



DVB-IP Phase 1.3 in the context of ETSI TISPAN NGN

**DVB Document A128
September 2008**

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DVB-IP Phase 1.3 in the context of ETSI TISPAN NGN

Editor: Keith Mainwaring
Version: 0.12 (June 2008)

1 Introduction

This report describes the issues involved with the use of DVB-IP Phase 1.3 systems in the context of an ETSI TISPAN NGN Release 2 system. Release 2 of ETSI TISPAN's NGN includes support of IPTV services using two approaches – one using a dedicated IPTV subsystem and one based on the use of IMS. A comparison is made of the DVB and TISPAN architectures and the procedures for initialisation of the Home Network End Device, service discovery and selection, and control of Content-on-Demand and Live Media Broadcast services.

The DVB-IP Phase 1.3 specification addresses the requirements on a Home Network End Device (e.g. Set-Top Box) to support IPTV services. In overview:

- The network configuration of the HNED (IP address ...) is done using the DHCP protocol.
- The entry point to get the service discovery information can use a DHCP option or a DNS mechanism.
- The discovery of live content (list of services, metadata, connection information...) is done through the SD&S (Service Discovery & Selection) protocol and metadata. Two modes are possible for the HNED to retrieve this information : pull with HTTP, and push with DVBSTP.
- The programme schedule of broadcast channels and the content made available by Content on Demand services is published by the Broadband Content Guide (BCG), using TV-Anytime metadata. Pull and push modes are available and an optional “query” mode based on SOAP is also possible.
- The Real-Time Streaming Protocol (RTSP) is used for control of the delivery of on-demand content, and can optionally be used also for broadcast TV and audio (radio) programs.
- RTSP profiles for *Live Media Broadcast (LMB)*, *Media Broadcast with Trick Modes (MBwTM)* and *Content on Demand (CoD)* are defined.
- IGMP is used to connect/disconnect to/from multicast streams.
- RTCP is only allowed as Sender Report messages to inform receivers of transmission statistics and to synchronize multiple multicast streams (for example for Picture in Picture). No Receiver Report is allowed.
- The Audio and Video streams and the Service Information are multiplexed into an MPEG-2 Transport Stream. The resulting MPEG-2 packets are encapsulated in UDP or RTP, with DSCP packet markings for quality of service.

DVB-IP 1.3 does not define any specific access network architectures or requirements apart from the ability for the network to operate with the protocols identified by the

DVB-IPTV specification. ETSI TISPAN specifies how IPTV services are supported by the TISPAN defined Next Generation Network (NGN). In particular, ETSI IPTV makes use of the Network Attachment Subsystem (NASS) [6] and the Resource and Admission Control Subsystem (RACS) that control transport stratum resources. In addition, the IMS-based approach for supporting IPTV makes use of IMS for establishing IPTV sessions and interacting with the Resource and Admission Control Subsystem.

2 Reference Documents

2.1 DVB

[1] ETSI TS 102 034 version 1.3.1 (2007-10): “Transport of MPEG 2 Transport Stream (TS) Based DVB Services over IP Based Networks”

The following specifications are also relevant:

ETSI 102 539 version 1.2.1(2008-04): “Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)”

ETSI TS 102 542 V1.2.1 (2008-04): Digital Video Broadcasting (DVB); Guidelines for DVB-IP Phase 1 Handbook

2.2 ETSI TISPAN

[2] ETSI TS 181 016 V2.0.0 (2007-11) Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Service Layer Requirements to integrate NGN services and IPTV; and

[3] ETSI TS 181 014 V2.0.0 (2007-11) Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Requirements for network transport capabilities to support IPTV services.

[4] ETSI TS 182 028 V2.0.0 (2008-01) Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IPTV Architecture; Dedicated subsystem for IPTV functions

[5] ETSI TS 182 027 V2.0.0 (2008-02) Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IPTV Architecture; IPTV functions supported by the IMS subsystem

[6] ETSI TS 183 063 V2.0.10 (2008-04) DTS/TISPAN-03127-NGN-R2 Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS based IPTV Stage 3 specification - Approved as 17TD022r1

[7] ETSI TS 183 064 V0.1.1 (2008-06) DTS/TISPAN-03137-NGN-R2 Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Dedicated IPTV subsystem stage 3 specification (Pending TB approval)

3 Scope

3.1 DVB Scope

The scope of DVB-IP Phase 1.3 [1] is limited to:

- MPEG-2 transport streams.
- Live Media Broadcast services (but no trick modes over multicast) and Content on Demand services.
- Use of IPv4.

Conditional Access or Content Protection are considered as out of scope because content dependant. Network security and authentication are not addressed in the current DVB-IPTV handbook.

3.2 TISPAN Scope

TISPAN has produced two IPTV service requirements specifications:

- Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Service Layer Requirements to integrate NGN services and IPTV [2]; and
- Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Requirements for network transport capabilities to support IPTV services [3].

The service layer requirements are wide-ranging and really comprise a “wish-list” of requirements that have not all been met in the architecture and protocol specifications.

