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Digital Video Broadcasting (DVB);
Technical Specification for DVB Services
in the Home Network Phase 1

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Contents

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Foreword

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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 Digital Video Broadcasting Project (DVB) is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services. DVB fosters market driven solutions that meet the needs and economic circumstances of broadcast industry stakeholders and consumers. DVB standards 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 to provide global standardization, interoperability and future proof specifications.

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 DVB-HN Phase 1 is limited to the distribution of DVB services (broadband and broadcast) over a home network to and between DVB devices in a single home. This means that DVB broadcast and broadband networks will be terminated at specific DVB Home Network devices connected to the home network that subsequently advertise and transport DVB content over the home network to other DVB Home Network devices.

1 Scope

The present document covers a subset of the use cases from the DVB Home Network commercial requirements (TM3422) and described in ETSI TS 102 905 (V1.1.1) [3]; it is therefore called DVB-HN Phase 1. It supports features like:

- connecting DVB HN devices to the home network allowing them to receive existing DVB services;
- detecting other DVB Home Network devices on the home network;
- detecting capabilities of other DVB Home Network devices on the home network;
- advertising of DVB content to other DVB HN devices on the home network:
  - that is available on the Access Network;
  - that is stored on a DVB Home Network device on the home network;
- streaming DVB content:
  - from the Access Network over the home network to a DVB Home Network device;
  - from a DVB Home Network device over the home network to another DVB Home Network device.

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 http://docbox.etsi.org/Reference.

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

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

[1] ETSI TS 102 034 (V2.1.1): "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks".

[2] ETSI TS 102 539: "Digital Video Broadcasting (DVB); Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)".

[3] ETSI TS 102 905 (V1.1.1): "Digital Video Broadcasting (DVB); Technical Specification for DVB Services in the Home Network Phase 1".

[4] IEEE 802.3™-2015: "IEEE Standard for Ethernet Section 4".

[5] IEEE 802.11™-2012: "Standard for Information Technology- Telecommunications and information exchange between systems- Local and metropolitan area network- Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications".

[6] IEC 62481-1: "Digital living network alliance (DLNA) home networked device interoperability guidelines - Part 1: Architecture and protocols".

[7] IEC 62481-2: "Digital living network alliance (DLNA) home networked device interoperability guidelines - Part 2: DLNA media formats".

[8] IETF RFC 1042: "A Standard for the Transmission of IP Datagrams over IEEE 802 Networks".

[9] IETF RFC 826: "An Ethernet Address Resolution Protocol - or - Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware".

[10] ETSI TS 101 154: "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream".

[11] ETSI TS 102 825-9: "Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB-CPCM); Part 9: CPCM System Adaptation Layers".

[12] IETF RFC 2475: "An Architecture for Differentiated Services".

[13] IETF RFC 4594: "Configuration Guidelines for DiffServ Service Classes".

[14] IEC 29341-1-1:2011: "Information technology - UPnP Device Architecture - Part 1: UPnP Device Architecture Version 1.1".

[15] ETSI TS 102 323: "Digital Video Broadcasting (DVB); Carriage and signalling of TV-Anytime information in DVB Transport Streams".

[16] ETSI TS 102 822-3-2: "Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 2: System aspects in a uni-directional environment".

[17] IETF RFC 4588: "RTP Retransmission Payload Format".

[18] ETSI TS 102 822-3-1: (V1.3.1): "Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 1: Phase 1 - Metadata schemas".

[19] IETF RFC 4861: "Neighbor Discovery for IP Version 6 (IPv6)".

[20] IETF RFC 4193: "Unique Local IPv6 Unicast Addresses".

[21] ConnectionManager:3 Service: "For UPnP Version 1.0", December 2010.

NOTE: Available under http://upnp.org/specs/av/UPnP-av-ConnectionManager-v3-Service.pdf.

[22] ContentDirectory:4 Service: "For UPnP Version 1.0", December 2010.

NOTE: Available at http://upnp.org/specs/av/UPnP-av-ContentDirectory-v4-Service.pdf.

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

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI TS 102 034 [1], ETSI TS 102 539 [2] and the following apply:

Device Class: class defined by a set of Logical Functions

NOTE: A single physical device may support multiple Device Classes. A Device Class may be distributed over several physical devices (DVB-BGD).

Logical Function: function providing a Home Network feature

NOTE: Logical Functions defined are: Streaming Point (SP), Discovery Point (DP) and Rendering Point (RP).

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 102 034 [1], ETSI TS 102 539 [2] and the following apply:

AL-FEC	Application Layer Forward Error Correction
AN	Access Network
BCG	Broadband Content Guide
CDS	Content Download Service
CoD	Content on Demand
CPCM	Content Protection and Copy Management
CRID	Content Reference IDentifier
CRL	Certificate Revocation List
CSV	Comma Separated Values
DLNA	Digital Living Network Alliance
DNG	Delivery Network Gateway
DNS	Domain Name System
DP	Discovery Point
DSCP	Differentiated Services Code Point
DVB-BGD	Digital Video Broadcasting - Bidirectional Gateway Device
DVB-C	Digital Video Broadcasting - Cable
DVB-MR	Digital Video Broadcasting - Media Renderer
DVB-MS	Digital Video Broadcasting - Media Server
DVB-S	Digital Video Broadcasting - Satellite
DVBSTP	DVB SD&S Transport Protocol
DVB-T	Digital Video Broadcasting - Terrestrial
DVB-UGD	Digital Video Broadcasting - Unidirectional Gateway Device
EPG	Electronic Program Guide
ETSI	European Telecommunications Standards Institute
FEC	Forward Error Correction
HN	Home Network
HN-DP	HN-Broadband Discovery Point
HNED	Home Network End Device
HN-RP	HN-Rendering Point
HN-SP	HN-Broadband Streaming Point
HTTP	Hyper Text Transfer Protocol
ID	IDentifier
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPTV	Internet Protocol TV
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standardization

LAN	Local Area Network
LMB	Live Media Broadcast
MAC	Media Access Control
MHP	Multimedia Home Platform
MPEG	Moving Pictures Expert Group
QoS	Quality of Service
RFC	Request For Comments
RP	Rendering Point
RSNA	Robust Security Network Association
RTP	Real-time Transport Protocol
RTSP	Real Time Streaming Protocol
SAC	Secure Authenticate Channel
SD&S	Service Discovery and Selection
SDT	Service Descriptor Table
SI	Service Information
SOAP	Simple Object Access Protocol
SP	Streaming Point
SSRC	Synchronization Source
TS	Transport Stream
TV	TeleVision
TVA	TV-Anytime
UDP	User Datagram Protocol
UI	User Interface
UPnP AV	Universal Plug and Play Audio Video
UPnP CDS	Universal Plug and Play Content Discovery Service
UPnP DDC	Universal Plug and Play Device Discovery and Control
UPnP	Universal Plug and Play
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
VBR	Variable Bit Rate
WPA	WiFi Protected Access
XML	eXtensible Markup Language

4 Use Cases

4.0 General

This clause describes the Use Cases covered by the DVB-HN Phase 1 specification. The Use Cases are a subset taken from ETSI TS 102 905 (V1.1.1) [3].

DVB content is protected content or free to air content.

4.1 Use case 1: Streamed content from the Access Network into the Home Network

A DVB Home Network device receiving DVB content, streamed from the Access Network, forwards this content to another DVB Home Network device on the home network.

Streaming content means that the content is pushed by the source on the Access Network to the forwarding DVB Home Network device as a DVB-stream defined by ETSI TS 101 154 [10]. The DVB-stream can be:

- a live-TV stream part of a live media broadcast (LMB) service;
- a recorded program stored outside the home by a service provider and streamed as part of a Content on Demand (CoD) service.

4.2 Use case 2: Locally stored content

A user uses a DVB Home Network device which enables him to find and play DVB content that is advertised and distributed by another DVB Home Network device.

In this use case the DVB content is stored completely on the DVB Home Network device and no active connection to the Access Network is needed.

5 Home Network Architecture

5.1 Logical model

This clause presents the DVB Home Network model. The DVB-HN model is a logical model that defines logical functions and the IPI-HN interface.

Figure 1 presents the description model that will be used in the present document.

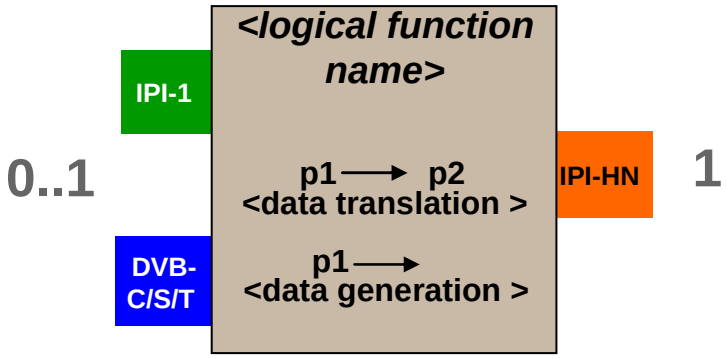


Figure 1: DVB-HN model building block: Logical Function

A logical function either:

- translates content/metadata coming in over the non-IPI_HN interface to content/metadata going out over the IPI-HN interface (use case 1);
- generates content/metadata going out over the IPI-HN interface (use case 2);
- receives content/metadata over the IPI-HN interface (use case 1 or 2).

These are the possible interfaces for DVB-HN logical functions:

- IPI-1: this is the DVB-IPTV interface as specified in ETSI TS 102 034 [1]. This interface provides access to DVB-IPTV services;
- IPI-HN: this interface is used by the DVB-HN function to interact with other DVB-HN functions over the home network. It is fully specified in the present document and is mandatory on any DVB-HN function;
- DVB-C/S/T: is the interface specified for delivering cable/satellite/terrestrial broadcast access network services into the DVB-HN.

A single instance of a logical function shall have one IPI-HN interface and may have at most one Access Network (AN) interface (IPI-1 or DVB-C/S/T). Physical devices with multiple AN interfaces are modelled with multiple logical functions implemented by that physical device.

A logical function shall be implemented as a whole by one physical DVB-HN device.

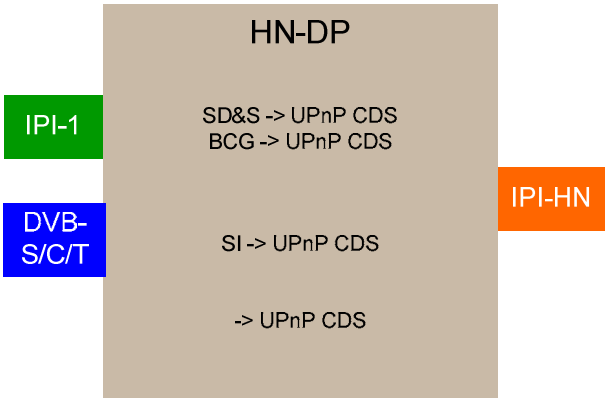
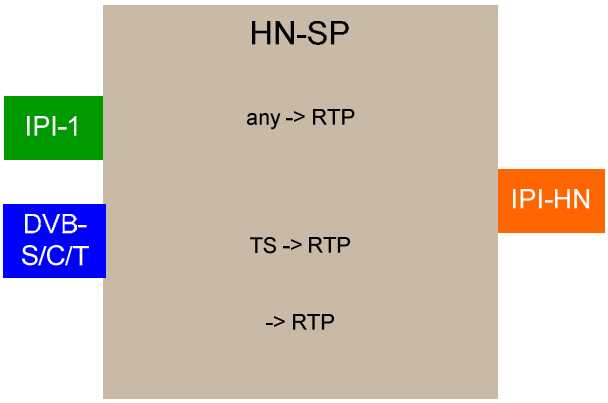
Different instances of logical functions may be implemented by different physical DVB-HN devices and communicate over the IPI-HN interface. This specification defines how logical functions communicate over the IPI-HN interface.

Manufacturers may decide on the combination of logical functions which they implement in their DVB-HN devices.

5.2 Logical functions

Table 1 describes each of the logical functions of the DVB-HN model.

Table 1: DVB Logical functions

DVB-HN Logical Function	Description
HN-DP	 Discovery Point: • Advertises DVB content over IPI-HN interface by translating SD&S and BCG data received via IPI-1 interface from IPI-1 access network into UPnP-CDS. • Advertises DVB content over IPI-HN by translating SI data received from DVB-S/C/T access network into UPnP-CDS. • Advertises in UPnP-CDS any locally stored DVB content over the IPI-HN interface. (See note 1)
HN-SP	 Streaming Point: • Streams the actual DVB content over the IPI-HN interface after it has been selected based on information advertised by the discovery point. A DVB HN SP performs at least one of the following: • It translates or forwards any streams received via the IPI-1 interface as unicast or multicast RTP on the IPI-HN interface. • If streaming content in IPI domain is compatible with HN domain, then content may be forwarded directly to the HN-RP, for example, where the media format is MPEG2-TS and transport protocol is DVB-HN compatible RTP. • If the content is stored locally on the DVB-HN device that implements this logical function it streams this content out over the IPI-HN interface with unicast RTP.

