adaptive Bit Rate applications shall be according to ETSI TS 103 285 [11].

9.1.2 MPEG-DASH AV Synchronization in NIP

While using the NIP defined FLUTE/ROUTE file transfer protocols, the NIP Multicast Server leaves timing information in MPEG-DASH manifest files unchanged from the origin. The MPEG-DASH manifest files broadcast via NIP therefore may or may not contain any time related information.

The Multicast Gateway shall ensure that segments signalled in the MPEG-DASH/HLS manifest/playlist files to NIP Clients correspond to segments actually available for NIP clients to provide gapless playback.

The NIP Multicast Gateway shall provide timing related information either:

by inserting or replacing the UTCTiming element (as defined in ISO/IEC 23009-1 [27]) in the MPEG-DASH manifest files received over-the-air, with:

- DIRECT-VALUE time as specified in clause 5.8.5.7 of ISO/IEC 23009-1 [27]. The @schemeIdURI attribute set shall be set to: urn:mpeg:dash:utc:direct:2014.

  The syntax for the value field shall use the notation specified in section 5.8.5.7 of ISO/IEC 23009-1 [27].

- The xs:dateTime HTTP URL to which HTTP GET requests can be made to obtain the timing information as defined in W3C XML Schema Part 2 [i.3]. The @schemeIdURI attribute set shall be set to: urn:mpeg:dash:utc:http-xsdate:2014.

  The exact syntax of the value of the @value field shall be as specified in clause 5.8.5.7 of ISO/IEC 23009-1 [27].

or by ensuring that the SegmentTimeline elements in the MPEG-DASH manifest files correspond to segments actually available for NIP Clients to retrieve.

In order for NIP Gateways to carry out this step, NIP Gateways shall understand/implement the MPEG-DASH manifest syntax.

9.2 Captions and Subtitles

NIP Clients shall be able to correctly render TTML based subtitles according to clause 7 of DVB-DASH (ETSI TS 103 285 [11]).

9.3 Time Shifting

Timeshifting for connected receivers shall be according to ETSI TS 103 285 [11].

Timeshifting for unconnected receivers is outside the scope of the present document.

9.4 Service Usage Reporting

Service Usage Reporting for connected receivers shall be according to clauses 5.3.6.1, 5.3.8.4, 10.2.2.3 and 11 of ETSI TS 103 769 [8]. Service Usage Reporting for unconnected receivers is outside the scope of the present document.

9.5 Generic File Delivery

9.5.1 Introduction

In addition to delivering audio-visual content for live consumption and related signalling, DVB-NIP also provides mechanisms for pushing any type of generic offline file-based content to NIP Receivers. These mechanisms apply to the following applications in NIP:

- NIP Broadcast Content and Service Guide as specified in Annex D.
- Broadcast of Content Protection Security Assets for Unconnected Receivers as specified in clause 10.3.
- Broadcast of Private Data as specified in Annex E.
- Broadcast of Generic Push Content.

All these NIP applications are based on using object carousel mechanisms i.e. repetitive file transmissions inside Multicast Transport Sessions as specified in ETSI TS 103 769 [8].

This clause describes the overall mechanisms available in NIP for carrying Generic Files, enabling those Generic Files to be located by NIP Gateways anywhere on the Broadcast Network and stored in a specified file structure from which they can be retrieved by NIP Clients. The clause ends with an overall generic workflow for NIP Gateways and a description on how Multicast Servers can be made aware of the files to be ingested for broadcast.

9.5.2 NIP Object Carousels in DVB-MABR Multicast Transport Sessions

9.5.2.1 Identifying a NIP MulticastGatewayConfiguration Transport Session

NIP generic file-based data shall be carried in object carousels inside DVB-MABR Multicast Transport Sessions (as defined in ETSI TS 103 769 [8]) and shall be identified in the **bootstrap** multicast gateway configuration instance document using the following two identifiers (attributes) introduced in clause 10 of ETSI TS 103 769 [8].

NOTE: The present document requires features found in ETSI TS 103 769 [8] or DVB Bluebook A176r5 and later.

- **@serviceClass**: The service class attribute carries a URI that identifies the overall type (class) of content carried inside a multicast transport session.

EXAMPLE 1: urn:dvb:metadata:nativeip:ContentGuide.

- **@tags**: this is a whitespace-separated list of URIs that may be used by NIP Gateways in order to uniquely identify multicast gateway transport sessions and to selectively filter those carrying content relevant to them and to decide on whether to cache the content or not. The URI coded in the @tags attribute may also be used to help NIP Gateways physically re-tune to the broadcast channel carrying the corresponding content.

EXAMPLE 2: http://dvb.gw/bbc.co.uk/CG/tva_schedule_CoreSet.

The values of both attributes and their use for different NIP applications are described in the corresponding sections listed above.

9.5.2.2 Multicast Transport Session Tagging

The example document below shows a declaration of a multicast gateway configuration transport session as used in NIP with the tagging mechanism defined in clause 9.5.2.1. Such tags shall allow to uniquely refer to a session from other NIP documents.

```
<?xml version="1.0" encoding="UTF-8"?>
<MulticastGatewayConfiguration xmlns="urn:dvb:metadata:MulticastSessionConfiguration:2023"
xmlns:phase2b="urn:dvb:metadata:ExtendedMulticastSessionConfiguration:2023"
xmlns:nip="urn:dvb:metadata:NativeIPMulticastSessionConfiguration:2023"
xmlns:ext="urn:dvb:metadata:Extensibility:2023"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" validityPeriod="P1D">

    <MulticastGatewayConfigurationTransportSession
xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType"
tags="http://dvb.gw/bbc.co.uk/CG/tva_schedule_CoreSet"
serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
        <TransportProtocol
protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE"
protocolVersion="1"/>
        <EndpointAddress>
            <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
            <NetworkDestinationGroupAddress>232.99.1.1</NetworkDestinationGroupAddress>
            <TransportDestinationPort>9999</TransportDestinationPort>
            <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
        </EndpointAddress>
        <BitRate average="280000" maximum="280000"/>
        <!-- No compression requested for XML documents in this carousel -->
        <ObjectCarousel>
        <!-- No object carousel requested for XML documents in this carousel -->
        </ObjectCarousel>
    </MulticastGatewayConfigurationTransportSession>
```

9.5.3 NIP Application-specific Manifest Files

Depending on the actual NIP application, additional information not currently available through DVB-MABR will be provided to NIP Gateways through so-called NIP Application Manifest files. These Manifest files are NIP application-specific and can be compared to the Manifest files which are provided with e.g. DVB-DASH sessions and which carry information about the actual data to be downloaded for a given NIP Application.

NIP so far provides Manifest file definitions for the following applications:

- NIP Broadcast Content and Service Guide as specified in Annex D.
- Broadcast of Content Protection Security Assets for Unconnected Receivers as specified in clause 10.3.
- Broadcast of Private Data as specified in Annex E.

Manifest files provide sufficient information for NIP Receivers to determine whether to download a given set of generic files and to allow receivers to locate file delivery sessions and tune to the NIP Stream carrying one or more of these sessions.

Manifest files are structured around sessions and for each session describe a set of tag references. Each tag reference is a list of URIs describing the content broadcast in those sessions. These tag references are used to uniquely identify particular NIP Multicast Transport Sessions in a NIP Broadcast Network.

9.5.4 URI-based Re-Tuning of Broadcast Receivers

The DVB-NIP system inherently relies on a URI-based re-tuning mechanism for NIP Gateways. NIP Gateways are aware of where URI objects are carried on the broadcast network thanks to the SIF described in clause 8.4.3. The purpose of the SIF is to associate URIs to BroadcastMediaStreams. This allows NIP Gateways to automatically re-tune to the broadcast carrier carrying this information when NIP Clients request particular URIs.

This mechanism is also available in the context of Generic File Delivery Applications. As long as URIs are associated to a BroadcastMediaStream in the SIF, the NIP Gateway is capable of re-tuning.

NOTE: URIs in this context may refer to an individual file or may in the context of tag references refer to a set of files labelled with a common tag. The SIF allows matching any URI to a logical location on the NIP Broadcast Network (clause 8.4.3.2).

9.5.5 NIP Gateway Workflow

9.5.5.1 From Application Manifest to Content Download

This clause describes the generic workflow of a NIP Gateway in the context of Applications making use of the Generic File Delivery mechanism.

As a prerequisite to such operation, it is assumed that the NIP Gateway has been installed and has downloaded all the information carried in the Announcement Channel of its Boostrap Stream. The NIP Gateway stores all Manifest files under their well-known name in the root of the NIP Gateway file structure.

For NIP Applications listed under clause 9.5.1, this includes the Manifest file for Content Protection Security Assets, the Manifest file for Private Data and any other Manifest file(s) carried in the Announcement Channel on the NIP Bootstrap Stream.

All such Manifest files contain information for NIP Gateways to be able to answer requests from NIP Clients:

- For a given NIP Application, the Application-specific Client starts requesting the corresponding Application Manifest URI. (This URI is application-specific and described in the corresponding Application sections of the present document).
- The NIP Application-specific Client parses the Manifest in order to locate the URI (tag references) that it requires for further operation. It then invokes an http request to the NIP Gateway for a particular tag reference (URI) it wants to retrieve.
- Using the SIF and NIF the NIP Gateway locates the NIP Stream carrying the requested <URI>(s).

- If necessary, the NIP Gateway re-tunes to the corresponding NIP Stream.
- The NIP Gateway then parses the Bootstrap Multicast Gateway Configuration Instance document on that NIP Stream to search for the associated @serviceClass and @tags in order to get the technical parameters of the multicast gateway transport session carrying the requested content.
- The NIP Gateway then starts to download the content conveyed by the selected Multicast Transport Session.
- It stores the content in the path provided by the <Content-Location> field in the FDT.
- The NIP Gateway answers the initial http request for content with a list of files being downloaded.
- The Application-specific Client can finally retrieve the content from the NIP Gateway.

9.5.5.2 NIP Gateway File Content Repository

The Application-specific content downloaded from the broadcast network shall be stored within the NIP Gateway file structure according to the path specified in the <ResourceLocator> element of the Bootstrap Multicast Gateway Configuration Instance document or alternatively the matching Content-Location field in the FDT:

- For the NIP Service Guide the Gateway repository path is specified in Annex D, clause 6.1.1.1.
- For the NIP Content Guide the Gateway repository path is specified in Annex D, clause 6.1.1.1.
- For Content Protection Asset signalling the <URI> is described in the Content Protection Assets manifest document.
- For Private Data Signalling the <URI> is described in the Private Data Signalling Entry Points document.

9.5.6 DVB-MABR Multicast Server Generic File Ingest Interface: NH2

NH2 represents the interface between the Multicast Server and the content hosting origin for Generic File based data. The Ingest function determines the data to be broadcast as part of NIP Object Carousels. If available, the Generic File Ingest function may use the Multicast Server Configuration generated by the DVB-MABR provisioning system and the <ResourceLocator> elements in the <ObjectCarousel> elements in order to determine the objects to be broadcast in a given multicast transport session. Other configuration methods may be implemented also by Multicast Server vendors. Ingested Generic Files shall never be multicast in the NIP Announcement Channel multicast transport session. NH2 is an http GET based interface.

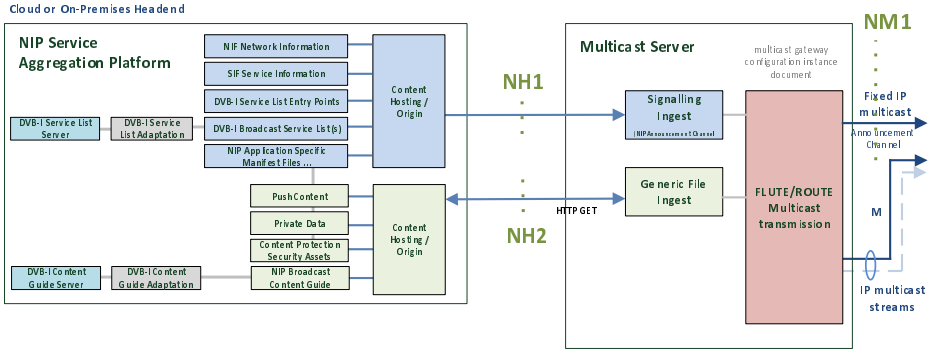


Figure 9.5.6-1: Logic for building the NIP Content Guide documents for Broadcast

10 Content Protection

10.1 Introduction

Content protection signalling shall be according to clause 8.4 of DVB-DASH ETSI TS 103 285 [11]. DVB NIP does not specify a full end-to-end content protection system (DRM).

DVB NIP re-uses the content protection principles set out by DVB-DASH ETSI TS 103 285 [11]. Such principles are the usage of specific parameters that are defined within the MPEG DASH ISO/IEC 23009-1 [27] MPD and within the ISO Common Encryption "CENC" (ISO/IEC 23001-7 [i.1]). This enables multiple DRMs to protect the content, sharing information (such as KeyIDs and ivs), and then using an opaque container for each DRM to carry DRM specific data (such as licence or licence acquisition information).

The protection of content is optional in DVB NIP but if used, it shall be in accordance with clause 8 of DVB-DASH ETSI TS 103 285 [11].

10.2 Connected Receivers

In the case of DVB-I Clients connected to a NIP Gateway and/or to an IP network via broadband, the DVB-I Client secure player shall comply to content protection mechanisms as specified in DVB-DASH ETSI TS 103 285 [11].

10.3 Unconnected Receivers (informative)

10.3.1 Broadcast Delivery of Content Protection Assets to Secured DASH Players

10.3.1.1 Introduction

Any proprietary DRM solution can be integrated in a DVB-NIP workflow to provide credentials to secured DASH players.

This feature is optional, but if implemented, it shall comply with the specification as given in the following sections.

DVB-NIP specifies the way to signal and convey the required security assets to NIP Gateways using broadcast only.

Based on the Generic File Delivery mechanism specified in clause 9.5, the solution consists of a dedicated .xml Manifest document called the "ContentProtectionAssetsSignallingManifest.xsd". The present document is broadcast on the NIP Gateway Bootstrap Stream Announcement channel and stored by the NIP Gateway in its root directory.

The Content Protection Assets Signalling Manifest allows content protection solution providers to identify and locate information on the Broadcast Network specific to their security assets.

This Manifest is retrieved by the content protection solution provider's application from the NIP Gateway. It is up to this application to make further queries to the NIP Gateway to the content URIs referenced in the manifest. The subsequent downloaded content is made available to the content protection solution application.

10.3.1.2 Manifest and Repository Convention

The NIP bootstrap stream carries a single Content Protection Assets Signalling Manifest carrying the information for all content protection solution providers and their assets required for protected services broadcast on the current physical or commercial network.

The Content Protection Assets Signalling Manifest shall be named: NIP-CPA-Manifest.xml.

The Manifest shall be downloaded by the NIP Gateway and cached in its root folder.

The convention above shall be respected as content protection solution provider applications rely on the correct path and manifest name.

The manifest URI shall be described in the SIF, as well as all the URIs, signalled as <TagRef> in the manifest itself.

10.3.1.3 Content Protection Assets Signalling Manifest

10.3.1.3.1 Structure

The Manifest document is structured according to the content protection solution provider unique identifier. This identifier shall correspond to the CP System ID registered at DVB Services Sàrl.

10.3.1.3.2 Multicast Transport Session Identifiers

10.3.1.3.2.1 @ServiceClass

For the Content Protection Assets Signalling Manifest and all the content listed in the Manifest itself, the @serviceClass as introduced in clause 9.5.2.1 shall be:

urn:dvb:metadata:nativeip:ContentProtectionAssets

10.3.1.3.2.2 @Tags

The Content Protection Assets Content @tags (URI) links the Manifest declarations to the bootstrap multicast gateway configuration instance document defined sessions.