The IMS-based IPTV architecture [5] and protocol [6] specifications include support for:

- Content on Demand (CoD)
- Broadcast
- Broadcast with trick modes
- Network Personal Video Recorder
- IPTV Presence

The dedicated IPTV subsystem architecture [4] and protocol [7] specifications include support for:

- Content on Demand (CoD)
- Near CoD
- Linear TV (i.e. Broadcast)
- Media broadcast with trick modes
- Network PVR
- IPTV and communicational features integration

The focus of TISPAN's work is on the integration of IPTV in the NGN architecture which includes support of:

- IPv4 and IPv6
- Authentication
- Security

4 Architecture

4.1 DVB-IP Phase 1.3

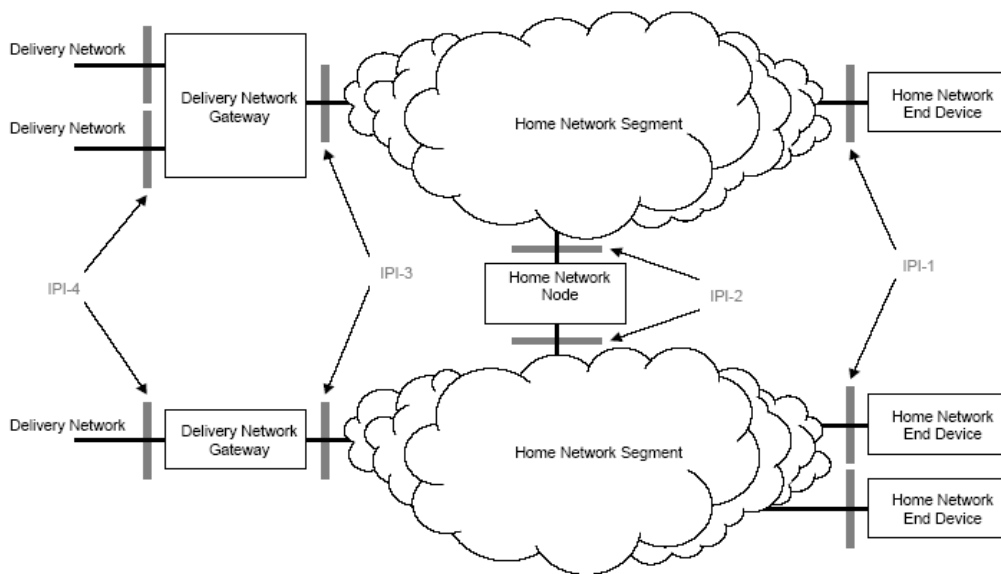


Figure 1. DVB-IP Phase 1.3 Architecture

Although the DVB architecture (as shown in Figure1) includes various Home Network segments and Delivery Network Gateways, only the IPI-1 interface to the Home Network End Device has been defined. All of the capabilities for device configuration, service discovery and selection, streaming control and media transmission are supported on the IPI-1 interface. In ETSI TISPAN the separate capabilities for device configuration, service discovery and selection etc are specified as discrete interfaces between the home network and different network functional entities.