DVB-HN Logical Function	Description
HN-RP	 Rendering Point • Receives and renders and/or stores content received via IPI-HN interface via RTP. • Local playback of stored content on the same physical device is subject to internal device implementation and is out of scope of DVB-HN. (See note 2)
NOTE 1: A DVB HN DP shall perform at least one of these bulleted functions. NOTE 2: The HN-RP may also implement an IPI-1 interface if it wants to be able to render a DVB stream delivered directly from the Access Network However this does not involve the IPI-HN interface and is therefore out of scope of the DVB-HN specification and not reflected in the logical function.	

5.3 Device Classes

In alignment with DLNA, DVB distinguishes different classes of devices. The identified classes specific to DVB-HN are listed in table 2. A physical device may implement one or more Device Classes.

Table 2: DVB-HN Device Classes

Acronym	Name	Definition	Logical functions
DVB-MR	DVB Media Renderer	A Device Class having IPI-HN interface with the role of rendering content it receives from another Home Network devices.	HN-RP.
DVB-MS	DVB Media Server	A Device Class having IPI-HN interface able to expose and serve locally stored DVB content.	HN-SP, HN-DP HN-SP and HN-DP shall be implemented in a single physical device.
DVB-UGD	DVB Unidirectional Gateway Device	A Device Class having IPI-HN and DVB-S/T/C interface(s) able to expose and serve DVB content coming from the broadcast AN.	HN-SP, HN-DP HN-SP and HN-DP shall be implemented in a single physical device.
DVB-BGD	DVB Bidirectional Gateway Device	A Device Class having IPI-HN and IPI-1 interface able to expose and serve DVB content coming from the broadband AN.	HN-SP, HN-DP In the scope of this specification, the network protocol between HN-SP and HN-DP (in the case of distributed implementation) is not defined. This may be part of future versions of this specification. HN-SP and HN-DP shall be implemented in a single physical device for Phase 1 HN. The support of the signalling part of IPI-1 (SD&S) is mandatory for HN-DP and the support of the content delivery part of IPI-1 (RTP) is mandatory for HN-SP.

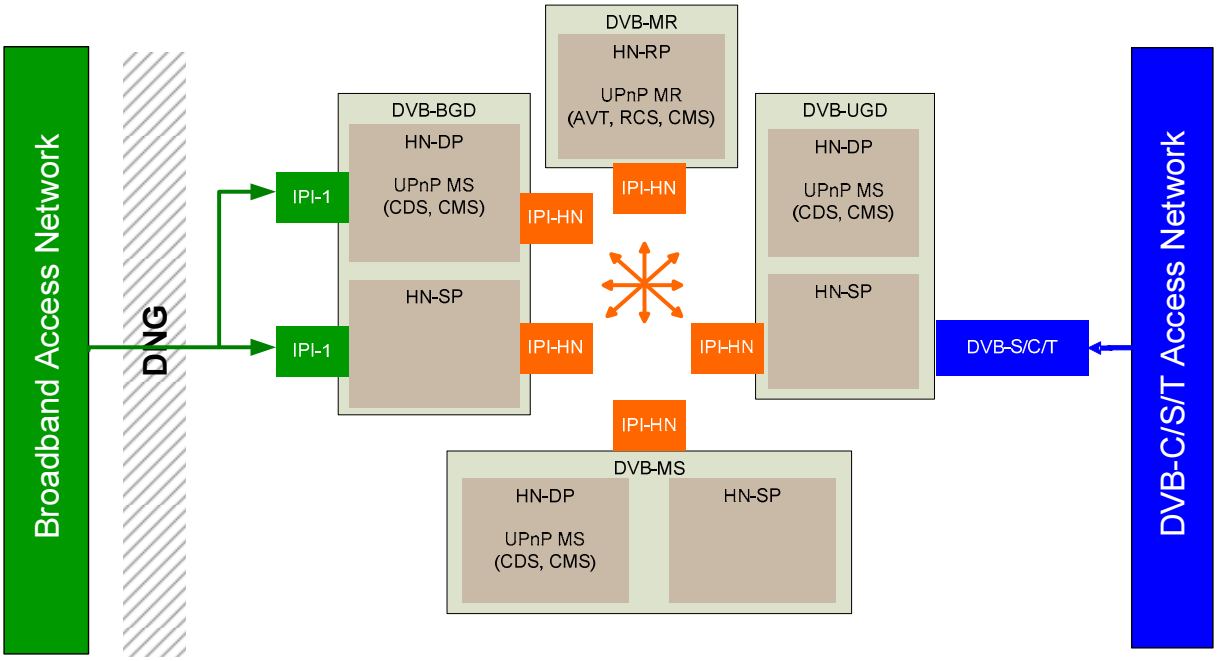
5.4 UPnP mapping

All Device Classes shall support UPnP Device Architecture [14] for discovery, description, control, eventing and presentation as defined in IEC 62481-1 [6]:

- A HN-RP shall support an UPnP AV MediaRenderer as defined in IEC 62481-1 [6] device having an AVTransport service, RenderingControl service and a ConnectionManager service.

- A HN-DP shall support an UPnP AV MediaServer as defined in IEC 62481-1 [6] device that shall include a ContentDirectory service and a ConnectionManager service.

Figure 2 represents the "data and control -plane" of the DVB-HN model that shows all the DVB-HN Device Classes with their Logical Functions and interfaces. The diagram does not show the "management plane" of the DVB-HN, i.e. elements needed to configure and manage the IPI-HN interface such as assigning IP addresses.



NOTE: The Delivery Network Gateway (DNG) is a logical function defined by DVB-IPTV [1] but it is not part of the "data&control-plane" of the DVB-HN Logical Model as it does not interface with any of the Logical Functions of the DVB-HN Logical Model. The DNG plays a role in the "management plane" of the DVB-HN to manage and configure the IP protocol stack of the IPI-1 and IP-HN interfaces.

Figure 2: DVB Home Network Logical Model (data & control plane)

Annex A provides several implementation scenarios with example allocations of DVB-HN logical functions to physical devices.

6 Networking and connectivity

This clause is related to the physical interfaces and MAC layers of the Home Network devices. This includes both wired and wireless standards for device connectivity.

A DVB HN device shall support at least one of the following connectivity methods:

- Ethernet (according to IEEE 802.3™ [4], minimum 100Tx).
- Wireless LAN (according to IEEE 802.11™ [5]).

A DVB HN device with a wireless interface shall support 802.11a, 802.11g or 802.11n [5], it may support any combination of them.

In addition other physical layers may be supported either directly (e.g. HomePlug AV) or by bridging from one of the mandatory network connection types by a DVB HN device.

A DVB HN device may have several physical connections to the Home Network. In that case it shall follow the DLNA Guidelines appendix C [6].

All IP-based traffic shall be carried transparently over the Home Network. For the encapsulation of IP datagrams IETF RFC 1042 [8] shall be used. Depending on the version of the IP protocol in use, for IPv4 the Address Resolution Protocol as defined in IETF RFC 826 [9] shall be used, for IPv6 the Neighbour Discovery Protocol as defined in IETF RFC 4861 [19] shall be used. Each device in a DVB Home Network should be uniquely identified by its MAC address (IEEE sanctioned 48 bit Ethernet address) that has been assigned to one of its network interfaces.

DVB HN devices shall support IPv4, an additional support of IPv6 is recommended. The physical IPI-HN interfaces inside a DVB Home Network are on a single IP subnet.

Each physical interface has at least one distinct IPv4 address; it may also be accompanied by an IPv6 address. Such IP addresses shall be obtained accordingly to DVB-IP [1] or, in case of an address assignment failure by an automated method. For IPv4 a method shall be chosen in accordance with DLNA Guidelines [6]. For Ipv6 the address format intended for local communications shall be used as described in IETF RFC 4193 [20].

A networking technology that uses a shared medium that cannot guarantee that signals cannot be received outside of the household (e.g. wireless) shall provide the option of providing a link layer security. This link layer security should be enabled by default and the device should provide a simple method for the consumer to configure the security settings.

Devices using IEEE 802.11™ [5] should support the security framework described in [5] including at least one of the RSNA algorithms. Devices using IEEE 802.11™ [5] should also implement the Wi-Fi Protected Setup test plan, as defined by the WiFi Alliance.

The link layer security for other shared access media should be comparable or higher in strength to the WiFi Protected Access (WPA) defined by the WiFi Alliance.

7 Supported media formats

7.0 Profiles and formats

HN-RP shall support the DLNA MPEG_TS_SD_EU profile (DLNA Guidelines [7]). HN-RP may also support additional media formats described in ETSI TS 101 154 [10].

HN-SP may send DVB content following any format described in ETSI TS 101 154 [10]. The ability to transcode to a DLNA supported format is not mandatory in the HN-SP.

7.1 Media Format Matching

Media Format matching is an important step in the process of discovering and presenting a content item to the end-user. The server exposes content which is available in a specific format. The rendering device is assumed to be able to render one or more formats, for the components of that content item, for example video, audio, subtitles.

The matching process shall ensure that a content item can be rendered by a rendering device:

- The media format of the content shall be exposed using the tva:AVAttributes XML elements (as defined in ETSI TS 102 822-3-1 [18]) present in the <item> XML structure of the CDS in the DVB defined extensions.
  - Furthermore, if the media format is compliant with a DLNA media format, it shall be exposed in the protocolInfo 4th field under DLNA.ORG_PN parameter, as defined by DLNA.
- The supported media formats of the HN-RP shall be exposed using the RCS::GetCapabilities() action. This new action is defined hereafter.
  - Furthermore, the HN-RP shall expose its DLNA media format capabilities using the protocolInfo 4th field under DLNA.ORG_PN parameter within the response to the CMS::GetProtocolInfo(), as defined by DLNA.

NOTE: If the media format of the components of a content item coming from a DVB source does not comply with any DLNA supported media format, a DVB_SPECIFIC_FORMAT value should be carried in the protocolInfo 4th field under DLNA.ORG_PN parameter.

7.2 Retrieve Supported Media Formats from the HN-RP

A new UPnP action is defined within the Rendering Control Service. It is called RCS::GetCapabilities().

Argument	Direction	relatedStateVariable
HorizontalSize	OUT	Size
VerticalSize	OUT	Size
SupportedMediaFormat	OUT	MediaFormatList

The Size state variable is an integer representing the size HN-RP is able to decode.

The MediaFormatList state variable is a string carrying an XML document following the XML schema:

```
<xs:element name="MediaFormatList">
    <xs:complexType>
        <xs:element name ="deliveryformat" type= dvb:ControlledTermType minoccurs="1"/
       maxOccurs="unbounded">
            <xs:sequence>
                <xs:element name="AudioFormat" type=" tva:ControlledTermType "minOccurs="0"
               maxOccurs="unbounded" maxOccurs="unbounded">/>
                <xs:element name="VideoFormat" type=" tva:ControlledTermType "minOccurs="0"
               maxOccurs="unbounded" maxOccurs="unbounded">/>
            </xs:sequence>
        <xs:element>
    </xs:complexType>
</xs:element>
```

The "deliveryFormat" will contain the termId of the delivery method referenced to classification scheme "DeliveryFormatCS " defined by DVB in annex D of the present document.

8 DVB HN Device Discovery

8.0 General

The method of description of a DVB Device Class in terms of UPnP DDC shall follow the same structure as used by DLNA [6].

8.1 DVB-HN Device Specific Extensions

DVB HN devices shall employ the <dvb:X_DVBDOC> XML element inside the <device> element of the device description document to indicate adherence to a particular DVB TM-IPI Home Network interoperability specification document version (the present document). The value of this element is the DVB Device Class, a dash character, followed by the numeric version value of the specification document.

The <dvb:X_DVBDOC> element indicates DVB compliance for a specific <device>, excluding its embedded devices listed in <deviceList>.

The value of the <dvb:X_DVBDOC> element is a string as defined below. Linear white spaces (LWS) are not implied in this definition below.

```
dvbdoc-value = dvb-dev-class "-" dvb-version
dvb-dev-class = "DVB-HN-MR" | "DVB-HN-MS" | "DVB-HN-BGD" | "DVB-HN-UGD" | other-dev-class
other-dev-class = *<"A" - "Z", "a" - "z", "-">
dvb-version = major-version "." minor-version
major-version = DIGIT
minor-version = DIGIT
```

An example of <dvb:X_DVBDOC> element is shown as follows:

```
<dvb:X_DVBDOC xmlns:dvb="urn:schemas-dvb-org:device-1-0">
     DVB-HN-UGD-1.01
</dvb:X_DVBDOC>
```

8.2 Discovery of CPCM Devices

A serving endpoint or a HN RP that implements DVB CPCM shall implement a DVB CPCM UPnP service and advertise this service in their UPnP device description, as defined by CPCM [11].