10.3.1.4 Content Protection Assets Signalling Manifest Schemas

10.3.1.4.1 Content Protection Assets Signalling Manifest Schema Declaration

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="urn:dvb:metadata:nativeip:2023" xmlns="urn:dvb:metadata:nativeip:2023"
  elementFormDefault="qualified">

  <xs:element name="ContentProtectionAssetsSignallingManifest"
    type="ContentProtectionAssetsSignallingManifestType" />
…
</xs:schema>
```

10.3.1.4.2 ContentProtectionAssetsSignallingManifestType

```
<xs:complexType name="ContentProtectionAssetsSignallingManifestType">
    <xs:sequence>
      <xs:element name="VersionUpdate" type="xs:dateTime" />
      <xs:element name="ContentProtectionProvider" type="ContentProtectionProviderType"
        minOccurs="1" maxOccurs="unbounded" />
    </xs:sequence>
</xs:complexType>
```

Table 10.3.1.4.2-1: Content Protection Assets Signalling Manifest Fields

Name	Semantic Definition	Constraints
VersionUpdate	Provides the version number of the Content Protection Assets Signalling Manifest. It indicates the date/time of the latest modification of the document. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ).	Mandatory
ContentProtectionProvider	Structure inherent to each Content Protection solution provider.	Mandatory

10.3.1.4.3 ContentProtectionProviderType

```
<xs:complexType name="ContentProtectionProviderType">
    <xs:sequence>
      <xs:element name="ContentProtectionAssetsSession" type="ContentProtectionAssetsSessionType"
        minOccurs="1" maxOccurs="unbounded" />
    </xs:sequence>
    <xs:attribute name="contentProtectionProviderID" type="CP_System_ID" use="required" />

<xs:simpleType name="CP_System_ID">
    <xs:restriction base="xs:hexBinary">
      <xs:length value="2" />
    </xs:restriction>
  </xs:simpleType>
  </xs:complexType>
```

Table 10.3.1.4.3-1: ContentProtectionProviderType Fields

Name	Semantic Definition	Constraints
ContentProtectionAssetsSession	This structure signals all parameters inherent to one carousel conveying private data content.	Mandatory
ContentProtectionProviderID	Unique identifier allocated to each private Content Protection solution supplier. In order to ensure the uniqueness of this identifier, it shall correspond to the CP_System_ID registered at DVB Services Sàrl. CP_System_ID format is a 2-bytes coded in hexadecimal as specified in ETSI EN 300 468 [14].	Mandatory

10.3.1.4.4 ContentProtectionAssetsSessionType

```
<xs:complexType name="ContentProtectionAssetsSessionType">
    <xs:sequence>
      <xs:element name="VersionUpdate" type="xs:dateTime" minOccurs="0" />
      <xs:element name="TagRef" type="xs:anyURI" minOccurs="1" maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
```

Table 10.3.1.4.4-1: ContentProtectionAssetSessionType Fields

Name	Semantic Definition	Constraints
VersionUpdate	According to the content protection solution requirements, the supplier may provide a version number of the described assets. It indicates the date/time of the latest content modification. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ).	Optional
TagRef	Reference one tag of the MulticastGatewayConfigurationTransportSession@tags list in the Boostrap Multicast Gateway Configuration Instance Document. Up to the broadcaster and the private data solution provider to ensure that listed URI are explicit enough to be properly interpreted by the application.	Mandatory

10.3.1.4.5 Content Protection Assets Signalling Manifest Example

```
<?xml version="1.0" encoding="UTF-8"?>
<ContentProtectionAssetsSignallingManifest xmlns="urn:dvb:metadata:nativeip:2023"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="urn:dvb:metadata:nativeip:2023
content_protection_assets_signalling_manifest.xsd">
   <VersionUpdate>2023-12-28T17:06:33Z</VersionUpdate>

   <ContentProtectionProvider contentProtectionProviderID="0200">
      <ContentProtectionAssetsSession>
         <VersionUpdate>2023-12-01T00:00:03Z</VersionUpdate>
         <TagRef>http://dvb.gw/PayTVoperator21.com/CP0200/Txp11</TagRef>
```

```
         <TagRef>http://dvb.gw/PayTVoperator21.com/CP0200/Txp12</TagRef>
      </ContentProtectionAssetsSession>
   </ContentProtectionProvider>

   <ContentProtectionProvider contentProtectionProviderID="0300">
      <ContentProtectionAssetsSession>
         <TagRef>http://dvb.gw/PayTVoperator31.com/CP0300/Basic</TagRef>
      </ContentProtectionAssetsSession>

      <ContentProtectionAssetsSession>
         <TagRef>http://dvb.gw/PayTVoperator31.com/CP0300/PremiumSubscription</TagRef>
      </ContentProtectionAssetsSession>

      <ContentProtectionAssetsSession>
         <TagRef>http://dvb.gw/PayTVoperator33.com/CP0300/PremiumSubscription</TagRef>
         <TagRef>http://dvb.gw/PayTVoperator33.com/CP0300</TagRef>
      </ContentProtectionAssetsSession>

   </ContentProtectionProvider>

</ContentProtectionAssetsSignallingManifest>
```

Bootstrap Multicast Gateway Configuration Instance Document

```
<?xml version="1.0" encoding="UTF-8"?>
<MulticastGatewayConfiguration xmlns="urn:dvb:metadata:MulticastSessionConfiguration:2023"
xmlns:phase2b="urn:dvb:metadata:ExtendedMulticastSessionConfiguration:2023"
xmlns:nip="urn:dvb:metadata:NativeIPMulticastSessionConfiguration:2023" xmlns:ext="urn:dvb:metadata:Extensibility:2023"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" validityPeriod="P1D">

  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType"
tags="http://dvb.gw/PayTVoperator21.com/CP0200/Txp11" serviceClass="urn:dvb:metadata:nativeip:ContentProtectionAssets">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.2.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/PayTVoperator31.com/CP0300/Basic" serviceClass="urn:dvb:metadata:nativeip:ContentProtectionAssets">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.2.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/PayTVoperator31.com/CP0300/PremiumSubscription" serviceClass=" urn:dvb:metadata:nativeip:ContentProtectionAssets">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.2.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
```

```
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>

  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/PayTVoperator33.com/CP0300/PremiumSubscription http://dvb.gw/PayTVoperator33.com/CP0300" serviceClass="
urn:dvb:metadata:nativeip:ContentProtectionAssets">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.2.4</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>
```

10.3.1.5 Receiver Implementation Guideline

10.3.1.5.1 NIP Gateway

The Content Protection Assets Manifest shall be broadcast on the bootstrap NIP stream(s) of the technical operator or commercial operator network, as specified in clause 8.2.5.1.

Each time the NIP Gateway tunes to the bootstrap NIP stream, it shall search for the presence of a Content Protection Assets Signalling Manifest in the NIP Announcement Channel by parsing the FDT for the following:

Content-Type="application/xml+dvb-nip-cpm"

The NIP Gateway shall download the *nip-cpa-manifest.xml* document and cache it in its root folder.

10.3.1.5.2 Content Protection Solution Application and NIP Gateway Interaction

- The content protection solution application sends an http GET request to the NIP Gateway for the Content Protection Assets Signalling manifest:

  /nip-cpa-manifest.xml

- The content protection solution application parses the manifest document and makes a query to the DVB Gateway for the selected <TagRef>.

EXAMPLE 1: dvb.gw/PayTVoperator21.com/CP0200/Txp11

- The NIP Gateway locates this URI (via SIF/NIF) and tunes to the NIP stream conveying it. In case of several <TagRef> signalled in the manifest, conveyed by the same Multicast Transport Session, at least one <TagRef> shall match in the SIF to confirm the NIP stream location.

- Once tuned, the NIP Gateway downloads and parses the Bootstrap Multicast Gateway Configuration Instance document and searches for the requested Multicast Transport Session:

  - @serviceClass = urn:dvb:metadata:nativeip:ContentProtectionAssets

  - @tags = URI of the Content Protection Assets

In case of several <TagRef> signalled in the manifest, conveyed by the same Multicast Transport Session, at least one <tags> shall match to identify the Multicast Transport Session.

EXAMPLE 2: dvb.gw/PayTVoperator21.com/CP0200/Txp11

- The NIP Gateway downloads and caches the entire content conveyed by the Multicast Transport Session linked to the queried <TagRef> (URI), using the path of the <Content-Location> field in the FDT.

Example repository folder content:

dvb.gw/op21.com/0200/Tp11/
contentprotectionassets.ext
file1.xml
file2.json
index.json
dvb.gw/op21.com/0200/xp12/
contentprotectionassets.ext
file11.xml
file21.mp4
index.json

- The NIP Gateway answers the initial http request with a document listing all the URI resources being downloaded from the Multicast Transport Session.
- Finally, the content assets are made available to the private data solution provider application. Download times may depend on overall content size.

NOTE: It is the responsibility of the content protection solution provider to inform the network operator about the memory resources of the receiver to be allocated for the download and caching of his assets.

10.3.2 MPEG Transport Stream Encryption

DVB-NIP A/V content broadcast using DVB-MPE encapsulated NIP Streams may be protected using DVB-CSA.

The workflow to signal and provide Entitlement Management Message (EMM) and Encrypted Control Messages (ECM) shall comply to DVB-CSA and DVB-SI (ETSI EN 300 468 [14]).

This solution will provide transport level security only and encrypt the entire content of the Multicast Transport Sessions inside the NIP Stream and conveyed as a DVB-MPE Service. All content will be deciphered prior to being provided to the DASH player.

11 Deployment Specific Protocols

11.1 NIP Gateway Announcement and Discovery Protocol

11.1.1 Introduction

Consumer NIP Gateways according to DM3 shall support DNS-SD/mDNS as network device discovery protocol.

This guarantees that network clients can easily discover the presence of a NIP Gateway on the local network and discover the services provided by the NIP Gateway.

NIP clients shall support the DNS-SD/mDNS Network Device Announcement and Discovery Protocol as specified under clause 11.1.2.

11.1.2 DNS-SD/mDNS

11.1.2.1 General

The method described in the present clause is intended to be applicable in DVB-NIP and DVB-HB [13] contexts. In particular, the term DVB Gateway indicates a device which may provide functions of a DVB-NIP Local Server as defined in the present document, a DVB-HB Gateway as defined in DVB-HB [13], or both.

A DVB Gateway shall announce its presence on the LAN and answer DVB client host query requests using the DNS-SD mechanism defined in IETF RFC 6763 [18] in conjunction with mDNS as defined in IETF RFC 6762 [17] and according to the following:

- A registered DVB Gateway service.
- At least three Domain Name System (DNS) records: a Pointer (PTR) record, a Service (SRV) record and a Text (TXT) record.

A client implementing this method shall support the DVB Gateway discovery according to IETF RFC 6763 [18] and IETF RFC 6762 [17], taking into account the information exposed in the DNS records as described in clauses 11.1.2.2, 11.1.2.3 and 11.1.2.4.

11.1.2.2 Pointer Record (PTR)

The PTR record is used to point clients looking for a DNS-SD service to the devices providing that service. The PTR record format is as follows:

```
<Service Type>.<Domain> <TTL> PTR <Instance Name>.<Service Type>.<Domain>
```

where:

`<Service Type>`	is the combination of a standard IP protocol name and a transport protocol name both prefixed with the underscore '_' character. The DVB Gateway shall use the following Service Type: `_dvbservdsc._tcp`. Additionally, the DVB Gateway should use the Service Type `_http._tcp` if the exposed service is also an HTTP server.
`<Domain>`	shall be set to `local`.
`<TTL>`	is the value in seconds of Time To Live in cache.
`<Instance Name>`	is the instance name of the service. It may be up to 63 bytes. Information on how to build Instance Names is provided in IETF RFC 6763 [18]. A recommendation is to provide short, descriptive and human-readable names. Unicode characters including spaces are allowed by IETF RFC 6763 [18].

Below are three examples of a DVB Gateway PTR record:

```
_dvbservdsc._tcp.local. 86400 PTR DVB Gateway Manufacturer A Model B._dvbservdsc._tcp.local.
_dvbservdsc._tcp.local. 86400 PTR Live TV Airport Lounge 2._dvbservdsc._tcp.local.
_dvbservdsc._tcp.local. 86400 PTR dvb:gw:35:7B:12:48:DE:01._dvbservdsc._tcp.local.
```

11.1.2.3 Service Record (SRV)

The SRV record has the following structure, as defined in IETF RFC 6763 [18] and IETF RFC 2782 [24]:

```
<Instance Name>.<Service Type>.<Domain> <TTL> IN SRV <Priority> <Weight> <Transport Port> <IP addres
s>
```

It associates the name of a service (structured as `<Instance Name>.<Service Type>.<Domain>`) with the IP address and port number of a server (host device) that offers that service, allowing a client to discover the local DVB Gateway service.

Below is an example of a DVB Gateway SRV record:

```
DVB Gateway Model A._dvbservdsc._tcp.local. 86400 IN SRV 0 0 80 192.168.1.101.
```

11.1.2.4 Text Record (TXT)

The TXT record is intended to convey a small amount of useful additional information about a service. It is a concatenated list of "key=value" pairs separated by semicolons, with the following structure:

```
<Instance Name>.<Service Type>.<Domain> <TTL> TXT "<key_1>=<value_1>[;<key_n>=<value_n>]"
```

Available keys for the TXT record are given in table 11.1.2.4-1.

Table 11.1.2.4-1: TXT record keys

Key	Semantic Definition	Constraints
txtvers	Decimal version number of the TXT record, as defined in IETF RFC 6763 [18].	Optional
dvbi_sep	URL of the Service List Entry Points exposed by the DVB Gateway. It can be local or remote.	Either dvbi_sep or dvbi_sl is mandatory
dvbi_sl	URL of the DVB-I Service List exposed by the DVB Gateway. It can be local or remote.	Either dvbi_sep or dvbi_sl is mandatory
priv_loc	URL of private signalling data for DVB Gateways not implementing DVB-I functionality.	Optional
cprot_ep	URL pointing to content protection server.	Optional
manuf	Manufacturer's name.	Optional
model	Model name of the device.	Optional
sn	Serial number of the device.	Optional
tuners	List of pairs of supported modulation types and respective numbers of tuners. Multiple pairs are separated by " ". Modulation type and number of tuners of that kind are separated by "/". Possible values of modulation type are: "DVB-T", "DVB-T2"; ", "DVB-S",", "DVB-S2", "DVB-S2X" "DVB-C". EXAMPLE: tuners=DVB-T2/4 DVB-S2/2	Optional
orb_pos_A	First received orbital position, expressed in positive or negative degrees representing East and West directions respectively. Relevant only if the DVB Gateway also includes satellite tuners.	Optional
orb_pos_B	Second received orbital position, expressed in positive or negative degrees representing East and West directions respectively. Relevant only if the DVB Gateway also includes satellite tuners.	Optional
orb_pos_C	Third received orbital position, expressed in positive or negative degrees representing East and West directions respectively. Relevant only if the DVB Gateway also includes satellite tuners.	Optional
orb_pos_D	Fourth received orbital position, expressed in positive or negative degrees representing East and West directions respectively. Relevant only if the DVB Gateway also includes satellite tuners.	Optional

Optional parameters are intended for filtering at client-side in case several DVB Gateway are available on the LAN. However, according IETF RFC 6763 [18], the TXT record is intended to be small, i.e. it should be kept below 1 300 bytes to fit into a single Ethernet packet.

Below are two examples of a DVB Gateway TXT record:

- DVB Gateway Model A._dvbservdsc._tcp.local. 86400 IN TXT "txtvers=1;dvbi_sep=http://192.168.1.101:80/SES.com/ServiceLitsEntryPoints.xml"
- Live TV Airport Lounge 2._dvbservdsc._tcp.local. 86400 IN TXT "dvbi_sl=https://www.example.com/dvb-i/sl/Service-List_France_1.xml;tuners=DVB-S2/16;orb_pos_A=-5;orb_pos_B=19.2"

11.2 Professional Edge Cache Receiver Configuration

11.2.1 Control API

A REST Control API for professional Edge Cache Receivers will be provided in a subsequent version of the present document.

Annex A (normative): Transport Stream based Carriage

A.1 Introduction

Receivers deployed with hardware that cannot be upgraded to the use of GSE-Lite according to ETSI TS 102 606-1 [4] may nevertheless support DVB Native IP transmissions with adapted software. In such deployments, the data link layer protocol to be used shall be Multi-Protocol Encapsulation (MPE) as specified in ETSI EN 301 192 [7] and based on data section transport using Transport Stream Packets according to ISO/IEC 13818-1 [15].

A.2 Multi-Protocol Encapsulation (MPE)

Using Multi-Protocol Encapsulation, IP datagrams are encapsulated in datagram_sections that are mapped into Transport Stream packets as defined in MPEG-2 systems ISO/IEC 13818-1 [15]. MPE datagram sections are specified in clause 7 of ETSI EN 301 192 [7]. The LLC-SNAP_flag in table 3 of clause 7 of ETSI EN 301 192 [7] shall be set to "0".

In DVB-NIP, MPE datagram sections are carried as part of a DVB defined Service within a Transport Stream. MPE sections are identified through their table_id in the section header (set to "0x3E") and their stream_type 0x0D in the PMT. A given service shall carry not more than one MPE stream. However within a transport stream multiple services, each carrying an MPE stream may coexist.

Services carrying MPE shall be identified in their TS as specified in ETSI EN 301 192 [7] and ETSI EN 300 468 [14]. At NIP level MPE services shall be described in the SIF table via their service_id, transport_stream_id and network_id.

All NIP Stream related features specified in the present document equally apply between GSE-Lite and MPE Streams with a single exception: IP ROHC according to clause 7.4 shall not be applied when carrying IP datagrams within MPE Streams.

A.3 MPE Signalling

A.3.1 In the Network Information File

Signalling mechanisms described under clause 8 of the present document shall also apply for Streams carried using MPE. In particular the use of MPE for the transport of all or some of the Streams part of DVB-NIP platforms shall be indicated in the Network Information File (NIF) <LinkLayerFormat> element carried as part of the NIP Announcement Channel.

A.3.2 Linkage descriptor in a Transport Stream NIT or BAT

NIP receivers supporting MPE may locate the presence of a NIP platform by following the linkage descriptor specified under this clause. Such linkage descriptor may be provided in the NIT of a TS based network in order to facilitate access to a NIP platform, where the bootstrap streams of a certain provider platform cannot be located through other means. This descriptor shall be carried in the first loop of the NIT or BAT. Several instances of this descriptor may be present on a given network linking to different Operators. If the same descriptor for the same provider_name appears in both the NIT and BAT, the BAT takes precedence.

An MPE based NIP receiver shall follow the provider name linkage for which it was designed or present to the user a choice of available provider names. At the end of the process a NIP compliant MPE based receiver shall tune to the Transport Stream and service_id indicated in the corresponding linkage_descriptor and that carries the Bootstrap Stream information as part of its Announcement Channel (clause 8.1.5).

Table A.3.2-1 defines a User Defined Linkage Descriptor pointing from a NIT or BAT to the Bootstrap Stream of a NIP platform provider_name.

Table A.3.2-1: Syntax for the linkage descriptor of type 0x21

Syntax	No. of bits	Identifier
linkage_descriptor() {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
transport_stream_id	16	uimsbf
original_network_id	16	uimsbf
service_id	16	uimsbf
linkage_type	8	uimsbf
if (linkage_type == 0x21) {		
provider_name_length	8	uimsbf
for (i=0; i<provider_name_length; i++) {		
text_char	8	uimsbf
}		
BootstrapType	1	bslbf
reserved_zero_future_use	7	uimsbf
for (j=0; j<N; j++) {		
private_data_byte	8	uimsbf
}		
}		
}		

Semantics of the private data bytes for linkage type 0x21:

transport_stream_id: This is a 16-bit field which identifies the TS containing the NIP Bootstrap Stream.

original_network_id: This 16-bit field gives the label identifying the network_id of the originating delivery system of the transport stream carrying the NIP Bootstrap Stream.

service_id: This is a 16-bit field which identifies the service containing the NIP Bootstrap Stream.

linkage_type: This is an 8-bit field specifying the type of linkage and shall be set to 0x21.

provider_name_length: This 8-bit field specifies the total length in bytes of the following provider_name.

text_char: This is an 8-bit field. A string "text_char" fields specifies the platform name as described above. Text information is coded using the character sets and methods described in Annex A of ETSI EN 300 468 [14].

BootstrapType: This 1-bit field indicates the scope of the NIF carried by the declared Bootstrap Stream. A value "0" indicates that the NIF describes the complete physical broadcast network from a "Technical Operator". A value "1" indicates that the NIF describes streams from a "Commercial Operator" carrying content for a specific Bouquet, as defined in ETSI EN 300 468 [14].

private_data_byte: This is an 8-bit field, the value of which is privately defined.

A.4 Simultaneous GSE-Lite and MPE operation

Operation with some streams being carried via MPE using DVB-S2 according to clause 7.2.3 and others via GSE-Lite using DVB-S2X according to clause 7.2.2 may be supported as part of some NIP deployments.

Annex B (informative): Sequence Diagram

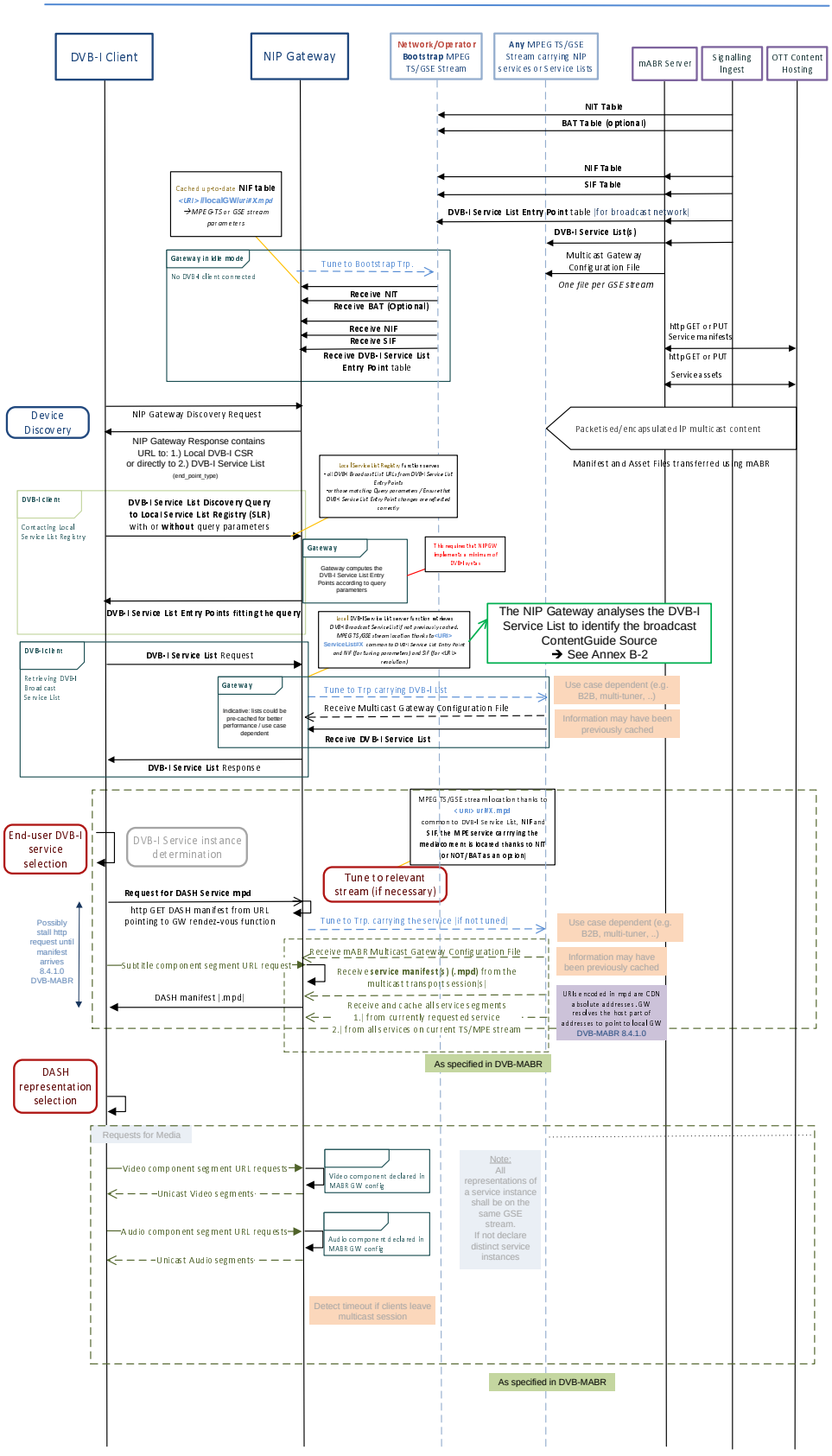


Figure B-1: Installation Sequence Diagram

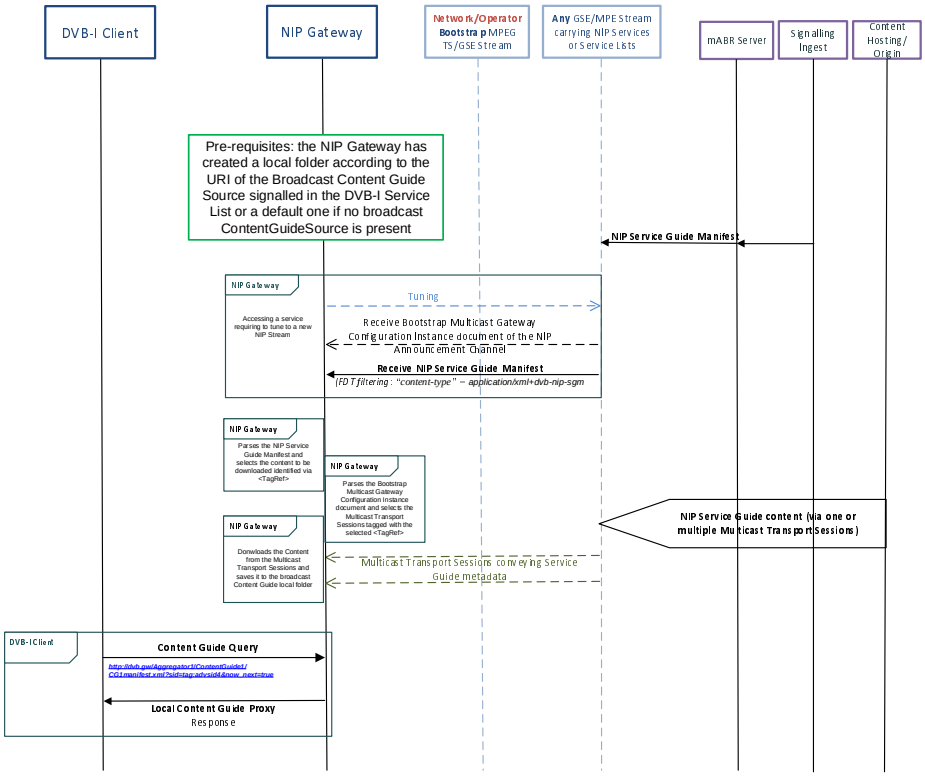


Figure B-2: NIP Service Guide Access Sequence Diagram

Annex C (informative): System Operation and Implementation Guidelines

C.1 Introduction

This clause provides informative recommendations to Operators and Manufacturers in order to help optimize the implementation of end-to-end NIP deployments. In particular this clause provides best practices for broadcasters and for manufacturers developing NIP Gateways designed for horizontal or vertical markets defined as:

- Horizontal Markets describe those NIP deployments which are not linked to any specific Commercial Operator. Such deployments rely on standardized receivers which are distributed through open retail channels and are capable of receiving any compliant broadcast signal.
- Vertical Markets describe deployments in relation to a particular Commercial Operator.

This annex is optional, but if implemented, implementers should comply with the specification given in the following sections.

C.2 Horizontal versus Vertical Market Deployments

A NIP Gateway designed for Horizontal Markets should provide access to any broadcast network, independently of any proprietary features related to any specific Commercial Operator.

Such NIP Gateways will target, as a preference, Bootstrap Streams tagged with BootstrapType value = "Physical Network".

This should not preclude any DVB-I Client connected to such NIP Gateway to access a Commercial Operator or an Aggregator Bootstrap Stream, present on the Broadcast Network, as described hereafter under clause C.4.2.

A NIP Gateway designed for a particular Vertical Market may integrate proprietary features and specific Bootstrap Stream(s) presets.

C.3 Recommendations to Content Originators

As specified in clause 8.3.2, Broadcast Service List Entry Points should reflect Broadcast Service Lists as proposed on the current Broadcast Network.

DVB-I Service Lists carried over the Broadcast Network should be optimized for that network.

As specified in clause 8.3.1, all representations of a given Service and declared in the service MPD are present on the current Broadcast Stream or available via broadband. Therefore, the service manifest should be designed on purpose for the actual broadcast network.

C.4 Recommendations to NIP Gateway manufacturers

C.4.1 Discovery of Bootstrap Streams

NIP Gateways should provide an integrated list of pre-stored Bootstrap Streams - In the case of Horizontal Market Gateways, those are the Bootstrap Streams provided by Technical Network Operators and in the case of Vertical Markets those are the Bootstrap Stream(s) provided by the Commercial Operators or Aggregators.

In the event of obsolete pre-stored settings (see clause 8.1.4.1), there should be a fallback mechanism based on physical scanning of the broadcast network. For each frequency locked, the receiver should attempt to tune to and parse the Announcement Channel for NIF, SIF and DVB-I Service List Entry Points.

- Horizontal Market receivers should target the NIF, SIF and co-located DVB-I Service List Entry Points searching for Bootstrap Streams tagged with BootstrapType value = "Physical Network".
- Gateways designed for Vertical Market Operators identified by their ProviderName should target the NIF, SIF and co-located DVB-I Service List Entry Points searching for Bootstrap Streams tagged with BootstrapType value = "Commercial Operator".

C.4.2 Switching between Provider Bootstrap Streams

A NIP Gateway designed for horizontal markets and installed thanks to the Physical Network Bootstrap Stream, should still be capable of providing access to any Bootstrap Stream of any Commercial Operator or Aggregator, present on the current Broadcast Network, if requested by a DVB-I or a proprietary Client.

While it is possible, as specified in ETSI TS 103 770 [9] for a DVB-I client to query a DVB-I service list for a particular ProviderName, NIP Gateways should also be capable of providing the Private Data Manifest to Private/Proprietary Applications

The NIP Gateway should then parse the SIF/NIF, searching for a Bootstrap Stream declared for that particular ProviderName and subsequently tune to this Bootstrap Stream. The NIP Gateway should download NIF, SIF and DVB-I Service List Entry Points for that Provider. The rest of the process remains identical as nominal one.

Alternatively a private or proprietary Application may use the URI-based re-tuning mechanism described under clause 9.5.4. The condition is that the URI is declared in the SIF document of the Network Operator on whose network the NIP Gateway was installed.

The flexibility described here requires that the Commercial Operator or Aggregator provides up-to-date Bootstrap Stream parameters to the Technical Network Operator.

C.4.3 Caching of Signalling Information

DVB-NIP signalling relies on the download and parsing of multiple files to discover the broadcast network topology. Some of these files are only broadcast on the dedicated bootstrap streams. In order to optimize the end-user experience it is recommended that NIP Gateways cache the following files and perform regular update checks:

- NIF.
- SIF.
- Service List Entry Points.

C.5 Support of MPEG/PES based services

C.5.1 DVB-I Service List signalling

The broadcast DVB-I Service Lists may also include signalling of services provided by a DVB TS-broadcast head-end, by indicating the relevant DVBSDeliveryParameters or DVBTDeliveryParameters elements according to ETSI TS 103 770 [9].

C.5.2 Integrated Native IP TVs (DM2)

Support of MPEG/PES based services is feasible for any Integrated Native IP TV featuring an MPEG demultiplexer and Audio-Video decoder.

C.5.3 Home Gateway + IP Clients (DM3)

Support of MPEG/PES based services is feasible for NIP Gateways implementing DVB-HB Profile B according to DVB document A179 [13].

Annex D:
NIP Content Guide (informative) and NIP Service Guide (normative)

D.1 Overview

D.1.1 Introduction

The present Annex describes mechanisms to implement a Content and Service Guide in the context of NIP based transmissions. The implementation of the NIP Content is an optional feature of NIP. However if a NIP Content and/or Service Guide is provided it should be implemented according to the following specification.

The NIP Content and Service Guide relies essentially on DVB-I (ETSI TS 103 770 [9]) and the syntax defined in DVB-I for the Content Guide

D.1.2 Connected vs Unconnected Use Cases

Whereas the DVB-I Content Guide according to ETSI TS 103 770 [9] is defined primarily for broadband connected clients, which may also exist in NIP deployments, the NIP specification also enables providing Content Guide information to unconnected receivers via the broadcast path.

The NIP Content and Service Guide represents therefore an adaptation of the original DVB-I Content Guide for un-connected broadcast-only receivers.

The NIP Content Guide over Broadcast does syntactically not differ from a DVB-I Content Guide that would be provided as an online service to bi-directionally connected receivers. Standard DVB-I clients may use, in unmodified form, either an online Content Guide or the NIP Content Guide provided via broadcast.

D.1.3 Definitions

The NIP Content and Service Guide specification makes a distinction between the NIP Content Guide and the NIP Service Guide. Such a distinction does not exist in DVB-I.

The NIP Content Guide provides **platform wide schedule event information** that is generally and primarily used for populating an Electronic Program Guide (EPG). The information in the NIP Content Guide can be quite extensive and consist of both event information metadata plus event related information such as images or illustrations. It can be likened to the EIT schedule information provided with Transport Stream based transmissions but in a more advanced manner. The NIP Content Guide is carried on a single NIP Stream where it is broadcast as a series of DVB-I documents. Each document covers a configurable period of time, backward and/or forward and together these documents complete the schedule information available at the NIP receiver and represent the NIP Content Guide.

The NIP Service Guide provides **service-related event information**. It is generally carried at least on the same NIP Stream as the service to which it refers. This does not mean that the information on a given NIP Stream cannot cross-carry also Service Guide Information from services on other NIP Streams if the platform operator decides to do so. The NIP Service Guide can be compared to the EIT p/f and actual/other information available in Transport Stream based systems. The NIP Service Guide is however a lot more flexible than what is available with EIT p/f mechanisms. The NIP Service Guide is often displayed as part of the channel change banner when zapping through TV services. The NIP Service Guide also consists of DVB-I formatted documents. The depth of information in each document is configurable by the broadcaster.

The NIP Content Guide Information and the NIP Service Guide Information are broadcast as a set of separate DVB-I documents, however are merged at the level of the NIP Gateway into a single Content Guide Endpoint to which DVB-I Content Guide Clients connect to interactively retrieve the information that they require.

The structure of the NIP Content Guide and of the NIP Service Guide i.e. all the files necessary to a receiver to recreate the Content Guide Endpoint are listed in so-called Content Guide Manifest and Service Guide Manifest files. These Manifest files are carried in the NIP Announcement Channel on the different NIP Streams and can be identified via their Content-Type URN in the FDT table of each NIP Stream. NIP receivers locate the Content Guide based on the <URI> of the Content Guide Manifest file. The Manifest file should be broadcast on the same NIP stream as the Content Guide metadata itself.

D.1.4 URI Handling for Unconnected Receivers

The NIP Content and Service Guide carried via broadcast is made available to NIP Clients by the NIP Gateway as a unique Content Guide Source endpoint. It can also be consumed directly by IDTV sets integrating NIP natively.

The location of the NIP Content Guide i.e. the URL under which it can be accessed by DVB-I clients on the NIP Gateway should be provided in the DVB-I Service List for the selected NIP broadcast platform under the <ContentGuideSource>, <ScheduleInfoEndpoint>, <URI> element.

The URI for the NIP Content Guide instance provided via broadcast should point to the local NIP Gateway domain: dvb.gw. and therein to the Content Guide Manifest xml file.

EXAMPLE 1: http://dvb.gw/ses.com/cg/Manifest.xml

This URI also represents the NIP Content and Service Guide Endpoint to which all Content and Service Guide requests from DVB-I clients are addressed to.

EXAMPLE 2:
http://dvb.gw/ses.com/cg/Manifest.xml?start=1669028400&end=1669050000&sid=tag:mitxp.com,2021:1.1021.28332

NOTE: DVB-NIP only supports the provisioning of a single Content Guide via broadcast. This restriction is there to guarantee proper memory resource management at the level of the NIP Gateway. The NIP broadcast Content Guide therefore needs to aggregate at the NIP headend the information sourced from different interactive content guides before broadcasting.

The provisioning of a NIP Content Guide via broadcast does not exclude the provisioning of other DVB-I ContentGuideSources available via broadband for connected receivers.

D.2 Technical Requirements and Constraints

D.2.1 NIP Content Guide

This Annex is optional, but if implemented, implementers should comply with the specification as given in the following clauses.