4.2 ETSI TISPAN NGN

4.2.1 IMS-based

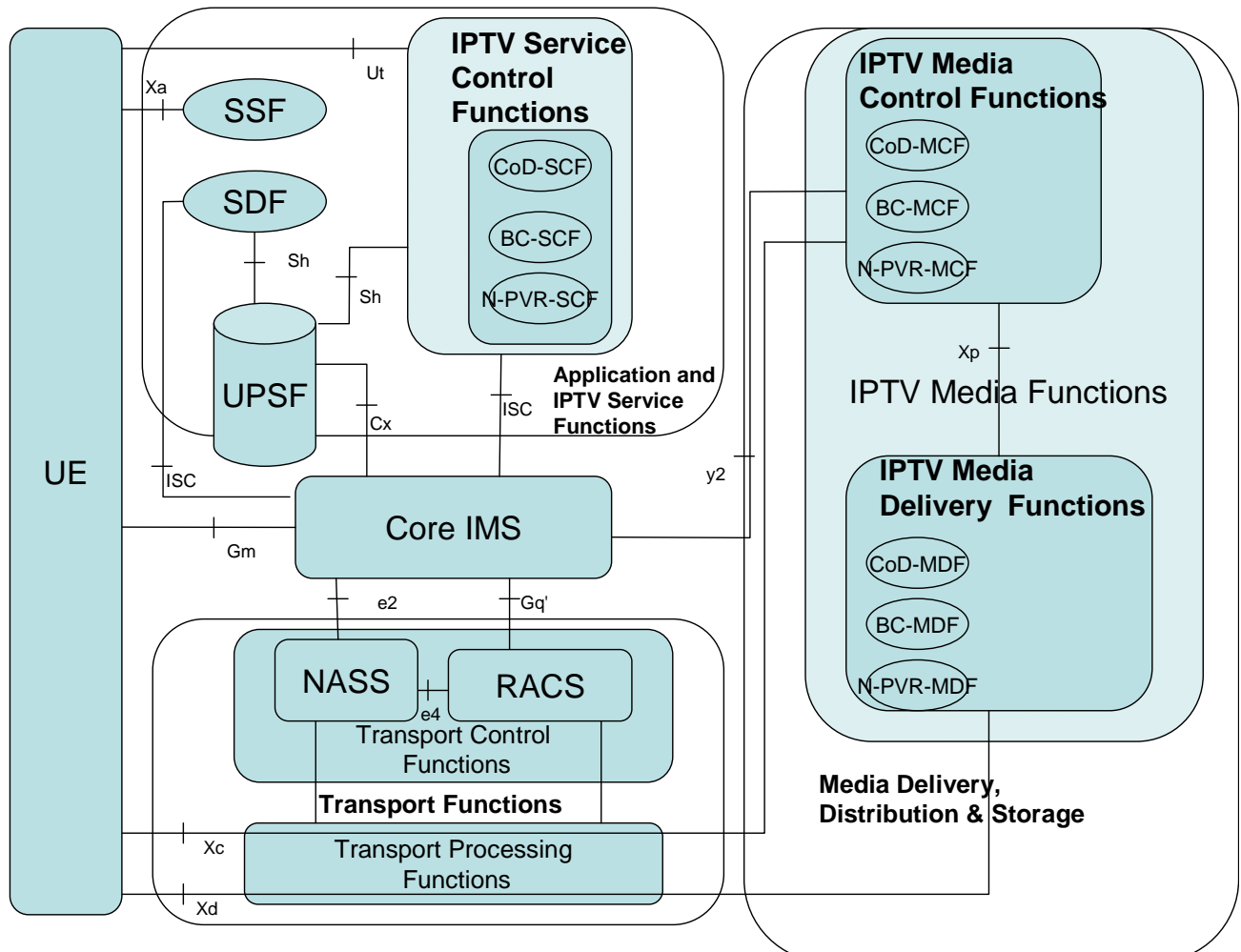


Figure 2. ETSI TISPAN IMS-based IPTV architecture.

In this architecture the IMS is used for IPTV service registration, Service Discovery and IPTV session control. SIP/SDP is used on the Gm, ISC and y2 interfaces. HTTP, DVBSSTP or FLUTE may be used on the Xa interface and the protocol on the Ut interface is HTTP. Streaming control is performed using RTSP/SDP on Xc interface and IGMP is used on the Xd interface. Diameter is used on the e2, Gq', Cx, Sh interfaces.

The procedures are as follows (and illustrated in Figure 3):

- 0) First of all it is needed to start or boot an UE (like a set-top-box, PC, mobile or any device with an IPTV client) and achieve network attachment to obtain network parameters (like an IP address, P-CSCF address, etc.).
- 1) After network attachment the UE initiates the IMS registration process with core IMS.
- 2) UE will perform IPTV service attachment functions including SIP based service discovery to perform SDF tasks.
- 3) Then UE is able to initiate the service selection procedures with SSF via Xa (using HTTP over Xa, using DVBSTP or FLUTE) to receive service selection information.
- 4) The IMS based IPTV UE needs to know and use received service selection information to establish appropriate multimedia session by generating SIP INVITE messages during service initiation procedure (over Gm towards home C-CSCF) send via IMS core to SCF.

NOTE 3: SIP based request for service initiation (SIP procedures is applicable also for service termination or termination) is used for BC service, CoD service or for NPVR Service.

NOTE 4: The core IMS is able to initiate resource reservation process for network resources needed by the IPTV streams according to the capabilities of the UE. The resource reservation and allocation is performed using standardised transport control functions of NGN RACS connected to the core IMS.

- 5) & 6) After the successful session initiation, the SCF informs the MCF via core IMS and y2 interface (or UE in some case like BC) about identification of selected content from the Media Delivery Function (or ECF/EFF in case of BC services) to initiate start streaming the selected multimedia content (CoD, nPVR).
- 7) The UE may control CoD media stream over the Xc interface (between the UE and the MCF) to control media delivery with RTSP protocol. The UE may control BC media stream over the Dj interface (between the UE and the ECF/EFF) to control media delivery with IGMP/MLD protocol.
- 8) The MDF performs media delivery over the Xd interface is based on UDP/RTP stream delivery and several transport variants.