9 Content Discovery

9.1 CDS

9.1.0 Introduction

The UPnP Content Discovery Service (CDS) as defined by DLNA [6] shall be used to expose all services that are made available over the HN. The CDS shall follow all the relevant guidelines defined by DLNA [6]. In addition to this, the UPnP CDS should carry the tva:AVAttributes XML elements as defined in ETSI TS 102 822-3-1 [18].

Services may originate either from intra-network servers such as HN servers offering stored content or from access network sources. From the HN side all those servers will offer the CDS information according to DLNA [6] extended as specified in the present document.

For content delivered over an access network the CDS will be populated by the access network delivery gateway device (HN-BGD or HN-UGD). The access network gateway devices shall translate the incoming metadata formats from the DVB-C/S/T or DVB IPTV delivery to CDS which may be exposed or queried within the HN. Clause 13 gives an indication of the functionality required in a DVB-C/S/T access network gateway device.

In this context a "service" may be in the form of a sequence of streamed content items as in a live media stream, with or without the ability to apply trick mode delivery to that content, or as a library of on-demand content items, such as episodes of a series, or an arbitrarily groups set of content items which have been recorded onto a storage device.

The DVB HN content items associated with those services shall be represented as EPGItems exposed within the HN using CDS as profiled by DLNA [6].

Content items within DVB services received from access networks, either directly or via storage (time-shifting), may have several components of the same type, e.g. multiple audio and multiple subtitles for a given video component. Using CDS as profiled by DLNA [6], some or all of the combinations may be exposed as separate protocolinfo entries in the resource elements of separate HN EPGItems meaning that a single content item may be exposed several times, or as a single EPGItem with multiple resource elements, each including its own protocolInfo.

9.1.1 Translation of DVB metadata into UPnP CDS

The present document describes the mapping of the metadata provided over the access networks into CDS format for delivery into the DVB home network. However, in some cases there may not be a direct correspondence for some fields and elements of the incoming metadata in the CDS document structure. In the cases where there is no direct correspondence either the incoming metadata cannot be exposed or there may be omissions in the CDS.

The metadata mapping is compatible with CDS as specified by DLNA [6]. DVB defined translations from the standard DVB metadata formats (SI, SD&S [1], BCG [2], TVA [15] and [16]) and the details of these mappings are given in annexes B and C, which also show the precedence in the case where metadata from multiple sources is available for any CDS element.

9.2 Transport protocol information

There are four media transport methods for DVB-HN the description of which follows the ProtocolInfo concept as described in UPnP ConnectionManager:3 Service [21]. Each method covers both:

- Transport format.
- Session interaction between client and server.

The four methods are:

Media transport method	session protocol	transport format	Server	Client
HTTP	HTTP	HTTP	HTTP server	HTTP client
RTSP-RTP	RTSP	RTP	RTSP server, RTP sender	RTSP client, RTP receiver
Multicast v4	IGMP	RTP, UDP	IGMP proxy/server, RTP or UDP sender	IGMP client, RTP or UDP receiver
Multicast v6	MLD in ICMPv6	RTP, UDP	ICMPv6 proxy/server, RTP or UDP sender	ICMPv6 client, RTP or UDP receiver

If HTTP mode is used, then the DLNA Guidelines [6] shall be followed.

If RTSP-RTP mode is used, then the DVB IPI-1 handbook [1] shall be followed.

If one of the Multicast methods is used then:

- The upnp:res@protocolInfo attribute shall follow the following rules:
  - first field is set to "dvb-igmp" for Multicast v4 mode; first field is set to "dvb-mld" for Multicast v6 mode;
  - second field is set to "*";
  - third field is set to the RTP Payload Type (33 for MPEG2-TS) of the content;
  - the fourth field carries the same definition as described in the fourth field for the other transport modes.
- The URI of the res element follows the RTP locator as defined in ETSI TS 102 539 [2].

9.3 Tuner representation

In the ContentDiscovery service, a tuner shall be described following the DLNA Guidelines [6].

9.4 DVB CPCM

Content protected by DVB CPCM shall follow specific extensions as defined in the CPCM specifications [11].

A serving endpoint may contain a mixture of content that is both protected and unprotected. UPnP CDS fields in each content item description are used to signal if content is protected. If a content item has parts that are unprotected and parts that are protected, the entire content item shall be signalled as protected.

10 DVB content transport

10.0 MPEG-2 TS service delivery

A HN-SP with an IPI-1 interface shall support the reception of a MPEG-2 TS services that comply with clauses 7.1 and 7.2 of ETSI TS 102 034 [1].

On the IPI-HN interface, the HN-SP shall support sending a MPEG-2 TS service to another DVB device attached to the home network using RTP/UDP/IP unicast delivery and may support delivery to multiple devices using RTP/UDP/IP multicast. Therefore a HN-RP shall support the ability to connect to a multicast RTP/UDP/IP service delivered on the HN. Note a HN-SP is not mandated to translate an incoming multicast service into unicast.

Both the HN-RP and HN-SP shall support RTP on the IPI-HN interface for streamed MPEG2 TS services.

The use of direct User Datagram Protocol (UDP) encapsulation format (as defined in clause 7.1.2 of ETSI TS 102 034 [1]) is not a defined format of the IPI-HN interface. The HN-SP may convert this UDP stream to RTP (a defined format of the IPI-HN interface) or use direct UDP streaming, a vendor specific extension.

On the IPI-HN interface, the HN-RP shall support MPEG-2 TS for real time services and comply to clauses 7.1 and 7.2 of ETSI TS 102 034 [1].

The DVB HN devices may also implement HTTP as specified in the DLNA Guidelines [6] as a transport protocol for MPEG-2 TS service delivery in the Home Network.

10.1 RTSP

A HN-SP and HN-RP shall support the RTSP protocol as defined in ETSI TS 102 034 [1].

Although all the necessary information will be contained in the UPnP CDS for a content item, the DESCRIBE method may be implemented to describe the transport for that content item. In that case the DESCRIBE answer should contain the UPnP CDS XML fragment describing the item.

10.2 DVB CPCM

If a serving endpoint provides protected content over HTTP transport and supports random access, it shall signal if it supports random access in the clear text domain by appropriate use of the "cleartextbyteseek-full" and "lop-cleartextbytes" bits of the "DLNA.ORG_FLAGS" parameter (see clauses 7.3.37 and 17.3.1 in DLNA [6]).

In the case of a cleartext byte seek request to a device that does not support the cleartext byte domain, the device shall respond with a HTTP error code 406.

As protection setup operations (e.g. SAC establishment, CRL exchange) may take some time and waiting until an item of content is requested may cause undesirable delays before the presentation of the content, initiation of content protection specific setup operations may be performed while browsing for content or upon invocation of AVT:SetAVTransportURI in order to mitigate these delays.

11 QoS

DVB shall use a QoS mechanism based on differentiated services code point (DSCP) definitions as given in IETF RFC 2475 [12] and IETF RFC 4594 [13] over the IPI-HN network. The values used shall be the same as defined in the DLNA Extended Guidelines [6].

These values are not identical to those specified in ETSI TS 102 034 [1] but there is general compatibility between them for the services which are commonly defined.

12 Reliable HN data transfers

The streaming of DVB content with TS/RTP/UDP between two DVB HN devices may be protected against packet loss by means of RTP retransmission. Duplicate or multicast repair shall not be used.

A HN-DP advertises the RTP retransmission support by means of UPnP CDS. RTP retransmission in DVB HN shall make use of the IETF RFC 4588 [17] Retransmission Packet Format.

The RTP retransmission service may be provided outside the DVB HN when the content is also sourced outside the DVB HN and entering the DVB HN via the HN-SP. The HN-DP advertises by means of UPnP CDS the relevant RTP retransmission related parameters - which can be a subset of the RTP retransmission parameters as defined in DVB RET and advertised on the IPI-1 interface [1]. Original RTP streams that are sourced outside the DVB HN shall not be combined with locally sourced RTP retransmission service.

When a HN-SP streams locally stored content with unicast RTP and the HN-SP provides RTP retransmission support, a SSRC multiplexing scheme shall be used. This means that the original RTP stream and the retransmission stream share the same source and destination transport address. A HN-DP shall advertise its RTP Retransmission capability via UPnP CDS XML metadata and optionally also by means of RTSP describe response, as defined in the DVB IPI-1 handbook [1].

Annex A (informative): Device Implementation Examples

A.0 Naming conventions

This annex presents several possibilities of DVB-HN deployment and actual device implementation. Figure A.1 presents the graphical elements as used in the following clauses.

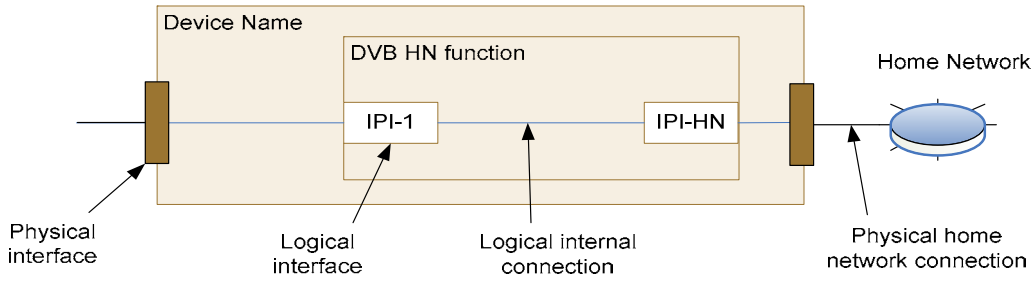


Figure A.1

A.1 DVB-HN broadband gateway device

The routing gateway function (the DNG) is integrated with the DVB-HN "broadband tuner". Thus this DVB-HN Broadband Gateway device provides usual broadband connectivity through the DNG and also DVB-HN connectivity through the IPI-HN interface. Those two interfaces are logical and are used on the same physical network connector.

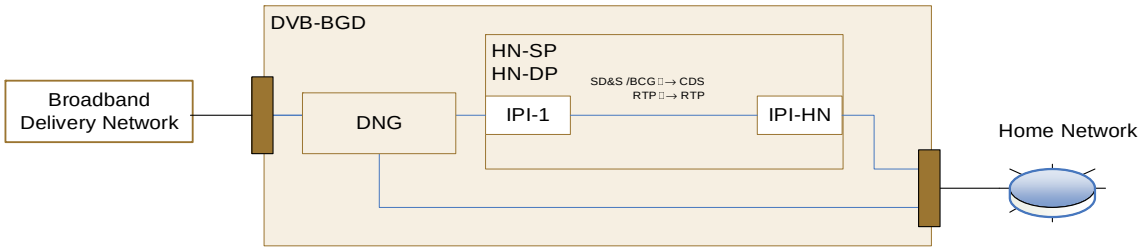


Figure A.2

A.2 DVB-HN hybrid broadcast/broadband tuner device

This device is receiving DVB broadcast services from its broadcast terrestrial interface and DVB IPTV services from its home network interface (using IPI-1 interface).

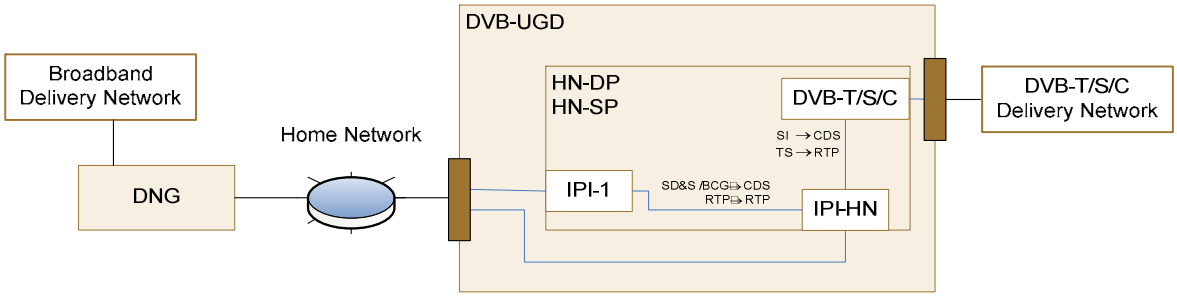


Figure A.3

A.3 DVB-HN/DLNA player device

This device is able to render DVB-HN content coming from DVB-HN servers and also DLNA content coming from DLNA servers.

- DLNA: this is the DLNA interface [6], used by HN devices to interact with other DLNA devices on the home network. This interface is optional for DVB-HN functions.