The NIP Content Guide potentially consists of a large volume of metadata that should be broadcast via one or more carousels. The carousel cycle times should make it possible for receivers joining at random times to acquire the information in a reasonable timeframe.

Given the volume of data, the information is best carried on a single NIP stream, reducing the redundancy of information between different NIP streams.

The NIP Content Guide information can be updated, either when the NIP Gateway is not streaming to a NIP Client, or in a timely manner when a NIP Client is consuming a service carried on the same NIP Stream as the NIP Content Guide.

Given the volume of data to be acquired, and the time necessary for doing so, it is preferable for the NIP Content Guide data to be stored in non-volatile memory (NVRAM) of the receiver. This avoids having to acquire the entire information set at each NIP Gateway wake-up or power-up.

The mechanisms proposed for broadcasting the DVB-NIP Content Guide are designed in such a manner as to allow any NIP Gateway to download and store the most relevant content according to its own memory footprint and storage capability.

For instance, a high-end NIP Gateway could store a 28 days deep NIP Content Guide with basic and enriched metadata (e.g. images), while a low-end NIP Gateway could only store a 24 hours deep NIP Content Guide without images.

The depth of the metadata periods is configurable by the broadcaster. This configurable period of time can be backward and forward looking.

The NIP Content Guide aims to either feed a DVB-I proxy server or an EPG/Zapbanner application or both.

D.2.2 NIP Service Guide

The NIP Service Guide is made available on each NIP Stream. It conveys the DVB-I formatted metadata files relative to the services on the actually tuned NIP stream. It may also convey metadata relative to the services from other NIP streams, depending of the functionality of the platform provider.

The depth of metadata period is configurable by the broadcaster.

Consider that the NIP service-related metadata from the NIP Service Guide, as caught in real time while tuned to a NIP stream, is likely to be an updated version of the metadata already previously downloaded and stored from the NIP Content Guide. This means that the Actual Start Time of certain events may diverge from the Published Start Time in the Content Guide. In such instances the NIP Gateway may select to overwrite the Published Start Time of events with the Actual Start Time if both have been received.

D.3 Overall Concepts

D.3.1 Main Concept

The NIP Content and Service Guide is sourced headend-wise from one or more existing DVB-I online Content Guide(s) or alternatively from one or more external content guide solution provider(s).

A Content Guide compiler logic at the headend makes queries to the Content Guide source(s) and forwards and/or formats (according to the source format received) the information into a format suitable for broadcast. Typically, this means generating one or more static DVB-I compliant files for broadcast. Each DVB-I file should be built according to the syntax defined in DVB-I (ETSI TS 103 770 [9]).

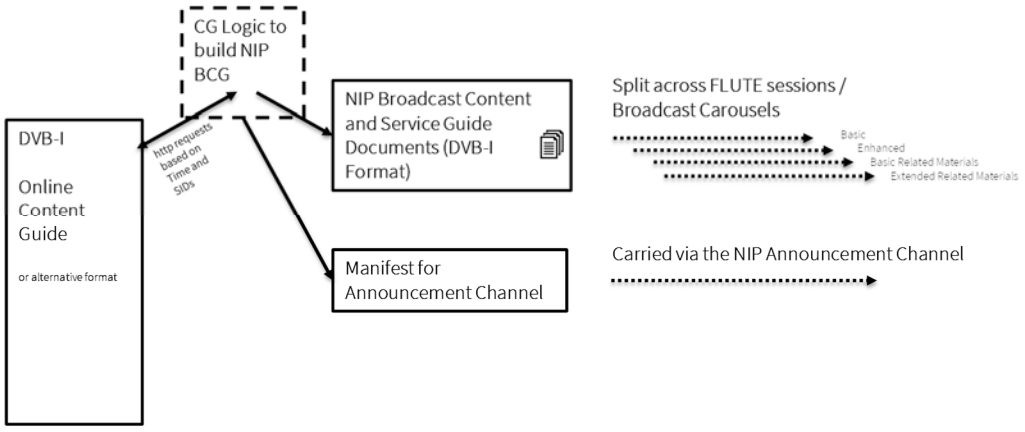


Figure D.3.1-1: Logic for building the NIP Content Guide documents for Broadcast

All DVB-I documents, making up the NIP Content and Service Guide, are broadcast via one or more carousels per NIP Stream. A carousel in this context is defined as one Flute Transport Session (identified by the Flute TSI) - according to the requirements laid out here in clause D.3.

The structure describing the different carousels in use and the way to access the carousels are described in the Manifest document carried on the NIP Announcement Channel (clauses D.5.3 and D.5.4). The sessions themselves with their multicast addresses are described in the multicast gateway configuration instance document.

The options for splitting/segmenting the information to be broadcast are described in clause D.4.

D.3.2 GW access to the NIP Content Guide

NIP Gateways access the NIP Content Guide in the following manner:

- The NIP Content and Service Guide URI should be retrieved from the DVB-I Broadcast Service List.
- Out of the possibly different DVB-I Content Guide sources listed, the NIP Content and Service Guide URI is identified by its domain name dvb.gw.
- The URI points to the Manifest .xml file describing the content guide and signalling its location.
- NIP Gateways access the Content Guide by doing a lookup for the Manifest URI in the SIF and NIF tables to locate the content guide.
- After tuning to the Transponder carrying the Content Guide, NIP Gateways tune to the announcement channel and its FDT.
- In the FDT, NIP Gateways check the Content-type URN associated to the Manifest file in order for it to correspond to the Content Guide Manifest.
- NIP Gateways analyse the Manifest file to understand the structure of the content guide.
- Through tag matching between the Content Guide Manifest and the Multicast Gateway configuration instance document, NIP Gateways can locate the MABR multicast sessions carrying the content guide.
- After joining these sessions NIP Gateways start downloading the different Content Guide documents and populate the NIP Gateway Content Guide database.
- NIP Gateways are now capable of answering via their DVB-I proxy functionality, DVB-I Content Guide requests coming from DVB-I Clients.

D.3.3 GW access to the NIP Service Guide

Gateway access to the NIP Service Guide is generally required when the gateway is tuned to a particular NIP service. It is therefore sufficient for the gateway to listen on that NIP Stream for the announcement channel and retrieve the manifest for the NIP Service Guide (checking the FDT Content-Type). The Manifest for the Service Guide together with the multicast gateway configuration document will point towards one or more FLUTE carousels carrying the data for the service guide.

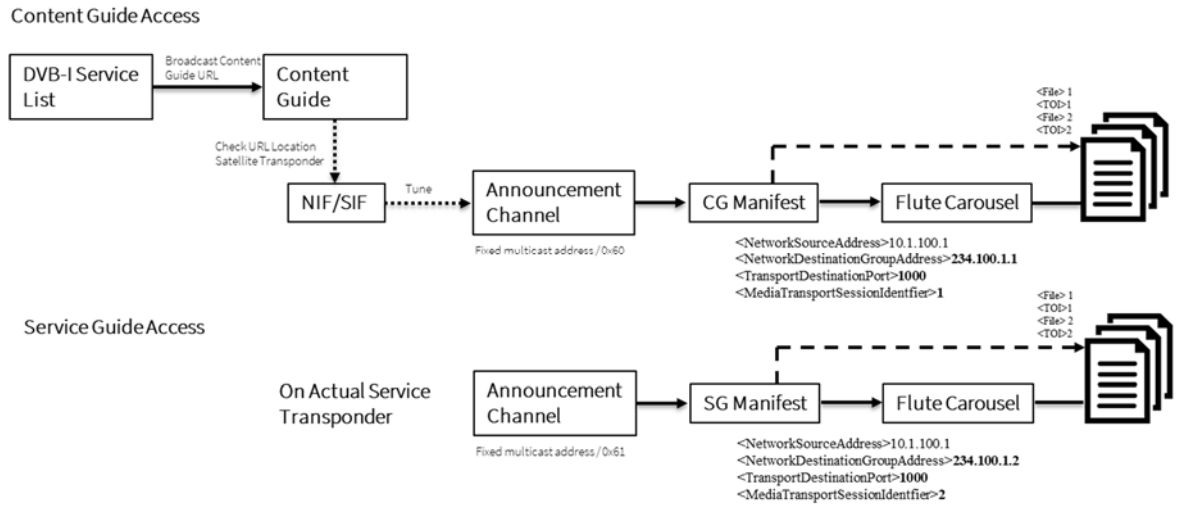


Figure D.3.3-1: GW Access to the NIP Content and Service Guide

D.3.4 Receiver Behaviour

D.3.4.1 DVB-I / NIP Client

The NIP Content and Service Guide implementation at the reception level consists of two logical components:

- An off-the-shelves DVB-I Client, part of the DVB-NIP client described in the present document.
- The DVB-NIP Gateway.

The DVB-I client is fully compliant to the DVB-I specification (ETSI TS 103 770 [9]). The DVB-I Client implements the DVB-I Content Guide functionality. The DVB-I client can interact with a DVB-I content guide available via broadband or the NIP Content and Service Guide provided via broadcast. The DVB-I Client does not make a difference between NIP Content Guide and Service Guide. The client only sees the DVB-I Content guide which contains the aggregated information from the broadcast NIP Content and Service Guide documents.

The DVB-NIP Gateway acts as a proxy server for queries coming from the DVB-I client. Depending on the queries (but also the particular manufacturer implementation), the NIP Gateway has already previously cached the information required to respond to such queries or needs to re-tune to obtain the information required. The DVB-NIP Gateway can answer requests from DVB-I Clients for Service Lists, Content Guide information and requests for AV streams coming from the Media Player component of the DVB-I client.

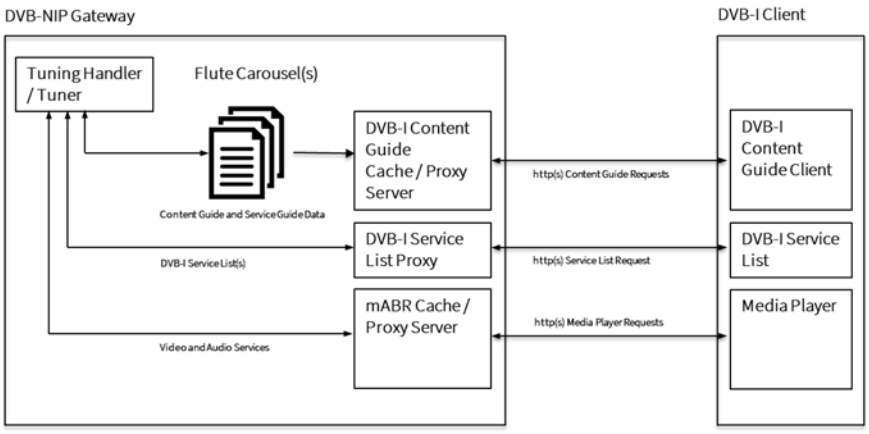


Figure D.3.4.1-1: Client-Gateway Interaction for the NIP Content and Service Guide

D.3.4.2 Embedded EPG and Channel Banner Application

IDTVs receiving NIP transmissions can directly make use of the NIP Content and Service Guide as they would with DVB-SI based schedule data. IDTVs can but may not rely on internal proxy gateways in order to feed the embedded Electronic Programme Guide functionality. The actual implementation will depend on the receiver architecture, e.g. whether it uses an off-the-shelves DVB-I client and whether the IDTV is connected or not to a broadband connection.

D.4 Content Guide Information Segmentation

D.4.1 Introduction

The NIP Content and Service Guide Data, although coming potentially from the same DVB-I Content Guide source, should be segmented/split for broadcast purposes according to the specific requirements related to the broadcast network and the different receiver populations. For this reason, the data is split across several DVB-I documents and broadcast over different transport sessions.

When DVB-I data is prepared for NIP broadcast it can be split across three different segmentation schemes (listed here in no particular order):

- Data Segmentation
- Temporal Segmentation
- Spatial Segmentation

Data Segmentation means that not all DVB-I information elements are provided as part of the same documents. Some documents e.g. those intended for receivers with limited amounts of resources, will only contain CoreSet information. Other documents will provide EnhancedSet Information and still other files will provide images, illustrations or channel logos.

Temporal Segmentation means that rather than having a single document covering the entire Schedule period, multiple documents are provided with data from limited or determined time periods e.g. a particular day of the week.

Spatial Segmentation means that the data to be transmitted will be broadcast using different Flute carousels with different transmission parameters. Some of these carousels will be slower in speed and some faster. Receivers can limit themselves to the reception of those carousels that they can support. The carousels related to the NIP Content Guide will generally be carried on the same NIP Stream, whereas the carousels related to service bound information for the NIP Service Guide will be carried on each NIP Stream carrying the corresponding service(s).

The entire structure of the various documents and carousels made available via broadcast is described in two Manifest documents. One Manifest is related to the NIP Content Guide and the second Manifest is related to the NIP Service Guide (clause D.7). The Manifests are structured such that they first list the Temporal splits operated on the overall data to be transmitted. Within a given time period they describe the type of data together with how and where they are transmitted.

D.4.2 Content and Service Guide Data Segmentation

D.4.2.1 Description

In order to support different receiver types with various hardware capabilities (CPU, RAM, NVRAM,..), the NIP Content and Service Guide information is split according to the data that is carried in the various documents and files.

The data is split across five logical document or material types:

- CoreSet (DVB-I XML doc);
- EnhancedSet (DVB-I XML doc);

- CoreSet Related Material (Images, Logos);
- Enhanced Related Material (Images);
- Recurring Related Material.

The first four may additionally correspond to more than one FLUTE session if sessions are split additionally in time over several different time periods. Recurring Related Material is not split across timed sessions.

D.4.2.2 Data Segmentation

The actual DVB-I elements, carried in documents of the CoreSet or EnhancedSet type are shown below:

Table D.4.2.2-1: DVB-I Elements segmented across BasicSet and EnhancedSet DVB-I Documents for NIP Broadcasting

CoreSet		EnhancedSet	
DVB-I elements		DVB-I elements	
ProgramDescription.ProgramLocationTable .Schedule.ScheduleEvent.Program @crid and ProgramDescription.ProgramInformationTable .ProgramInformation@programId	mandatory	ProgramDescription.ProgramLocationTable .Schedule.ScheduleEvent.Program@crid and ProgramDescription.ProgramInformationTable .ProgramInformation@programId	mandatory
ProgramDescription.ProgramLocationTable .Schedule.ScheduleEvent.PublishedStartTime	Mandatory for NIP Content Guide	ProgramDescription.ProgramInformationTable.BasicDescription.Synopsis (with @length="long") (1 200 chars)	optional
ProgramDescription.ProgramLocationTable .Schedule.ScheduleEvent.PublishedDuration	Mandatory for NIP Content Guide	ProgramDescription.ProgramInformationTable.BasicDescription.Keyword	optional
ProgramDescription.ProgramLocationTable .Schedule.ScheduleEvent.ActualStartTime	Mandatory for NIP Service Guide	ProgramDescription.ProgramInformationTable.BasicDescription.CreditsLists	optional
ProgramDescription.ProgramLocationTable .Schedule.ScheduleEvent.ActualDuration	Mandatory for NIP Service Guide	ProgramDescription.ProgramInformationTable.BasicDescription.EpisodeOf	optional
ProgramDescription.ProgramInformationTable.BasicDescription.Title	mandatory	ProgramDescription.ProgramInformationTable.BasicDescription.RelatedMaterial	optional url of related materials carried into "Assets"
ProgramDescription.ProgramInformationTable.BasicDescription.Synopsis (with @length="short") (90 chars)	optional		
ProgramDescription.ProgramInformationTable.BasicDescription.Synopsis (with @length="medium") (250 chars)	optional		
ProgramDescription.ProgramInformationTable .BasicDescription.Genre	mandatory		
ProgramDescription.ProgramInformationTable .BasicDescription.ParentalGuidance.MinimumAge	Mandatory according to local market regulation		

CoreSet		EnhancedSet	
ProgramDescription.ProgramInformationTable.BasicDescription.RelatedMaterial	optional url of related materials carried into "Assets"		

D.4.2.3 Related Material

Related Material describes non-textual information and is mainly used for providing illustrations/images and logos as part of the NIP Content and Service Guide. Related material is split across three different types:

- **Core Related Materials** (Images, Logos)
  - URI Links from the CoreSet
- **Extended Related Materials** (Images)
  - URI Links from the EnhancedSet.
- **Recurring Related Materials** (Images)
  - URI Links from either the BASIC or ENHANCED stream(s)

The granularity of the split applied to CoreSet and EnhancedSet Documents in their Temporal Segmentation should also be applied to Related Material transmissions. It would not be useful for receivers only interested in the Content Guide data for a particular day to listen to Related Material broadcasts for other days.

D.4.2.4 Data Document Naming and Content-Type

DVB-I documents should be named according to the following convention:

- tva_schedule_starttime_duration_CoreSet.xml
- starttime should represent a UTC date encoded in the following format: %Y%m%d%H%M%S
  - %Y: Year, zero-padded to 4 digits
  - %m: Month (01-12), zero-padded to 2 digits
  - %d: Day (01-31), zero-padded to 2 digits
  - %H: Hour (00-23), zero-padded to 2 digits
  - %M: Minute (00-59), zero-padded to 2 digits
  - %S: Second (00-60), zero-padded to 2 digits
- duration should adhere to the xsd:duration format, as specified in XML Schema 1.0.

EXAMPLE: tva_schedule_20221113000001_PT48H_CoreSet.xml

Files carrying Related Material can be freely named and the above convention does not apply.

NIP Content and Service Guide documents should be broadcast with the following Content-Type:

- application/xml+dvb-nip-cg

D.4.2.5 Data Compression

Payload data compression should be applied to all XML documents of the Type CoreSet and EnhancedSet as specified in clause 8.2.5.3.

Documents of the Type Basic Related Material, Extended Related Material, Recurring Material, all types mainly representing compressed image formats already, **should not be compressed** additionally for broadcast transmission.

D.4.2.6 Image File Formats

The following two image formats are available for image transmission as part of the NIP Content and Service Guide:

- jpg up to a resolution of 1920 x1080
- png up to a resolution of 1920 x1080

Only two aspect ratio formats are supported as part of the present document: 4:3 and 16:9.

Channel logos are recommended to be provided with a transparent alpha channel using png.

D.4.3 Temporal Segmentation

D.4.3.1 Description / Concept

D.4.3.1.1 Overview

Another possibility of segmenting the data to be transmitted is based on time. The various documents making up the NIP Content and Service Guide can describe only limited periods of time of the entire content guide. The sum of these documents allows the NIP receiver gateway to compile the overall Content Guide.

As an example: separate documents can describe various days of the week or some documents may provide the data beyond 7 days or the data of a backward-looking EPG. By organizing the data in this manner, not every receiver needs to read all the data. Receivers can select the data flexibly according to their own constraints and preferences.

D.4.3.1.2 Service Guide

Regarding the Service Guide, a segmentation in time is often applied in order to only provide information about the current plus one or two upcoming events.

D.4.3.1.3 Content Guide

In the Content Guide context, a much more sophisticated segmentation in time will generally be recommended to support different receiver populations. A typical split may be to carry different days of the week in separate documents or to group the information for all the days beyond day 8 in a single file with less information about the events on each day.

The example diagram below shows how the original DVB-I Content Guide is split into separate segments for Days S0 to S7 plus two segments (one listing all backwards events and one listing all days beyond day 8). For each day the data is additionally split according to the data types (Basic, Enhanced, Related Material...) described in the previous clause.

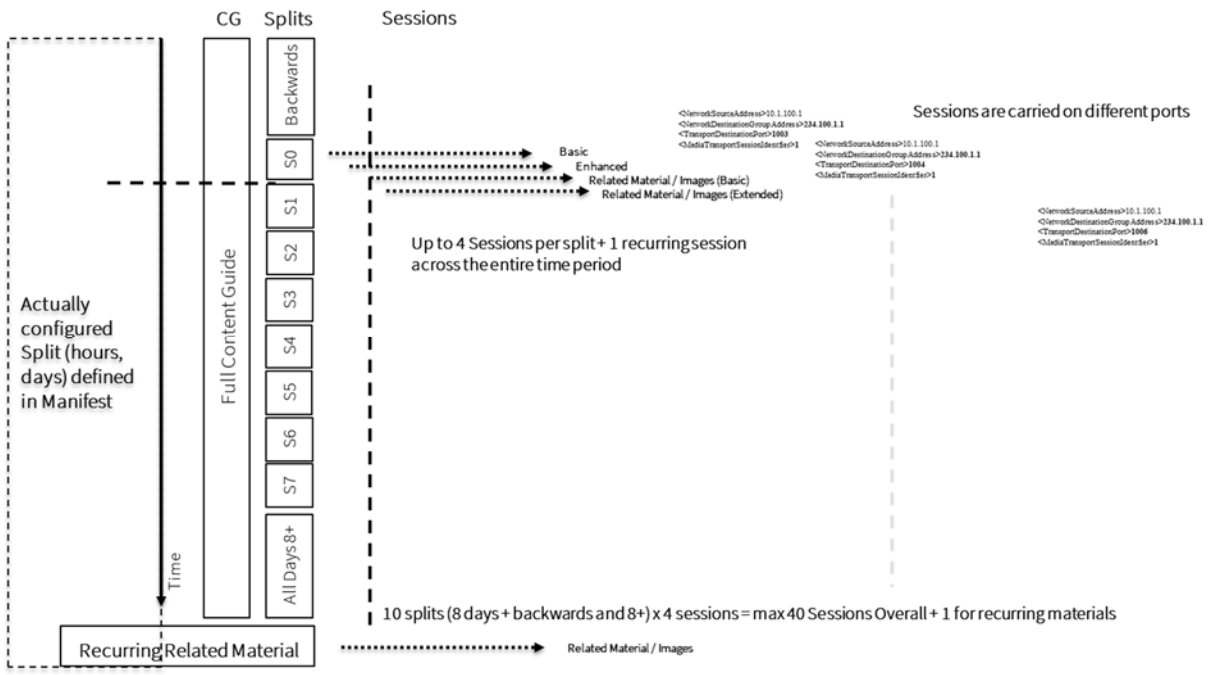


Figure D.4.3.1.3-1: GW Access to the NIP Content and Service Guide

D.4.4 Spatial Segmentation

D.4.4.1 Description

In order to support different receiver types with various hardware capabilities (CPU, RAM, NVRAM...), the NIP Content and Service Guide information can also be split across different Flute Transport Sessions.

This allows receivers to only join those sessions relevant to a particular receiver type. By enabling filtering at the lowest possible network level, helps to save receiver resources as far as possible.

Filtering of carousels at the receiver is enabled at the level of the:

- IP Multicast Destination Address;
- UDP Destination Port; and
- Flute TSI.

All FLUTE carousel sessions in use for broadcasting the content guide data are described in the Manifest document (clause 5) together with the Data Split, Bitrates and Overall Memory Requirements needed to process them. The information should be sufficient for receivers to intelligently select the documents and files they want to retrieve.

D.5 NIP Content and Service Guide Manifests

D.5.1 Signalling

The purpose of the Manifest documents is to inform receivers about the Content and Service guide segmentations and to provide the information necessary to re-build the Content and Service Guide at the receiver.

The manifest documents are conveyed using NIP Announcement Channel. The exact nature of the manifest file can be determined through the Content-Type and Content-Location associated to the Manifest file in the FDT of the Announcement channel.

D.5.2 Manifest Structures

D.5.2.1 Segmentation

The Manifest documents are structured using the following priority:

- Temporal Segmentation
- Data Segmentation
- Spatial Segmentation

D.5.2.2 Multicast Transport Session Identifiers

D.5.2.2.1 ServiceClass

For the NIP Service Guide, the <ServiceClass> as introduced in clause 9 of DVB Bluebook A177r6 (ETSI TS 103 769 [8]) is:

- urn:dvb:metadata:nativeip:ServiceGuide

The spelling should be respected.

For the NIP Content Guide the <ServiceClass> as introduced in clause 9 of DVB Bluebook A177r6 (ETSI TS 103 769 [8]) is:

- urn:dvb:metadata:nativeip:ContentGuide

The spelling should be respected.

D.5.2.2.2 Tags

The <TagRef> links the Manifest declarations to the multicast gateway configuration instance document defined sessions.

D.5.3 NIP Content Guide Manifest

D.5.3.1 Schema Declaration

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
   targetNamespace="urn:dvb:metadata:nativeip:2023" xmlns="urn:dvb:metadata:nativeip:2023"
   elementFormDefault="qualified">

   <xs:element name="NIPContentGuideManifest" type="NIPContentGuideManifestType" />
```