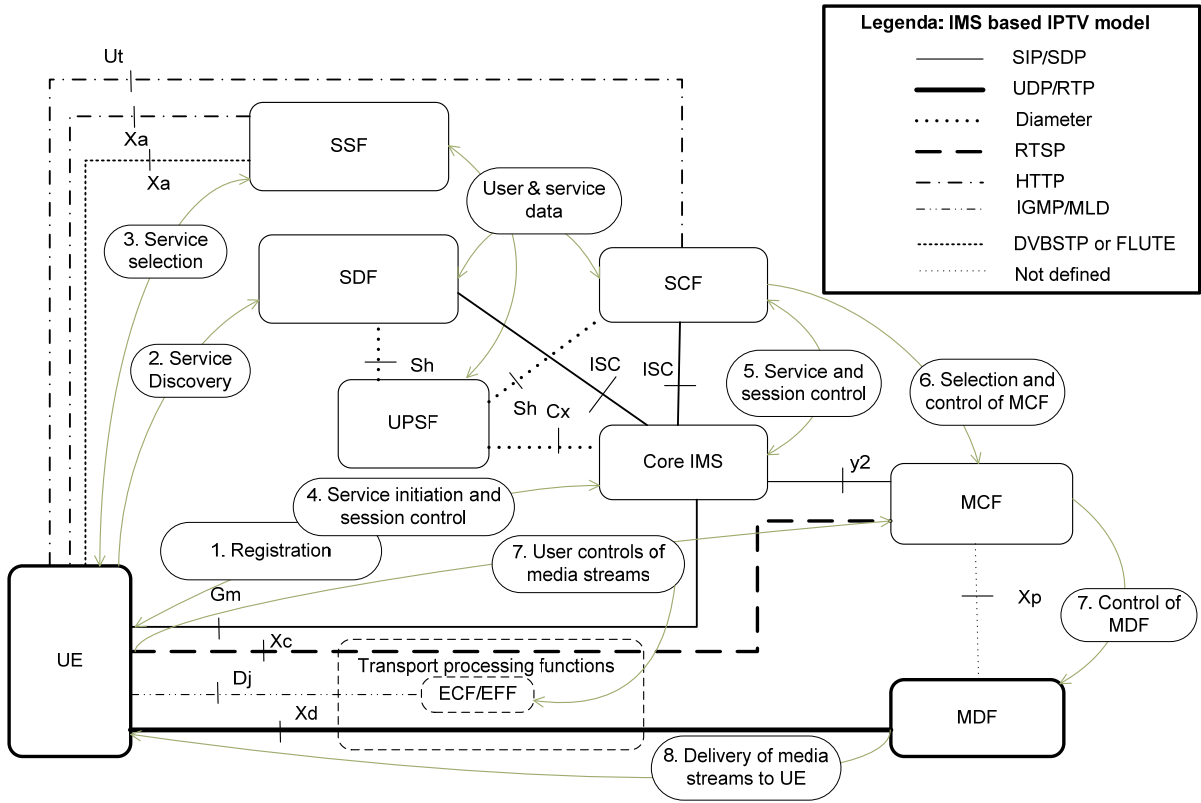


Figure 3. Outline of IMS-based IPTV procedures.

4.2.2 Dedicated IPTV Subsystem

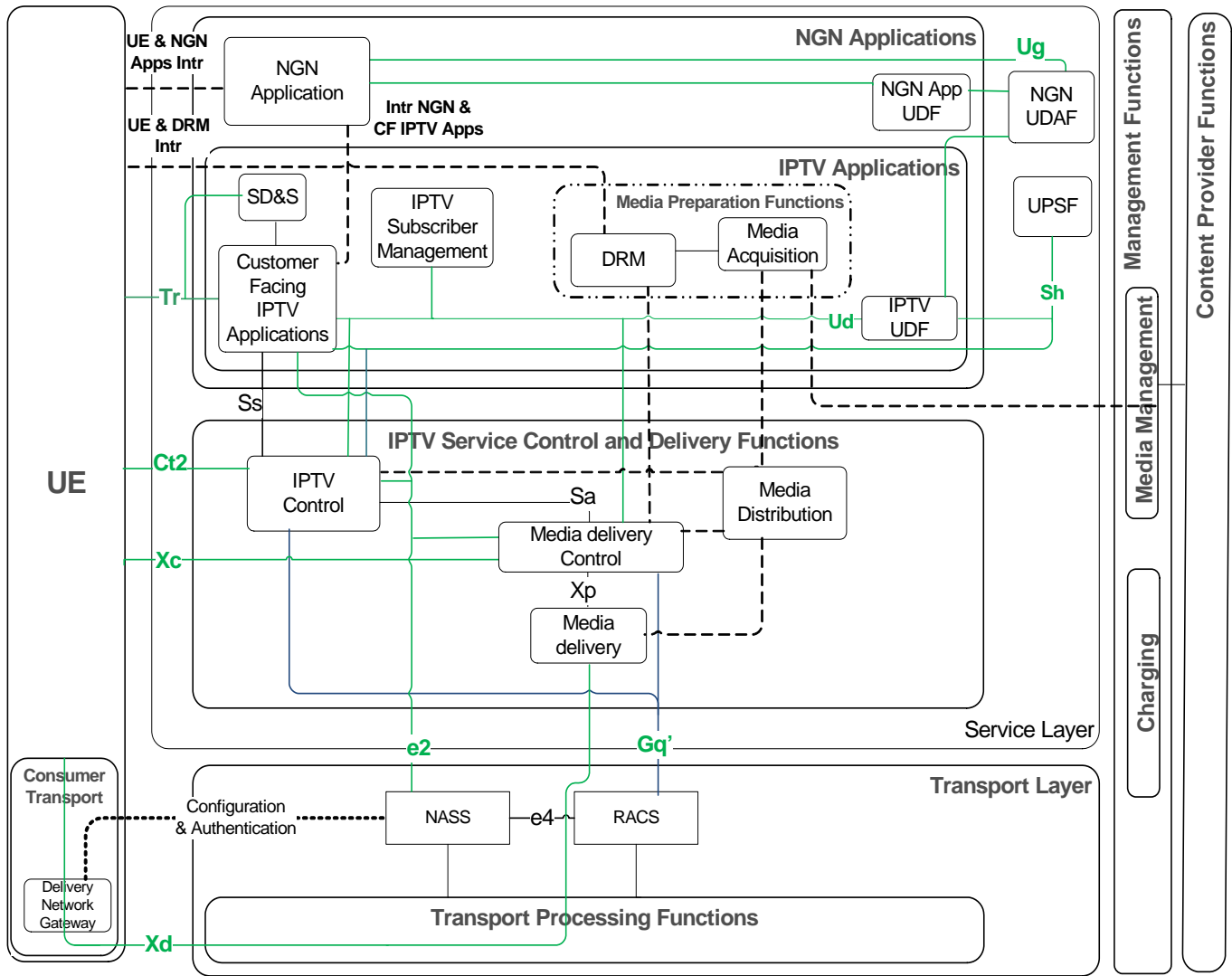


Figure 4. ETSI TISPAN Dedicated IPTV subsystem architecture.

The dedicated IPTV subsystem approach does not involve use of SIP and makes full use of the DVB-IP Phase 1.3 mechanisms while incorporating further capabilities. The main difference in this approach to DVB-IP Phase 1.3 is the use of the TISPAN NGN Transport Stratum and the associated interfaces from IPTV service control functional entities to NASS and RACS.