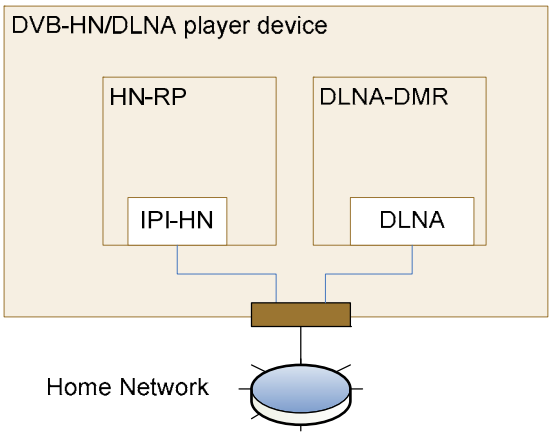


Figure A.4

A.4 DVB-HN broadcast tuner/player

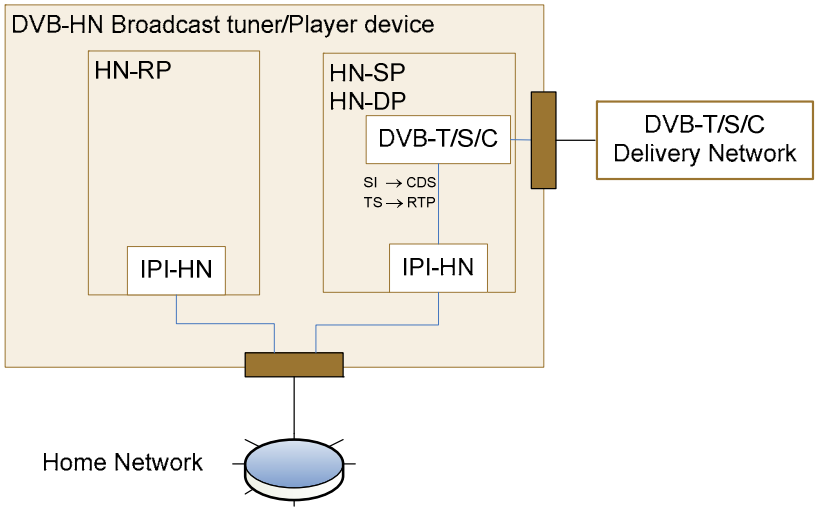


Figure A.5

Annex B (informative): Mapping DVB SI and TV Anytime information into UPnP CDS objects

B.0 General

This annex provides suggested values for populating UPnP CDS elements [21] and attributes by using information from a TV Anytime document or from DVB SI.

For TV Anytime documents, XPath syntax is used to designate the TV Anytime attribute/element that is used as the source of the information. To shorten these XPath strings, a "context node" is specified which needs to be inserted in front of each XPath entry in the tables B.1 to B.4.

For DVB SI, a path like syntax is adopted where each item is separated by a forward slash. The item to the right of the forward slash is contained within the item to the left of the slash. For example "SDT/Service descriptor/service provider name" indicates that the service descriptor is within the SDT and that the service provider name is within the service descriptor. The "&" character is used to indicate the concatenation of multiple items. The "+" character is used to denote the mathematical summation of the items.

Some UPnP elements and attributes can be populated with information from multiple sources within a TV Anytime document. In this situation, multiple XPath definitions are provided. The ordering of these entries is significant and the earlier entries should be used to populate UPnP elements/attributes in preference to later entries.

For some UPnP CDS elements/attributes, a fixed value is specified by providing the value in quotation marks.

In the tables B1 to B.4, the TV Anytime Schema is used with the "tva" namespace prefix, the MPEG-7 Schema is used with the "mpeg7" namespace prefix and the UPnP Schema CDS is used with the "upnp" namespace prefix.

B.1 Context nodes

1) /tva:TVAMain/tva:ProgramDescription/tva:ProgramInformationTable/tva:ProgramInformation

2) /tva:TVAMain/tva:ProgramDescription/tva:GroupInformationTable/tva:GroupInformation[@groupId=upnp: programID]

3) /tva:TVAMain/tva:ProgramDescription/tva:ProgramLocationTable/tva:Schedule/tva:ScheduleEvent[tva : Program@crid=upnp :programID]

4) /tva:TVAMain/tva:ProgramDescription/tva:ProgramLocationTable/tva:BroadcastEvent

5) /tva:TVAMain/tva:ProgramDescription/tva:ServiceInformationTable/tva:ServiceInformation[@serviceId =serviceIDRef]

6) /tva:TVAMain/tva:ProgramDescription/tva:GroupInformationTable/tva:GroupInformation[@groupId=upnp: seriesID]

B.2 epgItem

A UPnP CDS epgItem instance represents a program such as a single radio show, a single TV show or a series of programs.

Table B.1: epgItem:item Properties

Property Name	R/O	Context Node	DVB/TVA mapping	DVB/SI mapping	Remarks
upnp:class	R		"object.item.epgItem.videoProgram" or "object.item.epgItem.audioProgram"		
upnp:channelGroupName	O			BAT/Bouquet name descriptor	
upnp:channelGroupName@id	O			BAT/bouquet_id	
upnp:channelGroupName@languageCode	O			BAT/ Bouquet name descriptor/ISO_639_language_code	
upnp:epgProviderName	O				
upnp:serviceProvider	O	5	tva:Owner/text()	SDT/Service descriptor/service provider name	
upnp:channelName	O	5	tva:Name/text()	SDT/Service descriptor/service name	Contains the user-friendly name of the associated broadcast channel. This is typically used for live or recorded content.
upnp:channelNr	O				contains the number of the associated broadcast channel. This is typically used for live content or recorded content.
upnp:programTitle	O	4 1	tva:InstanceDescription/tva:Title/text() tva:BasicDescription/Title/text()	EIT/ Short event descriptor/event_name	contains the name of the program.
upnp:seriesTitle	O	6	tva:BasicDescription / tva:Title/text()		contains the name of the series.
upnp:programID	O	1 4	@programId @programId	EIT/event_id CIT/crid	
upnp:programID@type	O		"urn:tva:metadata:2004"	"urn:dvb:?"	indicates the type of the ID
upnp:seriesID	O	1 2	tva:MemberOf/text() @groupId		contains the CRID of a series.
upnp:seriesID@type	O	1	"urn:tva:metadata:2004"		indicates the type of the ID
upnp:channelID	O	5	tva:ServiceURL/text()	EIT/service_id & EIT/transport_stream_id & EIT/original_network_id	identifies the channel that was the source.
upnp:channelID@type	O		"SI" or "NETWORK"	"SI"	indicates the type of the ID
upnp:episodeCount	O	2	@numOfItems		contains the total number of episodes in the series
upnp:episodeNumber	O	1	tva:EpisodeOf@index		contains the episode number of this recorded content within the series to which this content belongs.
upnp:programCode	O	1	@programId	EIT/event_id	contains a unique program code to trigger automatic recording

Property Name	R/O	Context Node	DVB/TVA mapping	DVB/SI mapping	Remarks
upnp:programCode@type	O		"urn:tva:metadata:2004"	"urn:dvb:?"	indicates the type of the program guide service that defines the program code specified in the *upnp:programCode* property
upnp:rating	O	1 2	tva:BasicDescription/tva:ParentalGuidance/text() tva:BasicDescription/tva:ParentalGuidance/text()	EIT/Parental rating descriptor/rating	contains the viewer rating value of the content of this item
upnp:rating@type	O		"urn:mpeg:mpeg7:schema:2001"	EIT/Parental rating descriptor/country_code	indicates the rating system used
upnp:episodeType	O	3 3 3 3	tva:Live tva:Repeat tva:FirstShowing tva:LastShowing		indicates the broadcast novelty (for example, "*FIRST-RUN*" or "*REPEAT*") of this content item.
upnp:genre	O	4 1	tva:InstanceDescription/tva:Genre/text() tva:InstanceDescription/tva:Genre/text()	EIT/Content descriptor	
upnp:genre@id	O		ContentCS / termID ContentCommercialCS / termID	"urn:dvb:?"	identifies the genre scheme which defines the set of names used
upnp:genre@extended	O		ContentCS / termName ContentCommercialCS / termName		a CSV list of genre names, which are individually displayable strings, representing increasingly precise (sub)genre names. Example: "Sports,Basketball,NBA"
upnp:artist	O	1	tva :BasicDescription/ tva:CreditsList/tva:CreditsItem/ tva:PersonName r/mpeg7:GivenName/text() & tva :BasicDescription/ tva:CreditsList/tva:CreditsItem/ tva:PersonName r/mpeg7:FamilyName/text()		
upnp:artist@role	O	1 1	tva:BasicDescription / tva:CreditsList / tva:CreditsItem @role tva:BasicDescription/ tva:CreditsList/tva:CreditsItem/ tva:Character/mpeg7:GivenName/text() & tva:BasicDescription/ tva:CreditsList/tva:CreditsItem/ tva:Character/mpeg7:FamilyName/text()		

Property Name	R/O	Context Node	DVB/TVA mapping	DVB/SI mapping	Remarks
upnp:actor	O	1	tva :BasicDescription/ tva:CreditsList/tva:CreditsItem/ tva:PersonName r/mpeg7:GivenName/text() & tva :BasicDescription/ tva:CreditsList/tva:CreditsItem/ tva:PersonName r/mpeg7:FamilyName/text()		
upnp:actor@role	O	1 1	tva:BasicDescription / tva:CreditsList / tva:CreditsItem @role tva:BasicDescription/ tva:CreditsList/tva:CreditsItem/ tva:Character/mpeg7:GivenName/text() & tva:BasicDescription/ tva:CreditsList/tva:CreditsItem/ tva:Character/mpeg7:FamilyName/text()		
upnp:author	O	1	tva:BasicDescription/ tva:CreditsList/tva:CreditsItem [@role="urn:mpeg:mpeg7:cs:RoleCS:2001:AUTHOR"]/tva:PersonName r/mpeg7:GivenName/text() & tva:BasicDescription/ tva:CreditsList/tva:CreditsItem [@role="urn:mpeg:mpeg7:cs:RoleCS:2001:AUTHOR"]/tva:PersonName r/mpeg7:FamilyName/text()		
upnp:author@role	O		tva:BasicDescription/ tva:CreditsList/tva:CreditsItem/@role[@role="urn:mpeg:mpeg7:cs:RoleCS:2001:AUTHOR"]		
upnp:producer	O	1	tva:BasicDescription/ tva:CreditsList/tva:CreditsItem [@role="urn:mpeg:mpeg7:cs:RoleCS:2001:PRODUCER"]/tva:PersonName r/mpeg7:GivenName/text() & tva:BasicDescription/ tva:CreditsList/tva:CreditsItem [@role="urn:mpeg:mpeg7:cs:RoleCS:2001:PRODUCER"]/tva:PersonName r/mpeg7:FamilyName/text()		

Property Name	R/O	Context Node	DVB/TVA mapping	DVB/SI mapping	Remarks
upnp:director	O	1	tva:BasicDescription/ tva:CreditsList/tva:CreditsItem [@role="urn:mpeg:mpeg7:cs:RoleCS:2001:DIRECTOR"]/tva:PersonName r/mpeg7:GivenName/text() & tva:BasicDescription/ tva:CreditsList/tva:CreditsItem [@role="urn:mpeg:mpeg7:cs:RoleCS:2001:DIRECTOR"]/tva:PersonName r/mpeg7:FamilyName/text()		
dc:publisher	O	1	tva:BasicDescription/ tva:CreditsList/tva:CreditsItem [@role="urn:mpeg:mpeg7:cs:RoleCS:2001:PUBLISHER"]/tva:PersonName r/mpeg7:GivenName/text() & tva:BasicDescription/ tva:CreditsList/tva:CreditsItem [@role="urn:mpeg:mpeg7:cs:RoleCS:2001:PUBLISHER"]/tva:PersonName r/mpeg7:FamilyName/text()		
dc:contributor	O				
upnp:callSign	O	5	tva:Name/text()		Contains the broadcast station call sign of the associated broadcast channel. This is typically used for live content or recorded content. Example: "KGW".
upnp:networkAffiliation	O	5	tva:ParentService/text()		Contains the name of the broadcast network or distribution network associated with this content. This is typically used for live content or recorded content. Examples: "NBC", "CBS", "BBC".
upnp:serviceProvider	O	5	tva:Owner/text()	SDT/Service descriptor/service provider name	
upnp:price	O		ProgramInformation / BasicContentDescription / PurchaseItem / Price Schedule / ScheduleEvent / ProgramLocation / InstanceMetadata / PurchaseList / PurchaseItem / Price		Contains the price for a broadcast, series, program, movie, etc.
upnp:price@currency	O		ProgramInformation / BasicContentDescription / PurchaseItem / Price @Currency		Indicates the unit of currency used
upnp:payPerView	O				
upnp:epgProviderName	O		metadataOriginIdRef		Indicates the name of the Electronic Program Guide service provider