D.5.3.2 NIPContentGuideManifestType

```
<xs:complexType name="NIPContentGuideManifestType">
      <xs:sequence>
         <xs:element name="VersionUpdate" type="xs:dateTime" />
         <xs:element name="GuideSchedule" type="GuideScheduleType" minOccurs="1"
            maxOccurs="unbounded" />
      </xs:sequence>
   </xs:complexType>
```

Table D.5.3.2-1: NIPContentGuideManifestType fields

Name	Semantic Definition	Constraints
VersionUpdate	Date of the last update of the NIP Content Guide Manifest. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ).	Mandatory
GuideSchedule	Structure signalling the metadata content reported in a specific time slot.	Mandatory
GuideSession	This structure signals all parameters inherent to one carousel conveying content guide metadata.	Mandatory

D.5.3.3 GuideScheduleType

```
<xs:complexType name="GuideScheduleType">
      <xs:sequence>
         <xs:element type="xs:dateTime" name="PublishedStartTime" />
         <xs:element type="xs:duration" name="PublishedDuration" />
         <xs:element name="GuideSession" type="GuideSessionType" minOccurs="1"
            maxOccurs="unbounded" />
      </xs:sequence>
   </xs:complexType>
```

Table D.5.3.3-1: GuideScheduleType Fields

Name	Semantic Definition	Constraints
PublishedStartTime	The time at which the programme is advertised as starting which will typically be different from the actual exact start time as specified by DVB-I (ETSI TS 103 770 9).	Mandatory
PublishedDuration	The duration of the programme as displayed to viewers which will typically be different from the actual exact duration as specified by DVB-I (ETSI TS 103 770 9).	Mandatory
GuideSession	This structure signals all parameters inherent to one Multicast Transport Session conveying Content Guide metadata.	Mandatory