Outline of Dedicated IPTV subsystem procedures:

1. Configuration using NASS (equivalent to initial DVB procedures)
2. Tr interface used for Service Discovery (HTTP)

3. Ct2 interface used for Service Selection in DVB terminology (RTSP)
4. Xc and Xd interfaces for streaming control
5. Channel switching – IGMP leave & join (or with trick modes: IGMP leave – RTSP setup – RTSP teardown – IGMP join)

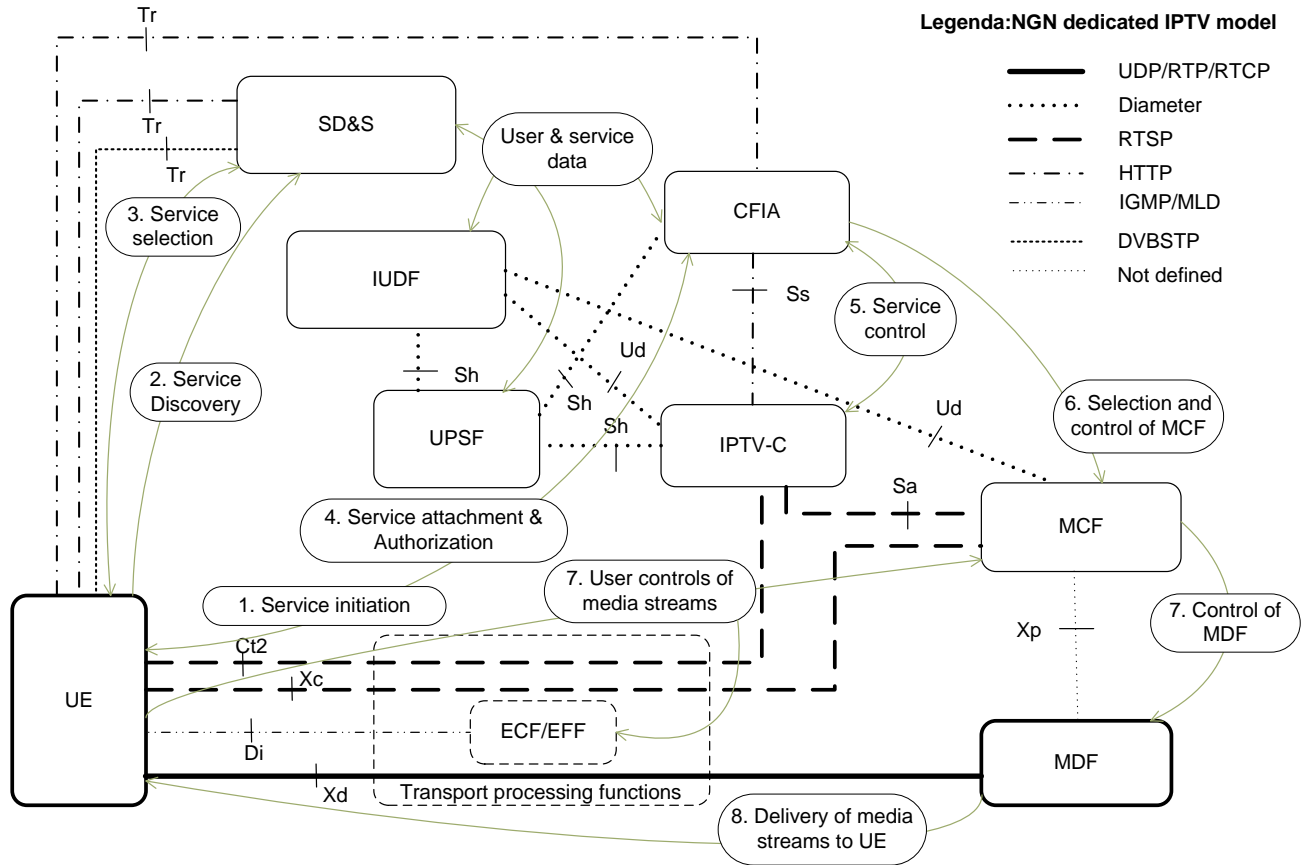


Figure 5. Outline of dedicated IPTV procedures (coupled and decoupled modes).

Dedicated IPTV introduces two operational modes:

Coupled: media delivery function is selected and resource reservation is performed at the time of the service selection (for immediate consumption).

Decoupled: media delivery function selection and resource reservation are deferred to the time when the service will be consumed and is embedded into the service consumption steps (for immediate and later consumption).

Steps

1. Service initiation, configuration-using NASS: initial DVB-IP SD&S procedures are applicable
- 2,3. Service discovery and selection: DVB-IP and DVB-BCG are applicable
4. Service Attachment: http based interface

5. Service Control (optional coupled mode): http based, nomination of media delivery and resource reservation at the service selection stage (immediate consumption case)
6. Media Delivery Selection (optional coupled mode): nomination of media delivery and resource reservation at the service selection stage (immediate consumption case)
7. Media Delivery Setup and Control: RTSP, DVB-IP applicable. In decoupled mode, step 5 is not required, step 6 and RAC are performed during redirect sequence.
8. Media Delivery [RTP \(MPEG2TS/RTP/UDP and MPEG2TS/UDP\)](#), DVB-IP applicable.

5 Initialisation

5.1 DVB-IP Phase 1.3

DHCP with DVB class designators is used by the HNEED to acquire an IP address and other configuration information (section 8.1 of [1]).

The HNEED requires network time services for a real-time clock, logging and optionally for the transport stream. The real time clock in the HNEED should be implemented using RFC 2030, Simple Network Time Protocol (SNTP) Version 4. As an option, Network Time Protocol (Version 3) as detailed in RFC 1305 should be implemented when time services with an accuracy of 1 ms to 50 ms are needed.