Property Name	R/O	Context Node	DVB/TVA mapping	DVB/SI mapping	Remarks
dc:description	O	4 1	tva:BasicDescription/tva:Synopsis/text() tva:BasicDescription/tva:Synopsis/text()	EIT/Short event descriptor/text	contains a brief description of the content item.
upnp:longDescription	O	4 1	tva:BasicDescription/tva:Synopsis[@length="long"]/text() tva:BasicDescription/tva:Synopsis[@length="long"]/text()		contains a few lines of description of the content item
upnp:icon	O	5 1	tva:Logo tva:BasicDescription/ RelatedMaterial / PromotionalMedia / TitleImage		contains a URI to some icon that a control point can use in its UI to display the content, for example, a CNN logo for a Tuner channel
upnp:region	O				contains some identification of the region, associated with the source of the object, for example, "US", "Latin America", "Seattle".
dc:language	O	1	tva:BasicDescription / Language	EIT/ Short event descriptor/ISO_639_language_code	property indicates one of the languages used in the content as defined by IETF RFC 3066 [i.1], for example, "en-US"
dc:relation	O	3 1 1 1 1	tva:MemberOf/@crid tva:BasicDescription/tva:RelatedMaterial/tva:HowRelated/@crid tva:DerivedFrom/@crid tva:EpisodeOf/@crid tva:MemberOf/@crid ProgramInformation / PartOfAggregatedProgram ProgramInformation / AggregationOf		defines a relation between two or more resources
upnp:scheduledStartTime	O	4	tva:PublishedStartTime/text()	EIT/start_time	to indicate the start time of a scheduled program, intended for use by tuners.
upnp:scheduledEndTime	O	4 4	tva:PublishedStartTime/text()+tva:PublishedDuration/text() tva:PublishedEndTime/text()	EIT/start_time + EIT/dutation	used to indicate the end time of a scheduled program, intended for use by tuners.
upnp:recordable	O				
upnp:runningStatus	O			SDT/running_status	
res@duration	O	4	tva:PublishedDuration/text()	EIT/duration	

A UPnP CDS audioProgram instance identifies a single instance of a broadcast audio program such as a radio show or a series of programs. This class is derived from the **epgItem** class and inherits the properties defined by that class. Additionally, the following OPTIONAL properties are RECOMMENDED for this class.

Table B.2: audioProgram:epgItem Properties

Property Name	R/O	Context Node	DVB-TVA mapping	DVB-SI mapping	Remarks
upnp:radioCallSign	O	5	tva:Name/text()	SDT/Service descriptor/service name	
upnp:radioStationID	O	5	@serviceId	SDT/service_id	
upnp:radioBand	O			EIT/? delivery system descriptor/frequency	contains the radio station frequency band (e.g. AM, FM)

A UPnP *videoProgram* instance is a video program such as a single TV show or a series of programs. This class is derived from the *epgItem* class and inherits the properties defined by that class. Additionally, the following OPTIONAL properties are RECOMMENDED for this class.

Table B.3: videoProgram:epgItem Properties

Property Name	R/O	Context Node	DVB TVA mapping	Remarks
upnp:price	O		ProgramInformation / BasicContentDescription / PurchaseItem / Price Schedule / ScheduleEvent / ProgramLocation / InstanceMetadata / PurchaseList / PurchaseItem / Price	
upnp:price@currency	O		ProgramInformation / BasicContentDescription / PurchaseItem / Price @Currency	
upnp:payPerView	O			indicates whether the object represents pay-per-view content.

B.3 TV Anytime Groups

A TV Anytime group (elements of type "tva:GroupInformationType") can be mapped to UPnP CDS EPG container objects.

Table B.4: epgContainer:container Properties

Property Name	R/O	Context Node	DVB TVA mapping	Remarks
upnp:class		R	"epgContainer:container", "object.container.channelGroup", "object.container.channelGroup.audioChannelGroup" or "object.container.channelGroup.videoChannelGroup"	
upnp:channelGroupName	5	O	tva:Name/text()	
upnp:channelGroupName@id	5	O	@serviceId	
upnp:epgProviderName		O	metadataOriginIdRef	
upnp:serviceProvider	5	O	tva:Owner/text()	
upnp:channelName	5	O	tva:Name/text()	
upnp:channelNr		O		contains the number of the associated broadcast channel. This is typically used for live content or recorded content.
upnp:channelID	5	O	@serviceId	
upnp:channelID@type		O	"TVAIDRef"	
upnp:radioCallSign	5	O	tva:Name/text()	
upnp:radioStationID	5	O	@serviceId	
upnp:radioBand		O		
upnp:callSign	5	O		contains the broadcast station call sign of the associated broadcast channel. This is typically used for live content or recorded content. Example: "KGW".
upnp:networkAffiliation	5	O		contains the name of the broadcast network or distribution network associated with this content. This is typically used for live content or recorded content. Examples: "NBC", "CBS", "BBC".
upnp:seriesID	2	O	@groupId	
upnp:serviceProvider	5	O	tva:Owner/text()	
upnp:price		O	ProgramInformation / BasicContentDescription / PurchaseItem / Price Schedule / ScheduleEvent / ProgramLocation / InstanceMetadata / PurchaseList / PurchaseItem / Price	
upnp:price@currency		O	ProgramInformation / BasicContentDescription / PurchaseItem / Price @Currency	
upnp:payPerView		O		indicates whether the object represents pay-per-view content.

Property Name	R/O	Context Node	DVB TVA mapping	Remarks
upnp:epgProviderName		O	metadataOriginIdRef	indicates the name of the Electronic Program Guide service provider
upnp:icon	5	O	tva:Logo/text() ProgramInformation / BasicContentDescription / RelatedMaterial / PromotionalMedia / TitleImage	contains a URI to some icon that a control point can use in its UI to display the content, for example, a CNN logo for a Tuner channel
upnp:region		O		contains some identification of the region, associated with the source of the object, for example, "US", "Latin America", "Seattle".
dc:language	1	O	tva:BasicDescription/tva:Language/text()	property indicates one of the languages used in the content as defined by IETF RFC 3066 [i.1], for example, "en-US"
dc:relation	5 1 1 1 1	O	tva:MemberOf/@crid tva:BasicDescription/ tva:RelatedMaterial/tva:HowRelated/@href tva:DerivedFrom/@crid tva:EpisodeOf/@crid tva:MemberOf/@crid ProgramInformation / AggregationOf	defines a relation between two or more resources
dc:title	2	O	tva:BasicDescription/tva:Title/text()	Title of this group
upnp:dateTimeRange		O		
@childCount	2	R	@numOfItems	

B.4 Other TV Anytime elements

The following TV Anytime elements cannot be mapped to UPnP CDS and therefore can only be provided using the UPnP CDS foreign metadata feature:

- ServiceInformation / Description.
- ServiceInformation / Genre.
- ServiceInformation / ServiceLanguage.
- SegmentInformation.
- SegmentGroupInformation.
- Review.
- OnDemandService.
- OnDemandProgram.

Annex C (informative): Mapping DVB SD&S information into UPnP CDS objects

This annex provides suggested values for populating UPnP CDS elements and attributes by using information from DVB SD&S.

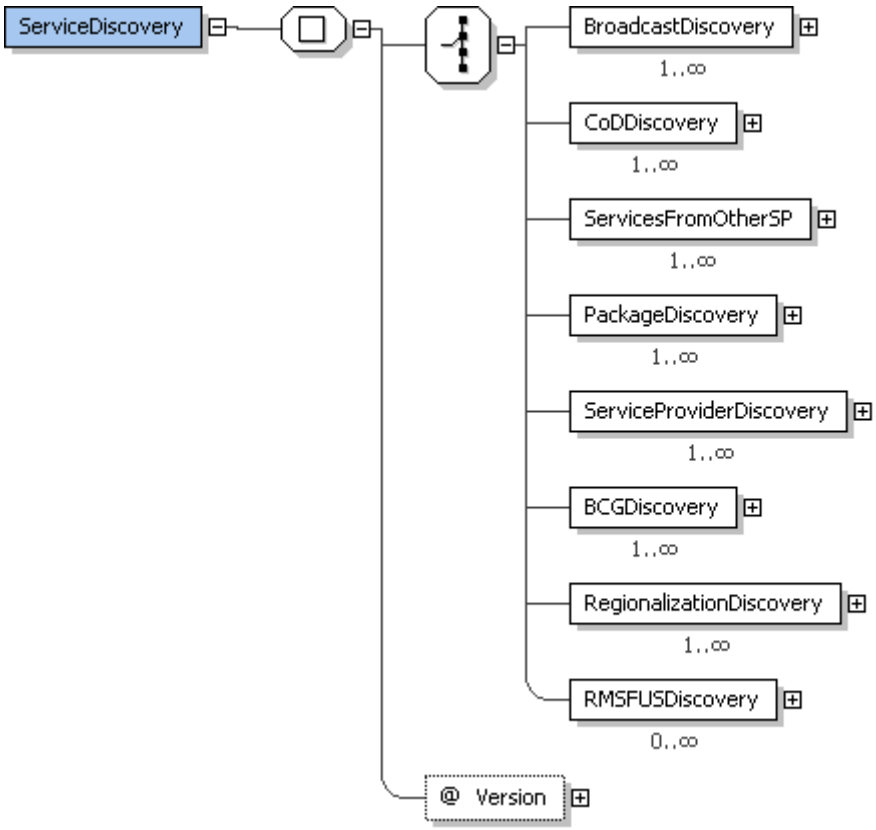


Figure C.1: Service Provider - SD&S to UPnP CDS mapping

Table C.1

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
ServiceDiscovery type:	/ServiceDiscovery			
@Version	Version of this record. A change in this value indicates a change in one of the ServiceProviderDiscovery Records.	O	N/A But UPnP has an eventing mechanism to update information : LastChange event	

	`<xsd:simpleType name="Version">`
	`  <xsd:restriction base="xsd:integer">`
	`  <xsd:minInclusive value="0"/>`
	`  <xsd:maxInclusive value="255"/>`
	`  </xsd:restriction>`
	`</xsd:simpleType>`			

ServiceProvider type (one entry per service provider):	/ServiceDiscovery/ServiceProviderDiscovery/ServiceProvider			

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
@DomainName	An internet DNS domain name registered by the Service Provider that uniquely identifies the Service Provider	M	N/A	

	`<xsd:simpleType name="DomainType">`
	`  <xsd:restriction base="xsd:string">`
	`  <xsd:pattern value="((.|\n|\r)*)?(\.(.|\n|\r)*)+"/>`
	`  </xsd:restriction>`
	`</xsd:simpleType>`			

@Version	Version of the Service Provider(s) Discovery record; the version number is incremented every time a change in any of the records that comprise the service discovery information for this Service Provider occurs.	M	N/A But UPnP has an eventing mechanism to update information : LastChange event	
@LogoURI	Pointer to a Service Provider logo for potential display.	O	upnp:icon	B.7.3
	`type="xsd:anyURI"`			
Name	Name of the Service Provider for display in one or more languages; one Service Provider name is allowed per language code, and at least one language is provided.	M	dc:title upnp:serviceProvider But none has a `Language` attribute Note: currently under discussion in UPnP: current status: postponed	B.1.7 B.9.4

	`<xsd:complexType name="MultilingualType">`
	`  <xsd:simpleContent>`
	`  <xsd:extension base="xsd:string">`
	`  <xsd:attribute name="Language" type="dvb:ISO639-2" use="required"/>`
	`  </xsd:extension>`
	`  </xsd:simpleContent>`
	`</xsd:complexType>`			

Description	Description of the Service Provider for potential display in one or more languages; one description is allowed per language code.	O	dc:description upnp:longDescription But none has a `Language` attribute	B.7.1 B.7.2
	`<xsd:complexType name="MultilingualType">` See above			
	/ServiceDiscovery/ServiceProviderDiscovery/ServiceProvider/Offering			