D.5.3.4 GuideSessionType

```
<xs:complexType name = "GuideSessionType">
      <xs:sequence>
         <xs:element name="tags" type="xs:anyURI" minOccurs="1" maxOccurs="unbounded"/>
         <xs:element name = "CarouselMaxDataSize" type = "xs: string" />
      </xs:sequence>
   </xs:complexType>
```

Table D.5.3.4-1: GuideSessionType Fields

Name	Semantic Definition	Constraints
TagRef	Reference one tag of the MulticastGatewayConfigurationTransportSession@tags list in the Boostrap Multicast Gateway Configuration Instance Document. These URIs should respect the path of the NIP Content Guide Source endpoint sets in the DVB-I Service List and the name should respect the convention specified in clause D.4.2.4.	Mandatory
CarouselMaxDataSize	Uncompressed data size of the carousel conveying the GuideSession. It will be used by DVB-NIP receivers to filter the GuideSession to be download according to the remaining memory available.	Mandatory

D.5.3.5 Example

The example below shows a Manifest document describing:

- A single two days backwards carousel for high-end receivers only.
- Several carousels describing the next two days.
- Two carousels describing the 6 days following thereafter.

```
<?xml version="1.0" encoding="UTF-8"?>
<NIPContentGuideManifest xmlns="urn:dvb:metadata:nativeip:2023"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="urn:dvb:metadata:nativeip:2023 ../NIPContentGuideManifest.xsd">

    <VersionUpdate>2022-11-15T00:00:00Z</VersionUpdate>
    <GuideSchedule>
        <PublishedStartTime>2022-11-13T00:00:01Z</PublishedStartTime>
        <PublishedDuration>PT48H</PublishedDuration>

        <GuideSession>
            <TagRef>
                http://dvb.gw/OP1/CG/Session1/CoreSet</TagRef>
            <TagRef>
                http://dvb.gw/OP1/CG/Session1/EnhancedSet</TagRef>
            <TagRef>
                http://dvb.gw/OP1/CG/Session1/EnhancedRelatedMaterials</TagRef>
            <CarouselMaxDataSize>146800640</CarouselMaxDataSize>
        </GuideSession>
    </GuideSchedule>

    <GuideSchedule>
        <PublishedStartTime>2022-11-15T00:00:01Z</PublishedStartTime>
        <PublishedDuration>PT48H</PublishedDuration>

        <GuideSession>
            <TagRef>
                http://dvb.gw/OP1/CG/Session2/CoreSet</TagRef>
            <CarouselMaxDataSize>20971520</CarouselMaxDataSize>
        </GuideSession>

        <GuideSession>
            <TagRef>
                http://dvb.gw/OP1/CG/Session3/CoreSetRelatedMaterials</TagRef>
            <CarouselMaxDataSize>20971520</CarouselMaxDataSize>
        </GuideSession>

        <GuideSession>
            <TagRef>
                http://dvb.gw/OP1/CG/Session4/EnhancedSet</TagRef>
            <CarouselMaxDataSize>31457280</CarouselMaxDataSize>
        </GuideSession>

        <GuideSession>
            <TagRef>
                http://dvb.gw/OP1/CG/Session5/EnhancedRelatedMaterials</TagRef>
            <CarouselMaxDataSize>52428800</CarouselMaxDataSize>
        </GuideSession>

        <GuideSession>
            <TagRef>
                http://dvb.gw/OP1/CG/Session6/RecurringRelatedMaterials</TagRef>
            <CarouselMaxDataSize>20971520</CarouselMaxDataSize>
        </GuideSession>
    </GuideSchedule>

    <GuideSchedule>
        <PublishedStartTime>2022-11-17T00:00:01Z</PublishedStartTime>
        <PublishedDuration>P6D</PublishedDuration>

        <GuideSession>
            <TagRef>
                http://dvb.gw/OP1/CG1/Session7/CoreSet</TagRef>
            <TagRef>
                http://dvb.gw/OP1/CG1/Session7/EnhancedSet</TagRef>
```

```
            <TagRef>
                http://dvb.gw/OP1/CG1/Session7/EnhancedRelatedMaterials</TagRef>
            <CarouselMaxDataSize>891289600</CarouselMaxDataSize>
        </GuideSession>

        <GuideSession>
            <TagRef>
                http://dvb.gw/OP1/CG1/Session8/RecurringRelatedMaterials</TagRef>
            <CarouselMaxDataSize>20971520</CarouselMaxDataSize>
        </GuideSession>
    </GuideSchedule>

</NIPContentGuideManifest>
```

Bootstrap Multicast Gateway Configuration Instance Document

```
<?xml version="1.0" encoding="UTF-8"?>
<MulticastGatewayConfiguration xmlns="urn:dvb:metadata:MulticastSessionConfiguration:2023"
xmlns:phase2b="urn:dvb:metadata:ExtendedMulticastSessionConfiguration:2023"
xmlns:nip="urn:dvb:metadata:NativeIPMulticastSessionConfiguration:2023" xmlns:ext="urn:dvb:metadata:Extensibility:2023"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" validityPeriod="P1D">

  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/OP1/CG/Session1/CoreSet http://dvb.gw/OP1/CG/Session1/EnhancedSet
http://dvb.gw/OP1/CG/Session1/EnhancedRelatedMaterials" serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="28000" maximum="28000"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/OP1/CG/Session2/CoreSet" serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/OP1/CG/Session3/CoreSetRelatedMaterials" serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>2</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/OP1/CG/Session4/EnhancedSet" serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
```

```
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>3</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/OP1/CG/Session5/EnhancedRelatedMaterials" serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>4</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/OP1/CG/Session6/RecurringRelatedMaterials" serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>5</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/OP1/CG/Session7/CoreSet http://dvb.gw/OP1/CG/Session7/EnhancedSet
http://dvb.gw/OP1/CG/Session7/EnhancedRelatedMaterials" serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.3</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/OP1/CG/Session8/RecurringRelatedMaterials.xml" serviceClass="urn:dvb:metadata:nativeip:ContentGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.3</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>2</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
```

```
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>
…
```

D.5.4 NIP Service Guide Manifest

D.5.4.1 Schema Declaration

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
   targetNamespace="urn:dvb:metadata:nativeip:2023" xmlns="urn:dvb:metadata:nativeip:2023"
   elementFormDefault="qualified">

   <xs:element name="NIPServiceGuideManifest" type="NIPServiceGuideManifestType" />
…
</xs:schema>
```

D.5.4.2 NIPServiceGuideManifestType

```
<xs:complexType name="NIPServiceGuideManifestType">
      <xs:sequence>
         <xs:element name="VersionUpdate" type="xs:dateTime" />
         <xs:element name="ServiceGuideSchedule" type="ServiceGuideScheduleType" minOccurs="1"
            maxOccurs="unbounded" />
      </xs:sequence>
   </xs:complexType>
```

Table D.5.4.2-1: NIPServiceGuideManisfestType Fields

Name	Semantic Definition	Constraints
VersionUpdate	Date of the last update of the NIP Content Guide Manifest. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ).	Mandatory
ServiceGuideSchedule	Structure signalling the metadata content reported in a specific time slot.	Mandatory

D.5.4.3 ServiceGuideScheduleType

```
<xs:complexType name="ServiceGuideScheduleType">
      <xs:sequence>
         <xs:element type="xs:dateTime" name="ActualStartTime" />
         <xs:element type="xs:duration" name="ActualDuration" />
         <xs:element name="ServiceGuideSession" type="ServiceGuideSessionType" minOccurs="1"
            maxOccurs="unbounded" />
      </xs:sequence>
   </xs:complexType>
```

Table D.5.4.3-1: GuideScheduleType Fields

Name	Semantic Definition	Constraints
ActualStartTime	The actual start time of scheduled event as specified by DVB-I (ETSI TS 103 770 [9]).	Mandatory
ActualDuration	The actual duration of scheduled event as specified by DVB-I (ETSI TS 103 770 [9]).	Mandatory
ServiceGuideSession	This structure signals all parameters inherent to one Multicast Transport Session conveying Content Guide metadata.	Mandatory

D.5.4.4 ServiceGuideSessionType

```
<xs:complexType name="ServiceGuideSessionType">
      <xs:sequence>
         <xs:element name="TagRef" type="xs:anyURI" minOccurs="1" maxOccurs="unbounded" />
         <xs:element name="CarouselMaxDataSize" type="xs:string" />
      </xs:sequence>
   </xs:complexType>
```

Table D.5.4.4-1: GuideSessionType Fields

Name	Semantic Definition	Constraints
TagRef	Reference one tag of the MulticastGatewayConfigurationTransportSession@tags list in the Boostrap Multicast Gateway Configuration Instance Document. These URIs should respect the path of the NIP Content Guide Source endpoint sets in the DVB-I Service List and the name should respect the convention specified in clause D.4.2.4.	Mandatory
CarouselMaxDataSize	Uncompressed data size of the carousel conveying the GuideSession. It will be used by DVB-NIP receivers to filter the GuideSession to be download according to the remaining memory available.	Mandatory

D.5.4.5 Example#1

This example depicts a manifest describing the split of data of the next 3 hours.

The breakdown of Flute carousels helps to provide CoreSet, EnhancedSet, CoreSetRelatedMaterials, EnhancedSetRelatedMaterials for a heterogeneous parc of receivers.

The Coreset and EnhancedSet Flute carousels bitrates are set in order to limit the latency between the decoded service and metadata display.

```
<?xml version="1.0" encoding="UTF-8"?>
<NIPServiceGuideManifest xmlns="urn:dvb:metadata:nativeip:2023"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="urn:dvb:metadata:nativeip:2023 ../NIPServiceGuideManifest-v3.xsd">

    <VersionUpdate>2022-11-12T23:59:00Z</VersionUpdate>
    <ServiceGuideSchedule>
        <ActualStartTime>2022-11-13T00:00:01Z</ActualStartTime>
        <ActualDuration>PT3H</ActualDuration>

        <ServiceGuideSession>
            <TagRef>
                http://dvb.gw/txp10/ServiceGuide/Session1/CoreSet</TagRef>
            <CarouselMaxDataSize>15360</CarouselMaxDataSize>
        </ServiceGuideSession>

        <ServiceGuideSession>
            <TagRef>
                http://dvb.gw/txp10/ServiceGuide/Session2/EnhancedSet</TagRef>
            <CarouselMaxDataSize>512000</CarouselMaxDataSize>
        </ServiceGuideSession>

        <ServiceGuideSession>
            <TagRef>
                http://dvb.gw/txp10/ServiceGuide/Session3/CoreSetRelatedMaterials</TagRef>
            <CarouselMaxDataSize>512000</CarouselMaxDataSize>
        </ServiceGuideSession>
    </ServiceGuideSchedule>

</NIPServiceGuideManifest>
```

Bootstrap Multicast GW Configuration Instance Document

```
<?xml version="1.0" encoding="UTF-8"?>
<MulticastGatewayConfiguration xmlns="urn:dvb:metadata:MulticastSessionConfiguration:2023"
xmlns:phase2b="urn:dvb:metadata:ExtendedMulticastSessionConfiguration:2023"
xmlns:nip="urn:dvb:metadata:NativeIPMulticastSessionConfiguration:2023" xmlns:ext="urn:dvb:metadata:Extensibility:2023"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" validityPeriod="P1D">

  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/txp10/ServiceGuide/Session1/CoreSet" serviceClass="urn:dvb:metadata:nativeip:ServiceGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/txp10/ServiceGuide/Session2/EnhancedSet" serviceClass="urn:dvb:metadata:nativeip:ServiceGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>2</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/txp10/ServiceGuide/Session3/CoreSetRelatedMaterials" serviceClass="urn:dvb:metadata:nativeip:ServiceGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>
```

D.5.4.6 Example#2

This example depicts a manifest describing the split of data of the next 6 hours.

There is only one Flute carousel to provide CoreSet, EnhancedSet and EnhancedRelatedMaterials for a homogenous parc of receivers without major memory footprint limitations.

```
<?xml version="1.0" encoding="UTF-8"?>
<NIPServiceGuideManifest xmlns="urn:dvb:metadata:nativeip:2023"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="urn:dvb:metadata:nativeip:2023 ../NIPServiceGuideManifest-v3.xsd">

    <VersionUpdate>2022-11-12T23:59:00Z</VersionUpdate>
    <ServiceGuideSchedule>
        <ActualStartTime>2022-11-13T00:00:01Z</ActualStartTime>
        <ActualDuration>PT6H</ActualDuration>
```

```
        <ServiceGuideSession>
            <TagRef>
                http://dvb.gw/txp10/ServiceGuide/Session1/CoreSet</TagRef>
            <TagRef>
                http://dvb.gw/txp10/ServiceGuide/Session1/EnhancedSet</TagRef>
            <TagRef>
                http://dvb.gw/txp10/ServiceGuide/Session1/EnhancedSetRelatedMaterials</TagRef>
            <CarouselMaxDataSize>1048576</CarouselMaxDataSize>
        </ServiceGuideSession>
    </ServiceGuideSchedule>

</NIPServiceGuideManifest>
```

Bootstrap Multicast GW Configuration Instance Document

```
<?xml version="1.0" encoding="UTF-8"?>
<MulticastGatewayConfiguration xmlns="urn:dvb:metadata:MulticastSessionConfiguration:2023"
xmlns:phase2b="urn:dvb:metadata:ExtendedMulticastSessionConfiguration:2023"
xmlns:nip="urn:dvb:metadata:NativeIPMulticastSessionConfiguration:2023" xmlns:ext="urn:dvb:metadata:Extensibility:2023"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" validityPeriod="P1D">

<MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/txp10/ServiceGuide/Session1/CoreSet http://dvb.gw/txp10/ServiceGuide/Session1/EnhancedSet
http://dvb.gw/txp10/ServiceGuide/Session1/EnhancedRelatedMaterials" serviceClass="urn:dvb:metadata:nativeip:ServiceGuide">
<TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="28000" maximum="28000"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>
```

D.5.4.7 Example#3

This example depicts a manifest describing the split of CoreSet data for two periods of 3H.

With the propre receiver implementation, this helps to provide in a rapid manner the current and next coming events, while the furthest events will be displayed later.