5.2 ETSI TISPAN NGN

This phase conforms to ES 283 001 concerning the attachment phase with the NASS. During the session initialization phase, the UE can fetch the information from the CNGCF (CNG Configuration Function) that is necessary to contact the SDF (e.g. the URI).

6 Authentication and Security

6.1 DVB-IP Phase 1.3

Authentication and security are not addressed in the DVB-IP Phase 1.3 specification.

6.2 IMS-based IPTV

UE authentication for connection to an IMS-based IPTV system for both SIP and HTTP communication shall follow ETSI TS 187 003, and may be performed either using the mechanisms specified in TS 133 222 or HTTP Digest access authentication, as described in RFC 2617. The UE shall implement Transport Layer Security (TLS), as described in RFC 2246 for connection to an IMS-based IPTV system.

6.3 Dedicated IPTV subsystem

Authentication can be performed by an Application Server implementing the role of an XCAP server as described in RFC 4825 or by a standalone XDMS server, in which case Tr interface is re-used between UE and the server.

HTTP Digest (RFC 2617) is recommended on the Tr interface. For backwards compatibility HTTP Digest as defined in RFC 2069 may be supported.

MD5 is recommended digest algorithm as defined in RFC 1321, MD5 Message Digest Algorithm.

7 Service Discovery and Selection

7.1 DVB-IP Phase 1.3

The Service Discovery and Selection procedures are as follows:

- 1) Determine Service Discovery entry point(s)
 - may be preconfigured; or
 - the well known multicast address registered with IANA - 224.0.23.14 (DvbServDisc) – can be used; or
 - acquired via DNS - service dvbservdsc, or the server exposed via DHCP option 15
- 2) Collect SP Discovery information from each entry point
 - The Service Provider Discovery Information may be multicast (push model) or retrieved on request (pull model).
- 3) Collect DVB-IP service discovery information from each SP
 - Service Provider Discovery Information holds pointers to the actual service discovery data. It is organized by service type (broadcast, content on demand, packages ...).
 - Service Provider Discovery Information and the Service Discovery Information may be transported by multicast or unicast mechanisms. DVB has defined a new protocol for the delivery of XML records over multicast, DVB SD&S Transport Protocol (DVBSTP). Its use is mandatory for transport of the SD&S information over multicast. HTTP is used to transport the SD&S information over unicast.

7.2 ETSI TISPAN NGN

7.2.1 IMS-based

The Service Discovery and Selection includes two steps:

- a) exchanges with the SDFs: retrieval of SSF addresses through core IMS. A SSF can be linked to a specific service type (broadcast , ...). The SSF metadata can identify what technology a service uses for the publishing of content guides or other services. TISPAN defines two service provider

technologies (DVB-IPTV and OMA-BCAST. The structure of the SSF metadata allows new technologies to be added in the future.

- b) exchanges with the SSFs: retrieval of content information (metadata, connection information ...). This can be done in unicast (DVB pull) or multicast (DVB push) modes.

7.2.1.1 Exchanges with SDFs

7.2.1.1.1 Using SIP

Two possible modes:

- TISPAN Pull mode:
 - o The UE sends a SIP SUBSCRIBE request to the SDF, using "ua profile" event.
 - o The SDF answers with a 200 OK message then a NOTIFY request including XML body (see below).
- TISPAN Push mode: the SDF acts as a third party registration. When receiving the REGISTER request from the core-IMS, it sends a SIP MESSAGE to the UE, including XML body (see below).

The information sent by the SDF as decided during TISPAN 15bis meeting is as followed. It is a list of exposed SSF entities. TISPAN also produced a mapping between the DVB technology (Service Provider Discovery metadata) and the TISPAN table (annex L.1.1)

For each SSF, the following information is sent:

Element Name	Description	Mandatory(M)/ Optional (O)	Many = several instances are possible
SSF	Root element	M	Many
@ID	Identifier for SSF defined uniquely for a given SDF	M	
@Technology	Indicates the technology used for delivering service selection information. Currently defined technologies are "dvb.org_iptv", "openmobilealliance.org_bcast" and "tispan.org_sad" Refer to Annex L for the mapping of Technologies defined in this specification. Refer to Annex O for the	M	

	definition procedure of new technologies.		
@Version	This is incremented when one or more fields in SSF element have changed.	O	
Description	Description of the SSF for potential display in one or more languages. One description is allowed per language	O	Many
ServiceProvider	Provides information about IPTV service provider	O	
@DomainName	The IPTV service provider domain name	M	
@LogoURI	Link for the IPTV Service Provider Logo	O	
Name	Name of the IPTV Service Provider for potential display in one or more languages. One name is allowed per language	M	Many
Description	Description of the IPTV Service Provider for potential display in one or more languages. One description is allowed per language	O	Many
Pull	Provide information to access SSF via Pull Mode	O	Many
@Location	URI of the SSF	M	
DataType	Specifies the type of service selection information available at the SSF (eg, COD, BC).	M	Many
@Type	The type of service selection information. The exact format is determined by the Technology.	M	
Segment	Used to logically separate service selection information.	The mandatory/optional nature of this parameter depends on the SSF Technology and is detailed in Annex L	Many
@ID	Identifier for segment. The exact format is determined by the Technology.	M	
@Version	This is incremented when the information in segment changes.	O	