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
OfferingListType type (one entry per offering):	<xsd:complexType name="OfferingListType"> <xsd:choice maxOccurs="unbounded"> <xsd:element name="Push" type="dvb:DVBSTPTransportModeType"/> <xsd:element name="Pull"> <xsd:complexType> <xsd:complexContent> <xsd:extension base="dvb:PayloadList"> <xsd:attribute name="Location" type="dvb:PullURL" use="required"/> </xsd:extension> </xsd:complexContent> </xsd:complexType> </xsd:element> </xsd:choice> </xsd:complexType> <xsd:complexType name="DVBSTPTransportModeType"> <xsd:complexContent> <xsd:extension base="dvb:PayloadList"> <xsd:attributeGroup ref="dvb:MulticastAddressAttributes"/> </xsd:extension> </xsd:complexContent> </xsd:complexType> <xsd:complexType name="PayloadList"> <xsd:sequence minOccurs="0" maxOccurs="unbounded"> <xsd:element name="PayloadId"> <xsd:complexType> <xsd:sequence minOccurs="0" maxOccurs="unbounded"> <xsd:element name="Segment"> <xsd:complexType> <xsd:attribute name="Version" type="dvb:Version" use="optional"/> <xsd:attribute name="ID" type="dvb:Hexadecimal16bit" use="required"/> </xsd:complexType> </xsd:element> </xsd:sequence> <xsd:attribute name="Id" type="dvb:Hexadecimal8bit" use="required"/> </xsd:complexType> </xsd:element> </xsd:sequence> </xsd:complexType>			
Push@Source Push@Address Push@Port	Port number and IP address of the multicast location of the DVB IP Offering Records which describe the offerings that the Service Provider makes available. This element is optional.	O M M	res Use the dvb locator (as defined in BCG)	B.2
Pull@Location	This URI encodes the location of the DVB IP Offering(s) Records which describe the offerings that the Service Provider makes available.	O	res Use the HTTP locator (as defined in UPnP)	B.2
	<xsd:simpleType name="PullURL"> <xsd:restriction base="xsd:anyURI"> <xsd:pattern value=".*/dvb/sdns/.*"/> </xsd:restriction> </xsd:simpleType>			

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
PayloadList type (one entry per payload ID):	/ServiceDiscovery/ServiceProviderDiscovery/ServiceProvider/Offering/Pull/PayloadId /ServiceDiscovery/ServiceProviderDiscovery/ServiceProvider/Offering/Push/PayloadId			
	<xsd:complexType name="PayloadList"> <xsd:sequence minOccurs="0" maxOccurs="unbounded"> <xsd:element name="PayloadId"> <xsd:complexType> <xsd:sequence minOccurs="0" maxOccurs="unbounded"> <xsd:element name="Segment"> <xsd:complexType> <xsd:attribute name="Version" type="dvb:Version" use="optional"/> <xsd:attribute name="ID" type="dvb:Hexadecimal16bit" use="required"/> </xsd:complexType> </xsd:element> </xsd:sequence> <xsd:attribute name="Id" type="dvb:Hexadecimal8bit" use="required"/> </xsd:complexType> </xsd:element> </xsd:sequence> </xsd:complexType>			
PayloadId@Id	Indicates the type of service discovery information available at the DVB-IP offering location. For example, this can be of type broadcast discovery or CoD discovery.	O		
Segment@ID	Indicates which segment carries service discovery information of type PayloadId@Id for this service provider.	C		
Segment@Version	Version number of the segment identified by Segment@ID.	O		

Table C.2: DVB-IP service - SD&S to UPnP CDS mapping

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
@DomainName	An internet DNS domain name registered by the Service Provider that uniquely identifies the Service Provider.	M		
@Version	Version of the DVB-IP Offering record, the version number is incremented every time a change in the DVB-IP Offering record is made.	C (see note 1)		
BroadcastOffering type:	/BroadcastDiscovery			

	`<xsd:complexType name="BroadcastOffering">`
	`  <xsd:complexContent>`
	`  <xsd:extension base="dvb:OfferingBase">`
	`  <xsd:sequence>`
	`  <xsd:element name="ServiceList" type="dvb:IPServiceList" maxOccurs="unbounded"/>`
	`  </xsd:sequence>`
	`  </xsd:extension>`
	`  </xsd:complexContent>`
	`</xsd:complexType>`
	
	`<xsd:complexType name="OfferingBase">`
	`  <xsd:attribute name="DomainName" type="dvb:DomainType" use="required"/>`
	`  <xsd:attribute name="Version" type="dvb:Version" use="optional"/>`
	`</xsd:complexType>`			

IPServiceList type (one per service list):	/BroadcastDiscovery/ServiceList			

	`<xsd:complexType name="IPServiceList">`
	`  <xsd:sequence>`
	`  <xsd:element name="ServicesDescriptionLocation" type="dvb:DescriptionLocationBCG" minOccurs="0" maxOccurs="unbounded"/>`
	`  <xsd:sequence>`
	`  <xsd:element name="SingleService" type="dvb:IPService" maxOccurs="unbounded"/>`
	`  </xsd:sequence>`
	`  </xsd:sequence>`
	`</xsd:complexType>`			

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
ServicesDescriptionLocation	If present, this contains the identifier(s) of the BCG Record(s) for the BCG Discovery element that carries the information on this offering.	O	New tag: dvb:MetadataServerUrl Example: <dvb:MetadataServerUrl> http://iptv.org/bcg_server_ 1 </dvb:MetadataServerUrl>	
	<xsd:complexType name="DescriptionLocationBCG" mixed="true"> <xsd:simpleContent> <xsd:extension base="dvb:DescriptionLocation"> <xsd:attribute name="preferred" type="xsd:boolean" use="optional"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType> <xsd:simpleType name="DescriptionLocation"> <xsd:restriction base="xsd:anyURI"/> </xsd:simpleType>			
ServicesDescriptionLocation@preferred	If present and set to true, specifies that this location contains the preferred BCG. The default value for this attribute is false.	O	New tag: dvb:MetadataServerUrl Example: <dvb:MetadataServerUrl preferred="true"> http://iptv.org/bcg_server_2 < dvb:MetadataServerUrl>	
	/BroadcastDiscovery/ServiceList/SingleService			

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
IPService type (one entry per service):	<xsd:complexType name="IPService"> <xsd:sequence> <xsd:element name="ServiceLocation" type="dvb:ServiceLocation"/> <xsd:element name="TextualIdentifier" type="dvb:TextualIdentifier"/> <xsd:element name="DVBTriplet" type="dvb:DVBTriplet"/> <xsd:element name="MaxBitrate" type="xsd:positiveInteger" minOccurs="0"/> <xsd:element name="SI" type="dvb:SI" minOccurs="0"/> <xsd:element name="AudioAttributes" type="tva:AudioAttributesType" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="VideoAttributes" type="tva:VideoAttributesType" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="ServiceAvailability" type="dvb:ServiceAvailabilityType" minOccurs="0" maxOccurs="unbounded"/> </xsd:sequence> </xsd:complexType> <xsd:complexType name="TextualIdentifier"> <xsd:attribute name="DomainName" type="dvb:DomainType" use="optional"/> <xsd:attribute name="ServiceName" type="dvb:Service" use="required"/> </xsd:complexType>			
TextualIdentifier@DomainName	An internet DNS domain name registered by the Service Provider that uniquely identifies the Service Provider. If this is not present, then the DNS domain name from the DVB IP Offering record is used.	O	N/A	
TextualIdentifier@ServiceName	A unique host name for the service within the service provider's domain	M	upnp:channel Name	B.1.7 B.8.1 B.11.2
DVBTriplet@Original Network Id	Identifies the network Id of the originating delivery system	M	upnp:channel ID with upnp:channel ID@type="SI"	B.8.5 (SRS B.4.2)
DVBTriplet@TS Id	Identifies the Transport Stream	M		
DVBTriplet@Service Id	Identifies a service from any other service within the TS. The service Id is the same as the program number in the corresponding program map table.	M		
MaxBitrate	Specifies the maximum bitrate (in kbits/s) of the overall stream carrying the service	O	res@bitrate	B.2.1.6 (check VBR recommendation)
ServiceLocation type (one entry per service location):	/BroadcastDiscovery/ServiceList/SingleService/Service Location At least one of IPMulticastAddress or RTSPURL is present.			
	<xsd:complexType name="ServiceLocation"> <xsd:choice maxOccurs="unbounded"> <xsd:element name="IPMulticastAddress" type="dvb:McastType"/> <xsd:element name="RTSPURL" type="dvb:RTSP"/> </xsd:choice> </xsd:complexType>			
IPMulticastAddress	Signals the use of multicast methods to access the service and provides the multicast address at which the service may be accessed. At least one of IPMulticastAddress or RTSPURL is present.	O	res Use the DVB locator (as defined in BCG)	B.2

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
	<xsd:complexType name="McastType"> <xsd:attributeGroup ref="dvb:MulticastAddressAttributes"/> <xsd:sequence minOccurs="0"> <xsd:element name="FECBaseLayer" type="dvb:FECLayerAddressType" maxOccurs="1" /> <xsd:element name="FECEnhancementLayer" type="dvb:FECLayerAddressType" minOccurs="0" maxOccurs="unbounded" /> </xsd:sequence> </xsd:complexType> <xsd:attributeGroup name="MulticastAddressAttributes"> <xsd:attribute name="Source" type="dvb:IPOrDomainType" use="optional"/> <xsd:attribute name="Address" type="dvb:IPOrDomainType" use="required"/> <xsd:attribute name="Port" type="xsd:unsignedShort" use="required"/> <xsd:attribute name="Streaming" type="dvb:StreamingType" use="optional"/> <xsd:attribute name="FECMaxBlockSize" type="xsd:unsignedShort" use="optional"/> <xsd:attribute name="FECMaxBlockTime" type="xsd:unsignedShort" use="optional"/> <xsd:attribute name="FECOTI" type="xsd:base64Binary" use="optional"/> </xsd:attributeGroup>			
IPMulticastAddress@Source	Optionally the IP unicast address of the source of the TS may be provided.	O		
IPMulticastAddress@Address	Provides the multicast address at which the service may be accessed.	M (see note 2)		
IPMulticastAddress@Port	Provides the port at which the service may be accessed.	M (see note 2)		
IPMulticastAddress@Streaming	Optionally indicates RTP or direct UDP streaming. In case the parameter is not provided, RTP streaming is assumed.	O		
FECBaseLayer	Contains the multicast address and port of the AL-FEC stream. This element is present if the FECEnhancementLayer element is present.	O		
	<xsd:complexType name="FECLayerAddressType"> <xsd:attribute name="Address" type="dvb:IPOrDomainType" use="optional"/> <xsd:attribute name="Port" type="xsd:unsignedShort" use="required"/> </xsd:complexType>			
FECBaseLayer@Address	IP Multicast Address for FEC Base Layer. If the IP multicast address is omitted, then the FEC flow is assumed to be on the same multicast address as the original data.	O		
FECBaseLayer@Source	IP Multicast Source Address for FEC Base Layer. If the IP multicast source address is omitted, then the FEC flow is assumed to be on the same multicast address as the original data.	O		
FECBaseLayer@Port	UDP port for FEC Base Layer.	M (see note)		

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
FECEnhancementLayer	Contains the multicast address and port of the AL-FEC enhancement stream(s). This element is present only if the FECBaseLayer element is present.	O		

	`<xsd:complexType name="FECLayerAddressType">`
	`<xsd:attribute name="Address" type="dvb:IPOrDomainType" use="optional"/>`
	`<xsd:attribute name="Port" type="xsd:unsignedShort" use="required"/>`
	`</xsd:complexType>`			

FECEnhancementLayer @Address	IP Multicast Address for FEC Enhancement Layer (Raptor) - may be repeated for multiple layers. If the IP multicast address is omitted, then the FEC flow is assumed to be on the same multicast address as the original data.	O		
FECEnhancementLayer@Source	IP Multicast Source Address for FEC Enhancement Layer (Raptor). If the IP multicast source address is omitted, then the FEC flow is assumed to be on the same multicast address as the original data.	O		
FECEnhancementLayer@Port	UDP port for FEC Enhancement Layer.	M (see note 2)		
IPMulticastAddress @FECMaxBlockSizePackets	This indicates the maximum number of stream source packets that will occur between the first packet of a source block (which is included) and the last packet for that source block (source or repair).	O		
IPMulticastAddress @FECMaxBlockSizeTime	The maximum transmission duration of any FEC Block (source and repair packets).	O		
IPMulticastAddress @FECObjectTransmissionInformation	The FEC Object Transmission Information for the Raptor code If an FECEnhancementLayer element is included then this element is included.	O		
RTSPURL	Signals the use of RTSP to access the service and provides the URL at which the service may be accessed. At least one of IPMulticastAddress or RTSPURL is present.	O	Use the dvb-rtsp:// locator	

	`<xsd:simpleType name="RTSP">`
	`<xsd:restriction base="xsd:anyURI">`
	`<xsd:pattern value="rtsp://.*"/>`
	`</xsd:restriction>`
	`</xsd:simpleType>`			