```
<?xml version="1.0" encoding="UTF-8"?>
<NIPServiceGuideManifest xmlns="urn:dvb:metadata:nativeip:2023"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="urn:dvb:metadata:nativeip:2023 ../NIPServiceGuideManifest-v3.xsd">

    <VersionUpdate>2022-11-12T23:59:00Z</VersionUpdate>
    <ServiceGuideSchedule>
        <ActualStartTime>2022-11-13T00:00:01Z</ActualStartTime>
        <ActualDuration>PT3H</ActualDuration>

        <ServiceGuideSession>
            <TagRef>http://dvb.gw/txp10/ServiceGuide/Session1/CoreSet</TagRef>
            <CarouselMaxDataSize>15360</CarouselMaxDataSize>
        </ServiceGuideSession>
    </ServiceGuideSchedule>

    <ServiceGuideSchedule>
        <ActualStartTime>2022-11-13T03:00:01Z</ActualStartTime>
        <ActualDuration>PT3H</ActualDuration>

        <ServiceGuideSession>
            <TagRef>http://dvb.gw/txp10/ServiceGuide/Session2/CoreSet</TagRef>
            <CarouselMaxDataSize>15360</CarouselMaxDataSize>
        </ServiceGuideSession>
    </ServiceGuideSchedule>
```

```
</NIPServiceGuideManifest>
```

Bootstrap Multicast GW Configuration Instance Document

```
<?xml version="1.0" encoding="UTF-8"?>
<MulticastGatewayConfiguration xmlns="urn:dvb:metadata:MulticastSessionConfiguration:2023"
xmlns:phase2b="urn:dvb:metadata:ExtendedMulticastSessionConfiguration:2023"
xmlns:nip="urn:dvb:metadata:NativeIPMulticastSessionConfiguration:2023" xmlns:ext="urn:dvb:metadata:Extensibility:2023
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" validityPeriod="P1D">

  <MulticastGatewayConfigurationTransportSession <MulticastGatewayConfigurationTransportSession
xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType"
tags="http://dvb.gw/txp10/ServiceGuide/Session1/CoreSet" serviceClass="urn:dvb:metadata:nativeip:ServiceGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType"
tags="http://dvb.gw/txp10/ServiceGuide/Session2/CoreSet" serviceClass="urn:dvb:metadata:nativeip:ServiceGuide">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.1.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>
```

D.6 Receiver Implementation Guideline

D.6.1 NIP Gateway

D.6.1.1 NIP Content Guide

D.6.1.1.1 NIP Content Guide Caching Workflow

In order to guarantee a satisfactory User Experience, NIP Gateways should pre-cache the Content Guide. The process of the NIP Content Guide pre-caching can start once the DVB-I Client has selected a DVB-I Service List.

NOTE 1: The pre-caching operation should consider the End-User experience.

Once identified, the NIP Content Guide information can be updated, either when the NIP Gateway is not streaming to a NIP Client, or in an opportunistic manner when a NIP Client is consuming a service carried on the same NIP Stream as the NIP Content Guide.

The NIP Content Guide caching workflow is as follows:

Step#1: The NIP Gateway creates the DVB-I content guide local repository according to the broadcast NIP Content Guide Source <URI>.

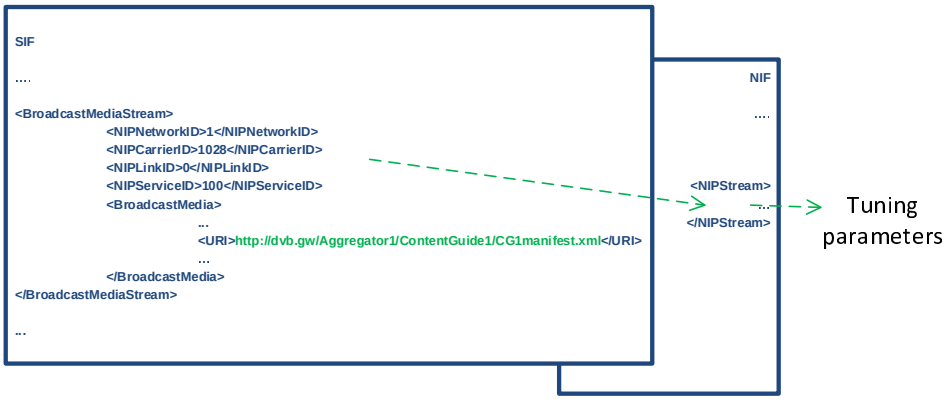
EXAMPLE: DVB-I Service List:

```
Service_List#1
...
<Service>
        ...
        <UniqueIdentifier>tag:advsid4</UniqueIdentifier>
        ...
        <ServiceName>tag:Aggregator1/ServiceID4</ServiceName>
        ...
        <ContentGuideServiceRef>http://dvb.gw/Aggregator1/ContentGuide1/CG1manifest.xml</ContentGuideServiceRef>
        ...
</Service>
...
<ContentGuideSourceList>
        <ContentGuideSource CGSID="cgs-dvbi-01">
                <Name xml:lang="en">ContentGuide1</Name>
                <ProviderName xml:lang="en">Aggregator1</ProviderName>
                <ScheduleInfoEndpoint contentType="application/xml">
                        <URI>http://dvb.gw/Aggregator1/ContentGuide1/CG1manifest.xml</URI>
                </ScheduleInfoEndpoint>
        </ContentGuideSource>
        ...
</ContentGuideSourceList>
...
```

In the example above the broadcast NIP Content Guide local repository is: */Aggregator1/ContentGuide1/*

Even in the case where no Content Guide is being broadcast by the Service List provider, it is still mandatory to declare a Content Guide URI in the DVB-I Service List which can act as a DVB-I endpoint for the NIP Service Guide requests.

Step#2: The NIP Gateway locates and tunes to the NIP stream conveying the NIP Content Guide Manifest and its metadata.



Step#3: Once tuned, the NIP Gateway parses the FDT of the NIP Announcement Channel and searches for:

- "content-type" attribute = NIP Content Guide manifest content type and,
- "content-location"attribute = URI of the NIP Content Guide Manifest

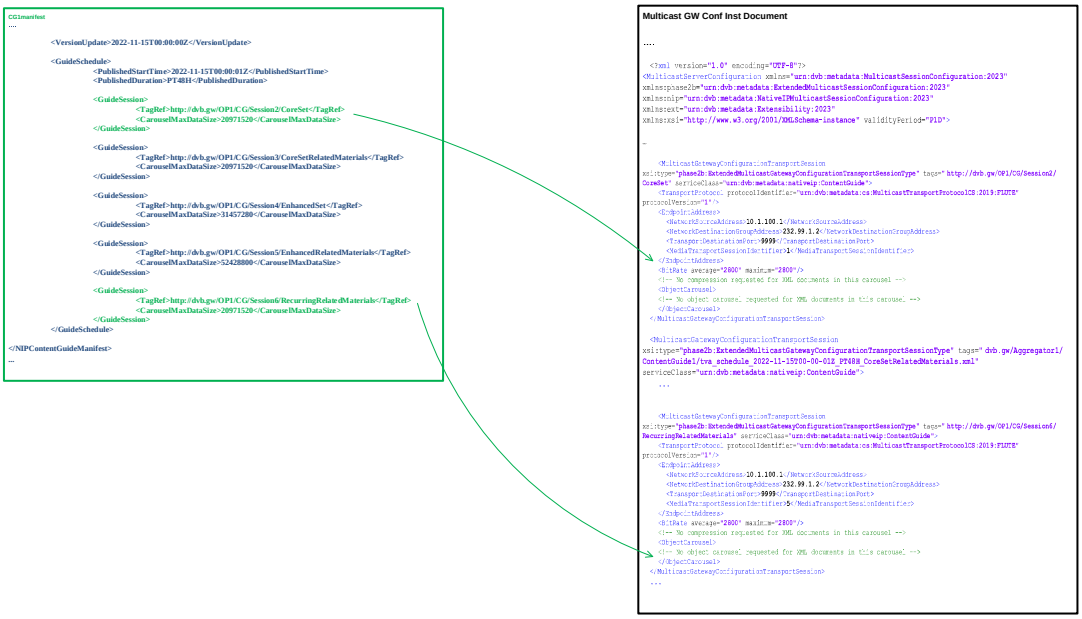
In our example:

- "content-type" = application/xml+dvb-nip-cgm,
- "content-location" = http://dvb.gw/Aggregator1/ContentGuide1/CG1manifest.xml

Step#4: The NIP Gateway downloads and parses the selected NIP Content Guide Manifest

Step#5: Depending on the receiver's memory capabilities, the Application selects and requests to the NIP Gateway, the download of the Multicast Transport Session(s) to be processed.

In the example, the application selects http://dvb.gw/OP1/CG/Session2/CoreSet and http://dvb.gw/OP1/CG/Session6/RecurringRelatedMaterials:



Step#6: The NIP Gateway downloads the selected Multicast Transport Session(s), parses and caches the content into the NIP Content Guide repository.

NOTE 2: The NIP Gateway does not need to check the relevance of the services (ServiceIDRref) described in the metadata content against the services described in the DVB-I Service List.

D.6.1.1.2 NIP Content Guide updates workflow

The NIP Gateway should update the NIP Content Guide content regularly, in order to provide the maximum of metadata depth as possible at any time.

Step#0: it is recommended to update the active DVB-I Service List(s) first and check the NIP Content Guide Manifest URI.

The update involves re-running steps #2 to #4 from clause D.6.1.1.1, followed by a check of the <VersionUpdate> field of the NIP Content Guide Manifest:

- If there is no change, then there is no need to update and the process can stop.
- If there is a change, then steps #5 and #6 from clause D.6.1.1.1 should be repeated.

D.6.1.1.3 Adding a new NIP Content Guide

If a DVB-I Client selects a new DVB-I Service List with a new NIP Content Guide Source, then the update of the NIP Content Guide should be carried out by repeating the procedure from step#1 to step#6 as described in clause D.6.1.1.1.

It is recommended to maintain the previous NIP Content Guide repositories, as long as the receiver hardware can support them.

D.6.1.2 NIP Service Guide

The NIP Service Guide is made available thanks to a unique Service Guide Manifest per NIP Stream.

Step#1: When tuned to a NIP stream, the NIP Gateway parses the FDT of the NIP Announcement Channel and searches for:

- "content-type" attribute = NIP Service Guide Manifest content type

In our example:

- "content-type" = application/xml+dvb-nip-sgm

Step#2: The NIP Gateway downloads and parses the selected NIP Service Guide Manifest.

Step#3: Depending on the receiver memory capabilities, the Application selects and downloads the Multicast Transport Session to be processed.

Step#4

In the example, the application selects http://dvb.gw/txp10/ServiceGuide/Session1/CoreSet:

Step#5: The NIP Gateway downloads the selected Multicast Transport Session(s), parses and caches the content into the NIP Content Guide repository of the current DVB-I Service List, according to the service discovery and program metadata as specified in DVB-I ETSI TS 103 770 [9].

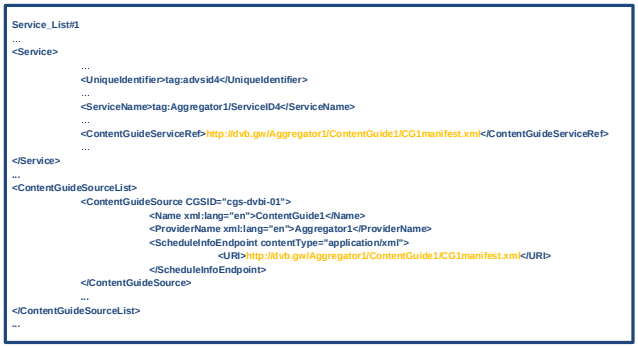
NOTE 1: The <path> of the ServiceGuide metadata URI can be ignored.

NOTE 2: The NIP Gateway does not need to check the relevance of the services (ServiceIDRef) described in the metadata content files against the services described in the DVB-I Service List.

D.6.2 DVB-I Client Content and Service Guide Queries to NIP Gateways

DVB-I Client Content and Service Guide queries to NIP Gateways use the following format:

In the DVB-I Service List Example:



EXAMPLE: The query to get schedule information of ServiceIDREF = "tag:advsid4" for the time slot [2024-01-06T22:25:00Z, 2024-02-03T23:30:00Z] would be: http://dvb.gw/Aggregator1/ContentGuide1/CG1manifest.xml?sid=tag:advsid4&start=1704579900 &end=1707003000

Or the query for getting Service Guide Information would be:

- http://dvb.gw/Aggregator1/ContentGuide1/CG1manifest.xml?sid=tag:advsid4&now_next=true

Annex E (informative): Private Data Signalling

E.1 Overview

This annex specifies a mechanism to signal and broadcast any kind of generic file-based content destined to a dedicated private application running on top of a NIP receiver or to a proprietary Client Application connected to a NIP Gateway.

This annex is optional, but if implemented, implementers should comply with the specification given in the following sections.

This feature comes as a response to the need of Commercial Operators wanting to use their own Service and Content Discovery Application or to push any kind of content, such as VOD files, Targeted Advertisements, Documents, etc. to their own population of receivers.

E.2 Technical Concept

E.2.1 Introduction

DVB-NIP specifies the way to signal and convey private data content to NIP Gateways using broadcast-only methods.

Based on the Generic File Delivery mechanism specified in clause 9.5, the Private Data Signalling solution consists of a dedicated Manifest (.xml document) compliant with the "PrivateDataSignallingManifest.xsd" schema, used to identify the content and the parameters to access the content which is carried on one or more carousels.

The Private Data Signalling Manifest should be downloaded and cached by the DVB-NIP Gateway when parsing the NIP Announcement Channel of a Bootstrap NIP Stream.

This Manifest is made available to the private data solution provider application. It is up to such application to make further queries to the NIP Gateway for the <TagRef> content links (URIs) present in the Private Data Signalling Manifest.

The content which will be downloaded as a result of these requests is made available to the private data provider application.

E.2.2 Manifest and Repository Convention

There should be one Private Data Signalling Manifest per Bootstrap NIP stream, gathering all entry points of all private data solution providers required for the services broadcast on the current physical or commercial network.

The Private Data Signalling Manifest document should be named as follows: NIP-PDS-Manifest.xml

The NIP Gateway should download and cache the Manifest in its root folder and make it available to any private data solution provider Application requesting it.

The naming and path convention should be respected as private data solution provider Applications will rely on it.

The Manifest URI should be described in the SIF, as well as all the URIs, signalled as <TagRef>, in the Manifest itself. If a URI signalled as <TagRef> in not present in the SIF, that means that the linked Multicast Transport Session is broadcast on the same NIP stream as the Manifest.

E.2.3 Private Data Signalling Manifest

E.2.3.1 Structure

The Manifest is structured according to the private data solution provider unique identifier. This should correspond to the Private Data Spec ID registered at DVB Services Sàrl.

E.2.3.2 Multicast Transport Session Identifiers

E.2.3.2.1 @serviceClass

For the Private Data Signalling Manifest, the @serviceClass as introduced in clause 9.5.2.1 should be: urn:dvb:metadata:nativeip:PrivateDataSignalling

E.2.3.2.2 @Tags

The TagRef (URI)s declared in the Private Data Signalling Manifest link to the bootstrap multicast gateway configuration instance document defined sessions.

E.2.4 Private Data Signalling Manifest Schemas

E.2.4.1 Private Data Signalling Manifest Schema Declaration

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="urn:dvb:metadata:nativeip:2023" xmlns="urn:dvb:metadata:nativeip:2023"
  elementFormDefault="qualified">

  <xs:element name="PrivateDataSignallingManifest" type="PrivateDataSignallingManifestType" />
```

E.2.4.2 PrivateDataSignallingManifestType

```
<xs:complexType name="PrivateDataSignallingManifestType">
    <xs:sequence>
      <xs:element name="VersionUpdate" type="xs:dateTime" />
      <xs:element name="PrivateDataProvider" type="PrivateDataProviderType" minOccurs="1"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
```

Table E.2.4.2-1: Private Data SignallingManifestType Fields

Name	Semantic Definition	Constraints
VersionUpdate	Provides the version number of the Private Data Signalling Manifest document. It indicates the date/time of modification of the latest document version. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ)	Mandatory
PrivateDataProvider	Structure inherent to each Private Data solution providers	Mandatory

E.2.4.3 PrivateDataProviderType

```
<xs:complexType name="PrivateDataProviderType">
    <xs:sequence>
      <xs:element name="PrivateDataSession" type="PrivateDataSessionType" minOccurs="0"
        maxOccurs="unbounded" />
    </xs:sequence>
    <xs:attribute name="privateDataProviderID" type="PrivateDataSpecID" use="required" />
  </xs:complexType>

<xs:simpleType name="PrivateDataSpecID">
    <xs:restriction base="xs:hexBinary">
      <xs:length value="4" />
    </xs:restriction>
  </xs:simpleType>
```

Table E.2.4.3-1: PrivateDataProviderType Fields

Name	Semantic Definition	Constraints
PrivateDataSession	This structure signals all parameters inherent to one Multicast Transport Session conveying private data content.	Mandatory
PrivateDataProviderID	This is the unique identifier allocated to each private data application solution provider. In order to ensure the uniqueness of this identifier, it should correspond to the Private_Data_spec_ID registered at DVB Services Sàrl. private_data_spec_id format is 4-bytes coded in hexadecimal as specified in ETSI EN 300 468 [14].	Mandatory

E.2.4.4 PrivateDataSessionType

```
<xs:complexType name="PrivateDataSessionType">
    <xs:sequence>
      <xs:element name="VersionUpdate" type="xs:dateTime" minOccurs="0" />
      <!-- element should start with upper-case -->
      <!-- Tags should be rename to TagRef to clearly indicate that this is a ref to a tag of the
Bootstrap MGC -->
      <xs:element name="TagRef" type="xs:anyURI" minOccurs="1" maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
```