Push	Provide information to access SSF via Push Mode	O	Many
@IPVersion	Specifies the IP Version (4 or 6). If omitted, then version 4 is assumed	O	
@MulticastAddress	The address to join to in order to retrieve service selection data	M	
@MulticastPort	The destination port corresponding to multicast address	M	
@SourceAddress	The address of the sender of the service selection data	O	
DataType	Specifies the type of service selection information available at the SSF (eg, COD, BC).	M	Many
@Type	The type of service selection information. The exact format is determined by the Technology.	M	
Segment	Used to logically separate service selection information.	The mandatory/optional nature of this parameter depends on the SSF Technology and is detailed in Annex L	Many
@ID	Identifier for segment. The exact format is determined by the Technology.	M	
@Version	This is incremented when the information in segment changes.	O	

This table allows the definition of SSFs that can send different types of discovery information: OMA-BCAST or DVB-IPTV technologies are currently defined in the TISPAN specification for IPTV delivery. The SSFs can also pertain to several service providers (similar to DVB).

This table is in fact very close to the DVB Service Provider Discovery record, but the discriminator is not the Service Provider, it is the SSF entity.

After receiving this information, the UE can contact the SSF to retrieve, for example, OMA-BACST ESG, DVB SD&S or BCG records.

Annex L.1.1 of the TISPAN specification describes the mapping of the DVB SD&S Service Provider discovery record to the TISPAN-defined generic XML schema for service attachment.

7.2.1.1.2 DVB-IPTV non-SIP SDF

Note that usage of a non-SIP SDF is specified as an option in Annex J.1 of *ETSI TS 183 063 V0.0.3 (2007-05) IMS based IPTV Stage 3 Specification*. This allows using the Service Provider Discovery from the DVB-IPTV Handbook.

7.2.1.2 Exchanges with the SSFs

The exchanges between UE and SSF follow the DVB specification (HTTP or DVBSTP) with the inclusion of UE identity in HTTP requests in unicast mode, for personalization purpose.

7.2.2 Dedicated IPTV subsystem

The mechanisms used to identify service providers and services in the context of service discovery conform to the DVB specification in ETSI TS 102034 [1]. The pull model of unicast delivery of DVB SD&S data is specified using HTTP, also in conformance with ETSI TS 102034.

Note that DVBSTP is optional at the UE side.

8 Control of Content-on-Demand and Live Media Broadcast

8.1 DVB-IP Phase 1.3

RTSP with DVB defined Transport header extensions is used for unicast control and optionally as a session layer for multicast streams. IGMP is used for actually connecting/disconnecting to/from multicast streams.

8.2 ETSI TISPAN NGN

8.2.1 IMS-based

SIP is used as session layer for service control for Broadcast and Content-on-Demand services. Procedures are specified for session initiation, modification and termination.

RTSP is used for content control and IGMP is used for joining and leaving multicast groups. To avoid misalignment of SDP information & RTSP URL, DNS lookups and REDIRECTs are prohibited.

For Service initiation the Request-URI in the INVITE request shall include the identifier of the Broadcast service package

Content on Demand service

The UE retrieves CoD content identifiers from the SSF, and possibly network parameters when available.

The UE initiates the session using a SIP INVITE.

Three options are possible:

- The UE includes SDP offer (mapping between information retrieved from SSF and ASDP) in the INVITE message. The SDP offer includes description of media delivery and RTSP channel.
- The UE includes the SDP offer in the INVITE only for RTSP channel. Then RTSP SETUP is done for each media delivery flow and the SIP session is updated subsequently with the SDP for media delivery.

Method 1 does not use RTSP SETUP/TEARDOWN (unless a Session Id is not provided in the SDP offer). Establishment and termination of flows are done using SIP exchanges.

Method 2 uses RTSP SETUP and TEARDOWN in conjunction with SIP messages. Trick-modes are done using RTSP PLAY/PAUSE in every option.

Table 1 - Applicability of RTSP Methods to the IMS-based IPTV solution

RTSP Method	Direction: C = client - UE; S = Server - MCF;	IETF RFC 2326 [11]	DVB Requirement ETSI TS 102 034 [6]		TISPAN IMS based IPTV	
			LMB	MBwTM and CoD	Method 1	Method 2
ANNOUNCE	C→S	MAY	MAY	MAY	N.A.	N.A.
ANNOUNCE	S→C	MAY	SHOULD	SHOULD	Shall	Shall
DESCRIBE	C→S	SHOULD	SHOULD	SHOULD	N.A.	Shall
GET_PARAMETER	C→S	MAY	SHOULD	SHOULD	Shall	N.A.
GET_PARAMETER	S→C	MAY	MAY	MAY	N.A.	N.A.
OPTIONS	C→S	SHALL	SHALL	SHALL	Shall	N.A.
OPTIONS	S→C	MAY	MAY	MAY	N.A.	N.A.
PAUSE	C→S	SHOULD	N.A.	SHALL	Shall	Shall
PLAY	C→S	SHALL	SHALL	SHALL	Shall	Shall
REDIRECT	S→C	MAY	SHALL	SHALL	N.A.	N.A.
SETUP	C→S	SHALL	SHALL	SHALL	N.A.	Shall
TEARDOWN	C→S	SHALL	SHALL	SHALL	N.A.	Shall
SET_PARAMETER	C→S	MAY	N.A.	N.A.	Shall	N.A.
SET_PARAMETER	S→C	MAY	N.A.	N.A.	N.A.	N.A.

RTSP Method	Direction: C = client - UE; S = Server - MCF;	IETF RFC 2326 [11]	DVB Requirement ETSI TS 102 034 [6]		TISPAN IMS based IPTV	
			LMB	MBwTM and CoD	Method 1	Method 2
RECORD	C→S	MAY	N.A.	N.A.	N.A.	N.A.