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
SI type:	/BroadcastDiscovery/ServiceList/SingleService/SI			
	<xsd:complexType name="SI"> <xsd:sequence> <xsd:element name="Name" type="dvb:MultilingualType" maxOccurs="unbounded"/> <xsd:element name="Description" type="dvb:MultilingualType" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="ServiceDescriptionLocation" type="dvb:DescriptionLocationBCG" minOccurs="0" maxoccurs="unbounded"/> <xsd:element name="ContentGenre" type="dvb:Genre" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="CountryAvailability" type="dvb:CountryAvailability" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="ReplacementService" type="dvb:ReplacementService" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="MosaicDescription" type="dvb:MosaicDescription" minOccurs="0"/> <xsd:element name="AnnouncementSupport" type="dvb:AnnouncementSupport" minOccurs="0"/> </xsd:sequence> <xsd:attribute name="ServiceType" type="dvb:ServiceType" use="required"/> <xsd:attribute name="PrimarySISource" type="dvb:PrimarySISource" use="optional" default="XML"/> </xsd:complexType>			
SI@ServiceType	Specifies the type of service; it is coded as per DVB SI standard. Examples are digital television service, digital radio sound service, mosaic service, data broadcast service, DVB MHP service, etc.	M (see note 2)	TBD	
	<xsd:simpleType name="ServiceType"> <xsd:restriction base="dvb:Hexadecimal8bit"/> </xsd:simpleType>			
SI@PrimarySISource	Specifies the type of service; it is coded as per DVB SI standard. Examples are digital television service, digital radio sound service, mosaic service, data broadcast service, DVB MHP service, etc.	M (see note 2)	TBD	
	<xsd:simpleType name="PrimarySISource"> <xsd:restriction base="xsd:string"> <xsd:enumeration value="Stream"/> <xsd:enumeration value="XML"/> </xsd:restriction> </xsd:simpleType>			

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
Name	Name of the service for display in one or more languages; one Service name is allowed per language code, and at least one language is provided (though not necessarily more than one).	M	upnp:channelName But none has a Language attribute	B.1.7 B.8.1 B.11.2
	<xsd:complexType name="MultilingualType"> <xsd:simpleContent> <xsd:extension base="xsd:string"> <xsd:attribute name="Language" type="dvb:ISO639-2" use="required"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType>			
Description	Description of the service for potential display in one or more languages; one description per language code maximum.	O	dc:description upnp:longDescription But none has a Language attribute	B.7.1 B.7.2
	<xsd:complexType name="MultilingualType"> <xsd:simpleContent> <xsd:extension base="xsd:string"> <xsd:attribute name="Language" type="dvb:ISO639-2" use="required"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType>			
ServiceDescriptionLocation	If present, this contains the identifier(s) of the BCG Record(s) for the BCG Discovery element that carries the information on this service. If this element is present, it is prefered to the ServicesDescriptionLocation.	O		
	<xsd:complexType name="DescriptionLocationBCG" mixed="true"> <xsd:simpleContent> <xsd:extension base="dvb:DescriptionLocation"> <xsd:attribute name="preferred" type="xsd:boolean" use="optional"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType> <xsd:simpleType name="DescriptionLocation"> <xsd:restriction base="xsd:anyURI"/> </xsd:simpleType>			
ServiceDescriptionLocation@preferred	If present and set to true, specifies that this location contains the preferred BCG. The default value for this attribute is false.	O		

<table>
<tr><th>Element / Attribute Name</th><th>Element / Attribute Description</th><th>Mandated/ Optional/ Conditional</th><th>UPnP CDS mapping</th><th>UPnP CDS section [22]</th></tr>
<tr><td>ContentGenre</td><td>Indicates one or more genre of the service (not individual programmes). For example movie/drama channel or news/current affairs channel. This uses the first level coding defined by DVB as content_nibble_level_1.</td><td>O</td><td>upnp:genre</td><td>B.4.1</td></tr>
<tr><td></td><td colspan="4"><pre>
<xsd:simpleType name="Genre">
    <xsd:restriction base="xsd:byte">
        <xsd:minInclusive value="0"/>
        <xsd:maxInclusive value="15"/>
    </xsd:restriction>
</xsd:simpleType>
</pre></td></tr>
<tr><td>CountryAvailability</td><td>Gives a list of countries and/or groups of countries where the service is intended to be available, and/or a list of countries and/or groups where it is not. This field is deprecated and Service Availability should be used instead.</td><td>Deprecated</td><td></td><td></td></tr>
<tr><td>AnnouncementSupport</td><td>The announcement support element identifies the type of spoken announcements that are supported by the service (for example emergency flash, road traffic flash, etc.). Furthermore, it informs about the transport method of the announcement and gives the necessary linkage information so that the announcement stream can be monitored.</td><td>O</td><td>N/A
Topic currently under discussion in DLNA</td><td></td></tr>
<tr><td></td><td colspan="4"><pre>
<xsd:complexType name="AnnouncementSupport">
    <xsd:sequence>
        <xsd:element name="Announcement" maxOccurs="unbounded">
            <xsd:complexType>
                <xsd:choice minOccurs="0">
                    <xsd:element name="TextualIdentifier"
type="dvb:TextualIdentifier"/>
                    <xsd:element name="DVBTriplet"
type="dvb:DVBTriplet"/>
                </xsd:choice>
                <xsd:attribute name="Type" type="dvb:Hexadecimal4bit"
use="required"/>
                <xsd:attribute name="ReferenceType"
type="dvb:Hexadecimal3bit" use="required"/>
                <xsd:attribute name="ComponentTag"
type="dvb:Hexadecimal8bit" use="optional"/>
            </xsd:complexType>
        </xsd:element>
    </xsd:sequence>
    <xsd:attribute name="SupportIndicator"
type="dvb:Hexadecimal16bit" use="required"/>
</xsd:complexType>
</pre></td></tr>
</table>

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
Replacement Service	Identifies a service replacement service which may be selected automatically by the HNED when the service being decoded fails.	O	N/A	
	<xsd:complexType name="ReplacementService"> <xsd:choice> <xsd:element name="TextualIdentifier" type="dvb:TextualIdentifier"/> <xsd:element name="DVBTriplet" type="dvb:DVBTriplet"/> </xsd:choice> <xsd:attribute name="ReplacementType" type="dvb:Hexadecimal8bit" use="optional" default="5"/> </xsd:complexType>			
MosaicDescription	The mosaic description element identifies the elementary cells of a mosaic service, groups different elementary cells to form logical cells, and establishes a link between the content of all or part of the logical cell and the corresponding service or package information.	O	N/A	
AudioAttributes	Signals details of the audio coding algorithms and purpose that the service may use. This takes the form of the AudioAttributtes element defined in clause 6.3.5 of ETSI TS 102 822-3-1 [18] and used in ETSI TS 102 323 [15]. The classification scheme used for the Coding element is either be defined by ETSI TS 102 323 [15], or provided by the present document. If this element is omitted, then the default value of MPEG-1 or MPEG-2 layer 2 backwards compatible, mono or stereo is used ; specifically this is the legacy value from ETSI TS 101 154 [10].	O	res@protocolInfo See clause 9.1 of the present document	B.2.1.1
VideoAttributes	Signals details of the video coding that may be used by the service. This takes the form of the VideoAttributes element defined in clause 6.3.5 of ETSI TS 102 822-3-1 [18] and used in ETSI TS 102 323 [15] . The classification scheme used for the Coding element is either be defined by ETSI TS 102 323 [15], or provided by the present document. If this element is omitted, then the default value of MPEG-2 coded video, operating at MP@ML at a frame rate of 25Hz is used; specifically this is the legacy value from ETSI TS 101 154 [10].	O	res@protocolInfo See clause 9.1 of the present document	B.2.1.1
ServiceAvailability	This element provides support for regionalization. It allows each service to have a list of "cells" (regions) with which the service is associated. By default, all the single services are available everywhere. There is at most one ServiceAvailability element for each CountryCode.	O	N/A	

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional/ Conditional	UPnP CDS mapping	UPnP CDS section [22]
	<xsd:complexType name="ServiceAvailabilityType"> <xsd:sequence> <xsd:element name="CountryCode" type="dvb:PackageAvailabilityCountryCodeType"/> <xsd:element name="Cells" type="xsd:string" minOccurs="0" maxOccurs="unbounded"/> </xsd:sequence> </xsd:complexType>			
CountryCode	This element indicates the country for which the availability is being defined.	M	N/A	
@Availability	This flag indicates whether the service is available in the country specified by CountryCode. The default is TRUE. When TRUE, the service is available in the specified country with the exception of those regions identified by Cells. When FALSE, the service is not available in the specified country with the exception of those regions identified by Cells.	O	N/A	
	<xsd:complexType name="PackageAvailabilityCountryCodeType"> <xsd:simpleContent> <xsd:extension base="xsd:string"> <xsd:attribute name="Availability" type="xsd:boolean" default="true"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType>			
Cells	A list of string identifiers representing geographical regions in the country identified by CountryCode. The Cells listed represent the exception to the value supplied by the flag, i.e. the negation of the Availability flag applies to any listed cells.	O	upnp:region	B.7.4
NOTE 1: The version number of the DVB-IP offering record is mandatory when the record is provided on request (i.e. "pull mode") and is optional when the record is multicasted (i.e. "push mode"). NOTE 2: The Mandatory here means that if the Optional parent information is transmitted, then this field is present.				

Table C.3: Packages - SD&S to UPnP CDS mapping

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional	UPnP CDS mapping	UPnP CDS section [22]
Packaged Services type:	/PackageDiscovery			
	<xsd:complexType name="Package"> <xsd:sequence> <xsd:element name="PackageName" type="dvb:MultilingualType" maxOccurs="unbounded"/> <xsd:element name="CountryAvailability" type="dvb:CountryAvailability" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="PackageDescription" type="dvb:DescriptionLocationBCG" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="Service" type="dvb:PackagedServiceType" maxOccurs="unbounded"/> <xsd:element name="PackageReference" minOccurs="0" maxOccurs="unbounded"> <xsd:complexType> <xsd:attribute name="Id" type="dvb:Hexadecimal16bit"/> </xsd:complexType> </xsd:element> <xsd:element name="PackageAvailability" type="dvb:ServiceAvailabilityType" minOccurs="0" maxOccurs="unbounded"/> </xsd:sequence> <xsd:attribute name="Id" type="dvb:Hexadecimal16bit" use="required"/> <xsd:attribute name="Visible" type="xsd:boolean" use="optional" default="true"/> </xsd:complexType>			
Package@Id	Identifies a package; this ID is allocated by the Service Provider	M	@id	B.1.1
Package@Visible	A Boolean which indicates in combination with the PackageAvailability element, whether this package is presented to the user. The default value is true.	O	N/A	
PackageName	Name of the package for display in one or more languages; one name per language code maximum.	M	dc:title But there is no Language attribute	B.1.7
	<xsd:complexType name="MultilingualType"> <xsd:simpleContent> <xsd:extension base="xsd:string"> <xsd:attribute name="Language" type="dvb:ISO639-2" use="required"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType>			
PackageDescription	If present, this contains the identifier(s) of the BCG Record(s) for the BCG Discovery element that carries the information on this package.	O	dc:description upnp:longDescription	B.7.1 B.7.2
	<xsd:complexType name="DescriptionLocationBCG" mixed="true"> <xsd:simpleContent> <xsd:extension base="dvb:DescriptionLocation"> <xsd:attribute name="preferred" type="xsd:boolean" use="optional"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType> <xsd:simpleType name="DescriptionLocation"> <xsd:restriction base="xsd:anyURI"/> </xsd:simpleType>			
PackageDescription@preferred	If present and set to true, specifies that this location contains the preferred BCG. The default value for this attribute is false.	O	N/A	
CountryAvailability	Gives a list of countries and/or groups of countries where the package is intended to be available, and/or a list of countries and/or groups where it is not. This field is deprecated and Package Availability should be used instead.	Deprecated	-	

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional	UPnP CDS mapping	UPnP CDS section [22]
PackageReference	The Id(s) of package(s) that are included in the current package.	O	@id	B.1.1
Service	List of services forming the package, comprising:	M		
	<xsd:complexType name="PackagedServiceType"> <xsd:sequence> <xsd:element name="TextualID" type="dvb:TextualIdentifier"/> <xsd:element name="DVBTriplet" type="dvb:DVBTriplet" minOccurs="0"/> <xsd:element name="DescriptionLocation" type="dvb:DescriptionLocationBCG" minOccurs="0"/> <xsd:element name="LogicalChannelNumber" type="xsd:positiveInteger" minOccurs="0"/> </xsd:sequence> </xsd:complexType> <xsd:complexType name="TextualIdentifier"> <xsd:attribute name="DomainName" type="dvb:DomainType" use="optional"/> <xsd:attribute name="ServiceName" type="dvb:Service" use="required"/> </xsd:complexType>			
TextualID@ DomainName	An internet DNS domain name registered by the Service Provider that uniquely identifies the Service Provider. If this is omitted the Service Provider Domain Name from the inherited DVB-IP Offering is used.	O	N/A	
TextualID@ServiceName	A unique host name for the service within the service provider's domain.	M	upnp:channelName	B.11.2
DVBTriplet	The DVB triplet by which the service may be known.	O	upnp:channelID with upnp:channelID@type ="SI"	B.8.5 (SRS B.4.2)
	<xsd:complexType name="DVBTriplet"> <xsd:attribute name="OrigNetId" type="dvb:OrigNetId" use="required"/> <xsd:attribute name="TSId" type="dvb:TSId" use="required"/> <xsd:attribute name="ServiceId" type="dvb:ServiceId" use="required"/> </xsd:complexType>			
DescriptionLocation	The URI of additional service description provided in the context of a package; this is not required to acquire a service.	O	res@contentInfo	B.2
	<xsd:complexType name="DescriptionLocationBCG" mixed="true"> <xsd:simpleContent> <xsd:extension base="dvb:DescriptionLocation"> <xsd:attribute name="preferred" type="xsd:boolean" use="optional"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType> <xsd:simpleType name="DescriptionLocation"> <xsd:restriction base="xsd:anyURI"/> </xsd:simpleType>			
LogicalChannelNumber	The logical channel number of the service.	O	upnp:channelNr	B.11.1