Table E.2.4.4-1: PrivateData Fields

Name	Semantic Definition	Constraints
VersionUpdate	Used to provide the current version of content conveyed by the Multicast Transport Session. UTC datetime formatted in Zulu Time Format (yyyy-mm-ddThh:mm:ssZ).	Optional
TagRef	Reference one tag of the MulticastGatewayConfigurationTransportSession@tags list in the Boostrap Multicast Gateway Configuration Instance Document. Up to the broadcaster and the private data solution provider to ensure that listed URI are explicit enough to be properly interpreted by the application.	Mandatory

E.2.4.5 Private Data Signalling Manifest Example

```
<?xml version="1.0" encoding="UTF-8"?>
<PrivateDataSignallingManifest xmlns="urn:dvb:metadata:nativeip:2023"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="urn:dvb:metadata:nativeip:2023 private_data_signalling_manifest.xsd"
>
   <VersionUpdate>2023-12-28T18:29:11Z</VersionUpdate>
   <PrivateDataProvider privateDataProviderID="00000003">
      <PrivateDataSession>
         <VersionUpdate>2023-12-12T10:00:00Z</VersionUpdate>
         <TagRef>http://dvb.gw/sky.com/pds00000003/newspaper</TagRef>
      </PrivateDataSession>

      <PrivateDataSession>
         <TagRef>http://dvb.gw/sky.com/pds00000003/servicediscovery/basic</TagRef>
         <TagRef>http://dvb.gw/sky.com/pds00000003/servicediscovery/premium</TagRef>
      </PrivateDataSession>
   </PrivateDataProvider>

   <PrivateDataProvider privateDataProviderID="00000025">
      <PrivateDataSession>
         <VersionUpdate>2023-12-28T00:00:00Z</VersionUpdate>
         <TagRef>http://dvb.gw/mtv.eu/pds00000025/ta/txp12</TagRef>
         <TagRef>http://dvb.gw/mtv.eu/pds00000025/ta/txp13</TagRef>
      </PrivateDataSession>
   </PrivateDataProvider>

</PrivateDataSignallingManifest>
```

Bootstrap Multicast GW Configuration Instance Document

```
<?xml version="1.0" encoding="UTF-8"?>
<MulticastGatewayConfiguration xmlns="urn:dvb:metadata:MulticastSessionConfiguration:2023"
xmlns:phase2b="urn:dvb:metadata:ExtendedMulticastSessionConfiguration:2023"
xmlns:nip="urn:dvb:metadata:NativeIPMulticastSessionConfiguration:2023" xmlns:ext="urn:dvb:metadata:Extensibility:2023"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" validityPeriod="P1D">

  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/sky.com/pds00000003/newspaper" serviceClass="urn:dvb:metadata:nativeip:PrivateDataSignalling">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.10.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>


  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType" tags="
http://dvb.gw/sky.com/pds00000003/servicediscovery/basic http://dvb.gw/sky.com/pds00000003/servicediscovery/premium" serviceClass="
urn:dvb:metadata:nativeip:PrivateDataSignalling">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.10.1</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>2</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>
```

```
  <MulticastGatewayConfigurationTransportSession xsi:type="phase2b:ExtendedMulticastGatewayConfigurationTransportSessionType"
tags="http://dvb.gw/mtv.eu/pds00000025/ta/txp12 http://dvb.gw/mtv.eu/pds00000025/ta/txp13" serviceClass="
urn:dvb:metadata:nativeip:PrivateSignalling">
    <TransportProtocol protocolIdentifier="urn:dvb:metadata:cs:MulticastTransportProtocolCS:2019:FLUTE" protocolVersion="1"/>
    <EndpointAddress>
      <NetworkSourceAddress>10.1.100.1</NetworkSourceAddress>
      <NetworkDestinationGroupAddress>232.99.10.2</NetworkDestinationGroupAddress>
      <TransportDestinationPort>9999</TransportDestinationPort>
      <MediaTransportSessionIdentifier>1</MediaTransportSessionIdentifier>
    </EndpointAddress>
    <BitRate average="2800" maximum="2800"/>
    <!-- No compression requested for XML documents in this carousel -->
    <ObjectCarousel>
    <!-- No object carousel requested for XML documents in this carousel -->
    </ObjectCarousel>
  </MulticastGatewayConfigurationTransportSession>
```

E.3 Receiver Implementation Guideline

E.3.1 NIP Gateway

Private data content is signalled on the Bootstrap NIP stream(s) of the Technical or Commercial Operator as specified in clause 8.2.5.1 using the Private Data Signalling Manifest.

Each time the NIP Gateway tunes to the Bootstrap NIP stream, it should detect the presence of a Private Data Signalling Manifest in the NIP Announcement Channel by parsing the FDT and searching for:

- *Content-Type*="application/xml+dvb-nip-pds"

The NIP Gateway should download the *NIP-PDS-Manifest.xml* document and cache it in its root folder.

E.3.2 Private Data Client Application

E.3.2.1 Client Application and NIP Gateway Behaviour

- The private data solution application may send an http request for the Private Data Signalling Manifest to the NIP Gateway any time:

  http://dvb.gw/NIP-PDS-Manifest.xml

- The private data solution Application parses the Manifest and makes an http GET query to the NIP Gateway for the selected <TagRef> (URI).

EXAMPLE 1: http://dvb.gw/sky.com/pds00000003/servicediscovery/basic

- The NIP Gateway locates this URI (via SIF/NIF) and tunes to the NIP Stream carrying it. If the URI is not listed in the SIF, then the Multicast Transport Session is on the same NIP Stream as the Manifest. In case of several <TagRef> signalled in the Manifest, carried on the same Multicast Transport Session, at least one <TagRef> should find a match in the SIF to confirm the NIP Stream location.

- Once tuned, the NIP Gateway downloads and parses the Bootstrap Multicast Gateway Configuration Instance document and searches for the requested Multicast Transport Session:

  @serviceClass = urn:dvb:metadata:nativeip:PrivateDataSignalling

  @tags = URI of the Private Data Assets

  In case of several <TagRef> signalled in the Manifest, carried on the same Multicast Transport Session, at least one <TagRef> should match in the Bootstrap Multicast Gateway Configuration Instance Document to identify the Multicast Transport Session.

EXAMPLE 2: http://dvb.gw/sky.com/pds00000003/servicediscovery/basic

- The NIP Gateway downloads and caches the entire content conveyed by the Multicast Transport Session linked to the queried <TagRef> (URI), using the path of the <Content-Location> field in the FDT.

Example repository folder content:

/sky.com/03/sd/basic/
servicelist.ext
logo.jpg
index.json
/sky.com/pds03/sd/premium/
servicelist.ext
credential.ext
logo.png
index.json

- The NIP Gateway answers the initial http request with a document listing all the URI resources being downloaded from the Multicast Transport Session.

- The private data assets downloaded and cached are made available to the private data solution provider Application. Download times may depend on overall content size.

It is the responsibility of the private data solution provider to inform the network operator about the memory resources that need to be allocated for downloading and caching his assets.

Annex F (informative): Joint DVB-NIP and DVB-HB Operation

F.1 Overview

DVB-NIP Gateways deployed in DVB markets with existing legacy transmissions of DVB Transport-Stream based AV Services may use some of the features and functionalities provided by the DVB Home Broadcast specification [13].

Many of the features and functions defined in DVB-HB can be added to DVB-NIP Gateways enabling these Gateways to provide both legacy TS-based Services as well as IP-based NIP Services to NIP DVB-I and DVB-DASH based Clients.

This Annex specifies a mechanism to signal and broadcast TS-based services in conjunction with NIP IP-based services in a NIP environment. The described mechanism purely applies to hybrid NIP implementations and does not require any changes to the core DVB-HB specification [13].

This Annex is optional, but if implemented, devices supporting this Annex should comply with the specification given in the following sections.

This feature comes as a response to the need of Commercial Operators wanting to introduce NIP services on the back of large existing Transport-Stream based deployments.

F.2 Technical Concept

F.2.1 Mode of Operation

As specified in clause 8.3.3.2 of the present document, DVB Native-IP Broadcast Services are declared in NIP DVB-I Broadcast Service Lists as Service instances according to clause 5.5.4 of ETSI TS 103 770 [9]. NIP Service declarations use the DVB-I declared "DASHDeliveryParametersType" as defined in clause 5.5.18.6 of ETSI TS 103 770 [9]. The URL within the "URIbasedLocation" points towards the manifest file of the service. The URL format is specified in clause 8.2.7.

DVB Legacy TS-based Services, according to this Annex, are also to be declared in DVB-I Service Lists as Service Instances according to clause 5.5.4 of ETSI TS 103 770 [9] and using the DVB-I declared "DASHDeliveryParametersType" as defined in clause 5.5.18.6 of ETSI TS 103 770 [9]. The URL within the "URIbasedLocation" points towards the Manifest file of the Service. The URI format is specified in clause F.2.2.

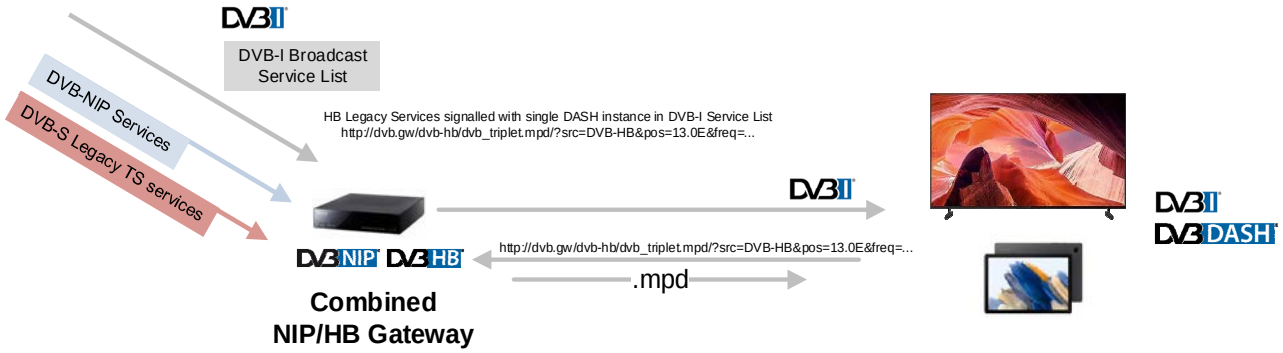


Figure F.2.1-1: Combined use of DVB-HB and DVB-NIP

DVB-NIP Gateways implementing support for Legacy TS-based services through DVB-HB functionality receive the Broadcast NIP DVB-I Service List(s) off-air and make it/them available to DVB-I Clients requesting the list. The only modifications made to the list by NIP Gateways as specified in the present document is the change of the local domain "dvb.gw" in broadcast DVB-I Service Lists to the actual assigned IP Address. Otherwise, the lists are passed on transparently and the Gateway may not further process the list(s).

DVB-I Clients, when receiving the list(s), may select any Service Instance therein and request the corresponding Service Instance from the combined DVB-NIP, DVB-HB Gateway.

The format of the DVB-HB Service Instance request(s) in NIP Broadcast Service Lists is described in clause F.2.2.

The DVB-HB Gateway function in the NIP Gateway should use the parameters in the client's request to:

- tune to the selected physical broadcast channel;
- filter the requested service based on the DVB triplet information in the request;
- re-package or re-encode the TS-based service to DVB DASH as specified in DVB-HB [13];
- generate a corresponding DASH .mpd document as specified in DVB-HB [13];
- respond to the original request by forwarding the mpd to the DVB-I client who made the request.

The DVB-I Client through its built-in client renders the DASH service as it would render any NIP service.

F.2.2 URI Specification for TS-Based Services

The URI Format for TS-based Services in on-air DVB-I Broadcast Service List(s) is as follows:

- http://dvb.gw/operator/«filename».mpd/?[query]

«filename» corresponds to the DVB-HB generated manifest file corresponding to the TS based service converted towards DASH. The file name is built as follows:

- <original_network_id>_<transport_stream_id>_<service_id>.mpd

EXAMPLE: 1_1019_10301.mpd

operator represents the path as defined in clause 8.2.7.

The **[query]** is composed of a series of attribute value pairs separated by the "&" (ampersand) sign. The attribute value pairs are each separated by the "=" (equal) sign:

- <attribute1>=<value1>&<attribute2>=<value2>&<attribute3>=<value3>…

Query attribute value pairs may appear in any order. The parser on the HB server should be sufficiently robust to correctly delineate values and identify the different parameters. Queries with unknown attributes should be ignored by the server.

The list of accepted attributes in the query is defined in the SAT>IP Specification [28], clauses 3.5.10 and 3.5.11 for DVB-S/S2 signals, Appendix C for DVB-T/T2 signals and Appendix D for DVB-C signals, and in the DVB-HB Specification [13], clause 8.2 for DVB-S2X signals, with the following exceptions:

- The first attribute in NIP queries for DVB-HB sourced TS-based services is the "src" element which points towards the DVB-HB function of the NIP Gateway and identifies the http request as relative to a TS-based service: src=DVB-HB.
- The "fe" and "pids" attributes are not used.

Overall Query Examples:

- DVB-S2 query:

  http://dvb.gw/operator/318_601_17702.mpd/?src=DVB-HB&pos=13&freq=11317&pol=v&msys=dvbs2&mtype=8psk&sr=27500&fec=34

- DVB-T2 query:

  http://dvb.gw/operator/270_1010_5321.mpd/?src=DVB-HB&freq=754&bw=8&msys=dvbt&tmode=2k&mtype=64qam&gi=132&fec=23

The NIP Gateway after receiving the DVB-I Service List and when exposing it to the NIP Client will change the URI to: URI = http://ip_address:port/operator/«filename».mpd/?[query]

F.2.3 NIP Content Guide for Combined HB/NIP Operation

The NIP Content Guide in deployments which make use of the functionality of clause F for combined legacy and NIP operation should be handled as specified by NIP.

Annex G (informative): Amendments to existing DVB specifications

The following specifications are amended for the implementation of DVB-NIP:

Specification, Reference and Version	Clause	Amendment
DVB-S2X ETSI EN 302 307-2 [2] V1.3.1 (2021-07)	5.1.7	UPs can be sliced except if ISSY is active.
DVB-GSE Part 1 ETSI TS 102 606-1 [4] V1.2.1 (2014-07)	D.2.2	Removed the following paragraph: "For maximum efficiency and to provide a simple receiver mode where PDU fragmentation is not necessary, it is required that when HEM (High Efficiency Mode) is used on the physical layer, the maximum number of concurrent GSE fragments is 1, which means that PDU fragmentation is not performed on the GSE layer. In this case it is expected that physical layer slicing will be performed as necessary."
DVB-GSE Part 2 ETSI TS 102 606-2 [5] V1.2.1 (2016-12)	5.1 5.2.1 5.2.2.10 5.2.2.15 5.2.2.16 5.2.2.17 A.3 A.4.3 (figure A.8)	Record Structures Descriptor Identification and Location Modified Descriptor: • ROHC-U descriptor Additional Descriptors: • IP multicast list descriptor • IPv6 multicast list descriptor • ROHC-U multicast descriptor Underlying data model Example of multicast transport
DVB-GSE Part 3 ETSI TS 102 606-3 [6] V1.1.1 (2014-07)	4.1.2 4.1.3 4.2 5	ROHC parameters ROHC Rules of Operation Adaptation Module Transport in GSE
DVB-SI ETSI EN 300 468 [14] V1.16.1 (2019-08)	Figure 60 clause 6.2.19	Added linkage_type 0x21 pointing towards a DVB-NIP bootstrap stream.
DVB-MABR (ETSI TS 103 769 [8]) A176r5 (2024-01)	9.5.2.1	@serviceClass @tags

History

Document history		
V1.1.1	September 2024	Publication