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional	UPnP CDS mapping	UPnP CDS section [22]
PackageAvailability	This element provides support for regionalization. It allows each package to have a list of "cells" (regions) with which the package is associated. By default, the package is available everywhere. There is at most one PackageAvailability element for each CountryCode.	O	N/A	
	<xsd:complexType name="ServiceAvailabilityType"> <xsd:sequence> <xsd:element name="CountryCode" type="dvb:PackageAvailabilityCountryCodeType"/> <xsd:element name="Cells" type="xsd:string" minOccurs="0" maxOccurs="unbounded"/> </xsd:sequence> </xsd:complexType> <xsd:complexType name="PackageAvailabilityCountryCodeType"> <xsd:simpleContent> <xsd:extension base="xsd:string"> <xsd:attribute name="Availability" type="xsd:boolean" default="true"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType>			
CountryCode	This element indicates the country for which the availability is being defined.	M	N/A	
CountryCode@Availability	This flag indicates whether the package is available in the country specified by CountryCode. The default is TRUE. When TRUE, the package is available in the specified country with the exception of those regions identified by Cells. When FALSE, the package is not available in the specified country with the exception of those regions identified by Cells .	O	N/A	
Cells	A list of string identifiers representing geographical regions in the country identified by CountryCode. The Cells listed represent the exception to the value supplied by the flag, i.e. the negation of the Availability flag applies to any listed cells.	O	upnp:region	B.7.4

Table C.4: Broadband Content Guide - SD&S to UPnP CDS mapping

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional	UPnP CDS mapping	UPnP CDS section [22]
BCGOffering type:	/BCGDiscovery			
	<xsd:complexType name="BCGOffering"> <xsd:complexContent> <xsd:extension base="dvb:OfferingBase"> <xsd:sequence> <xsd:element name="BCG" maxOccurs="unbounded"> <xsd:complexType> <xsd:sequence> <xsd:element name="Name" type="dvb:MultilingualType" maxOccurs="unbounded"/> <xsd:element name="Description" type="dvb:MultilingualType" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="TransportMode" type="dvb:TransportModeType"/> <xsd:element name="Logo" type="xsd:anyURI" minOccurs="0"/> <xsd:element name="Type" type="tva:ControlledTermType" minOccurs="0"/> <xsd:element name="TargetProvider" type="dvb:DomainType" minOccurs="0" maxOccurs="unbounded"/> <xsd:element name="BCGProviderName" type="dvb:MultilingualType" minOccurs="0" maxOccurs="unbounded"/> </xsd:sequence> <xsd:attribute name="Id" type="tva:TVAIDType" use="required"/> <xsd:attribute name="Version" type="dvb:Version" use="optional"/> </xsd:complexType> </xsd:element> </xsd:sequence> </xsd:extension> </xsd:complexContent> </xsd:complexType>			
BCG	BCG record	M		
BCG@Id	Identifies a Broadband Content Guide Provider/Server; this Id is allocated by the Service Provider	M	TVA mapping	
BCG@Version	Version of this record. A change in this value indicates a change in one of the BCG Records.	O		
Name	Name of the Broadband Content Guide offering for display in one or more languages; one name is allowed per language code, and at least one language is provided (though not necessarily more than one).	M	dc:title But there is no Language attribute	B.1.7
	<xsd:complexType name="MultilingualType"> <xsd:simpleContent> <xsd:extension base="xsd:string"> <xsd:attribute name="Language" type="dvb:ISO639-2" use="required"/> </xsd:extension> </xsd:simpleContent> </xsd:complexType>			
Description	Description of the Broadband Content Guide for potential display in one or more languages; one description per language code.	O	dc:description upnp:longDescription But none has a Language attribute	B.7.1 B.7.2
	<xsd:complexType name="MultilingualType">			
Logo	A pointer to an optional logo for the content guide.	O	upnp:icon	B.7.3

Element / Attribute Name	Element / Attribute Description	Mandated/ Optional	UPnP CDS mapping	UPnP CDS section [22]
Type	This indicates if the content guide relates to live programs, content on demand, both, or some other form of content. The extensible classification scheme provided in the present document is used.	O	TVA mapping	
TargetProvider	The domain name of the provider whose content is described by this BCG (for example Canal+). The domainName (there is no domainName parameter, it is targetProvider) is the same as a domain name present in the ServiceList.	O	upnp:serviceProvider	
	<xsd:simpleType name="DomainType"> <xsd:restriction base="xsd:string"> <xsd:pattern value="((.|\n|\r)*)?(\.(.|\n|\r)*)+"/> </xsd:restriction> </xsd:simpleType>			
TransportMode	The location where the broadband content guide may be found.	M	res DVB needs to define the way to expose those connection information	B.2
	<xsd:complexType name="TransportModeType"> <xsd:choice maxOccurs="unbounded"> <xsd:element name="DVBSTP" type="dvb:DVBSTPTransportModeType"/> <xsd:element name="HTTP" type="dvb:HTTPTransportModeType"/> </xsd:choice> </xsd:complexType> <xsd:complexType name="DVBSTPTransportModeType"> <xsd:complexContent> <xsd:extension base="dvb:PayloadList"> <xsd:attributeGroup ref="dvb:MulticastAddressAttributes"/> </xsd:extension> </xsd:complexContent> </xsd:complexType> <xsd:complexType name="HTTPTransportModeType"> <xsd:complexContent> <xsd:extension base="dvb:PayloadList"> <xsd:attribute name="Location" type="dvb:PullURL" use="required"/> <xsd:attribute name="SOAP" default="false"/> </xsd:extension> </xsd:complexContent> </xsd:complexType>			
DVBSTP	Specifies the location at which the content guide is available using the DVBSTP protocol, and details the relevant segments that are being transmitted.	O		
http@Location	Specifies the location at which the guide may be found.	M (if the http element is used)		
http@SOAP	Indicates if the guide may be queried using the SOAP protocol rather the mechanism outline in clause 5.4.2 of ETSI TS 101 034 [1]. The default value of this attribute is "false".	O		
BCGProviderName	The name of the BCG provider (for example "Telerama"). This field is identical to the textual string of the Publisher attribute of the TVAMain element in the BCG metadata	O	upnp:epgProviderName	B.9.7

Annex D (informative): Delivery Format Classification Scheme as used in supported media formats

The classification scheme used in clause 7.2 for the supported media formats is shown below.

```
<?xml version="1.0" encoding="UTF-8" ?>
<ClassificationScheme uri="urn:dvb:metadata:cs:DeliveryFormatCS:2009">
<!-- ################################################################ -->
<!-- DeliveryFormat -->
<!-- Definition: This is used to define the delivery format of the content stream -->
<!-- ################################################################ -->
    <Term termID="1">
        <Name>dvb-ff</Name>
    </Term>
    <Term termID="2">
        <Name>mpeg-ts</Name>
    </Term
    <Term termID="3">
        <Name>mpeg-ps</Name>
    </Term>
    <Term termID="4">
        <Name>mpeg-es</Name>
    </Term>
</ClassificationScheme>
```

Annex E (informative): Broadcast Tuner implementation

A typical home network may include sources of content serving locally within the home, e.g. audio and video players, and also contribution feeds from delivery networks, e.g. IPTV, DVB-C/S/T.

Currently content delivered over broadcast networks will be delivered as services carried in MPEG-2 packets in multiplexes accessed by tuning to specific RF frequencies and demodulating the multiplex received. In order to make services from this multiplex available over the home network the MPEG-2 packets is demultiplexed and possibly decrypted before encapsulating them in IP packets for use across the home network.

In cases where no storage or timeshift buffering is involved this will result in a 'near-realtime' isochronous content service stream to which an HN renderer can connect.

In order to make the content available across the HN the server exposes the content to the rendering devices. Therefore, the incoming metadata is parsed and the parts relevant to the selected service translated into UPnP form, the audio/video components multiplexed and encapsulated as MPEG-2/IP into the outgoing stream in a way which maintains any time relationships with the content. The following figure shows a functional schematic representation of a "Tuner device" suitable to do this. The transport protocol used for IP streaming into the HN should be appropriate for that network, in the case of the DVB HN this would be RTP/UDP/IP.

Link Layer protection or DVB CPCM should be applied if required by the service providers who share the home network environment, e.g. a broadband IPTV/internet provider and an unrelated satellite or terrestrial service.

The appropriate QoS marking (see clause 11) should be applied at both Ethernet and IP layers.

The UPnP services necessary for making and maintaining the IP connections within the HN is provided as part of the server implementation.

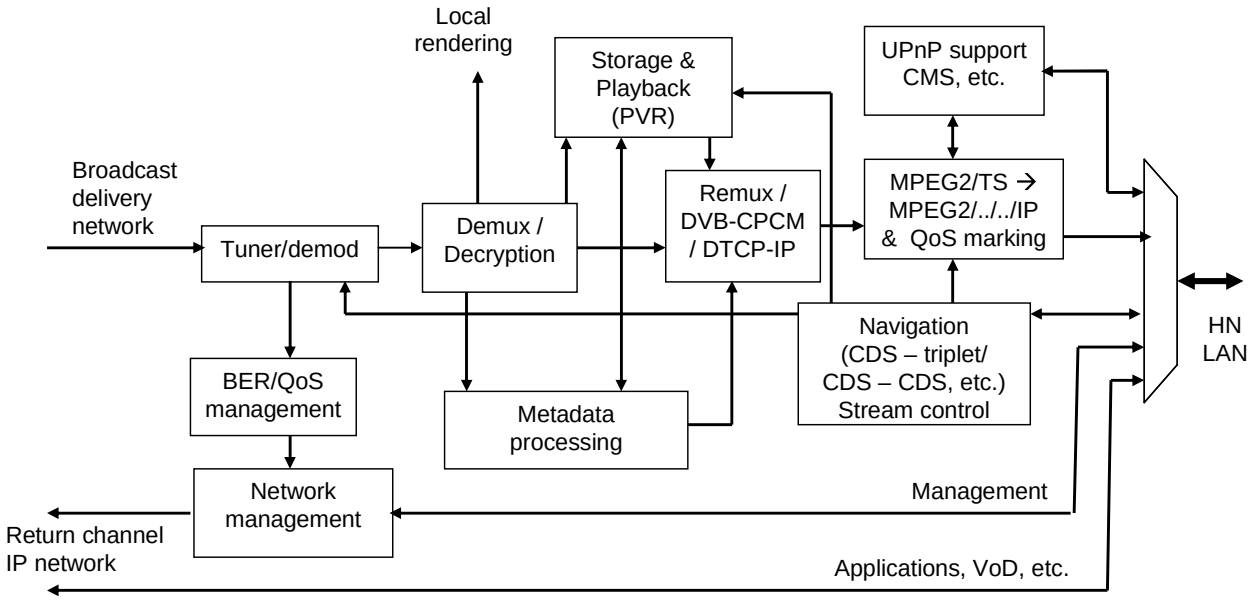


Figure E.1: Functional Schematic Representation of "Tuner device"

If a return channel is included there may be a link through to the HN IP service to allow use of interactivity or a remote UI for a remote management function.

This tuner implementation may be part of a physical device which has other features such as storage (PVR) and local rendering.

If the device has local storage which is intended to be shared across the HN the creation, storage and exposure of appropriate metadata to allow the HN rendering devices to identify and locate that stored content.

Annex F (informative): Bibliography

- IEEE 802.1d™-200): "IEEE Standard for Local and metropolitan area networks: Media Access Control (MAC) Bridges".
- IEEE 802™-2001: "IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture".
- IEEE 802.1Q™-2005: "IEEE Standard for local and metropolitan area networks - Virtual Bridged Local Area Networks".
- IEC 62481-3: "DLNA Networked Device Interoperability guidelines expanded October 2006 Volume 3: Link Protection".
- ETSI TS 102 824: "Digital Video Broadcasting (DVB); Remote Management and Firmware Update System for DVB IPTV Services (Phase 2)".
- IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".

History

Document history		
V1.1.1	May 2010	Publication
V2.1.1	April 2016	Publication