Note: The text in **bold** shows differences comparing to IETF RFC 2326 [11] table 2.

Annex L.3.1 describes the mapping of SIP and SDP parameters to DVB BCG.

Broadcast service

SIP sessions are used to:

- Allocate/release resources for a set of channels subscribed by the user,
- Download policy in the AN, through RACS procedures. This allows multicast control of channel access (i.e. the UE will can only join channels subscribed by the user)
- Possibly update information during a broadcast session.

Zapping is done using IGMP or MLD. If IPv4 is used, the UE shall support IGMPv3 (RFC3376) and if IPv6 is used, the UE shall support MLDv2 (RFC3810). The use of IGMP is aligned with DVB's usage.

Annex L.2.1 describes the mapping of SIP, SDP and IGMP parameters to DVB SD&S elements.

8.2.2 Dedicated IPTV subsystem

The usage of RTSP and IGMP is in line with the DVB specification. If IPv4 is used, the UE shall support IGMPv3 (RFC3376) and if IPv6 is used, the UE shall support MLDv2 (RFC3810).

Table 2 – Applicability of RTSP methods in IETF, DVB and TISPAN NGN dedicated IPTV (informative).

RTSP Method	Direction: C = client - UE; S = Server - MCF;	IETF RFC 2326 [6]	DVB Requirement ETSI TS 102 034 [5]		TISPAN NGN dedicated IPTV	
			LMB	MBwTM and CoD	Coupled mode	Decoupled mode
ANNOUNCE	C→S	MAY	MAY	MAY	MAY	MAY
ANNOUNCE	S→C	MAY	SHOULD	SHOULD	SHOULD	SHOULD
DESCRIBE	C→S	SHOULD	SHOULD	SHOULD	SHOULD	SHOULD
GET_PARAMETER	C→S	MAY	SHOULD	SHOULD	SHOULD	SHOULD
GET_PARAMETER	S→C	MAY	MAY	MAY	MAY	MAY
OPTIONS	C→S	SHALL	SHALL	SHALL	SHOULD	SHOULD
OPTIONS	S→C	MAY	MAY	MAY	MAY	MAY
PAUSE	C→S	SHOULD	N.A.	SHALL	SHALL	SHALL
PLAY	C→S	SHALL	SHALL	SHALL	SHALL	SHALL
REDIRECT	S→C	MAY	SHALL	SHALL	N.A.	SHALL
SETUP	C→S	SHALL	SHALL	SHALL	SHALL	SHALL
TEARDOWN	C→S	SHALL	SHALL	SHALL	SHALL	SHALL
SET_PARAMETER	C→S	MAY	N.A.	N.A.	N.A.	N.A.
SET_PARAMETER	S→C	MAY	N.A.	N.A.	N.A.	N.A.
RECORD	C→S	MAY	N.A.	N.A.	N.A.	N.A.

9 QoS and Resource & Admission Control

9.1 DVB

The QoS mechanism defined in the DVB-IPTV specification makes use of the Differentiated Services model. Packets are marked to indicate the appropriate per-hop forwarding behaviour. Table 3 indicates the IP DSCP Values, IP Precedence and Ethernet packet markings that are specified.

Table 3. DSCP values and corresponding IP Precedence and Ethernet IEEE 802.1p marking

Traffic Type	IP DSCP Value	IP Precedence	IEEE 802.1 User Priority Value
Voice Bearer	0b110000	0b110	0b110
Video Bearer (high priority)	0b100010	0b100	0b100
Video Bearer (lower priority)	0b100100	0b100	0b100
Voice & Video Signalling	0b011010	0b011	0b011
Best Effort Data	0b000000	0b000	0b000

9.2 TISPAN

9.2.1 IMS-based IPTV

Resource requirements are indicated in SIP/SDP and corresponding requests made of the Resource & Admission Control Subsystem by the core-IMS. Policy can be “pushed” down to enforcement points or “Pulled” from RACS by an enforcement point.

The protocol on the Gq' reference point shall make use of Diameter as specified in ETSI TS 183 017.

Content on Demand service

Basic RACS procedures are used for CoD (i.e. similar to conversational service).

RACS is used for:

- admission control
- resource allocation
- policy (e.g. open/close gates).

Broadcast service

The user indicates the set of BC channels for which the session is applicable and specifies the largest bandwidth of all the BC services indicated in the service package attribute. If the user desires to join a BC service outside of this negotiated set of channels, a session modification is required.

When joining a multicast group traffic policies may be received from the RACS in response to a query from the ECF/EFF (i.e. RACS pull model).

9.2.2 Dedicated IPTV

Resource reservation is performed by IPTV service and control functions via standard Gq' interface. No DVB-IP UE modifications are required. Policy can be “pushed” down to the enforcement points or “Pulled” from RACS by an enforcement point.

The protocol on the Gq' reference point shall make use of Diameter as specified in ETSI TS 183 017.

Central admission control is used for unicast based services and local admission control for multicast based services.

10 Transport of the content

10.1 DVB

DVB mandates the use of MPEG2-TS encapsulation for the content. Then the MPEG2-TS can be transported over the IP network thanks to the RTP/UDP protocols or directly over the UDP protocol. The HNEF must support both methods, while the IPTV service can use only one of them. This ensures interoperability between devices and services.

10.2 TISPAN

10.2.1 IMS-based

Two ways of transporting the IPTV content are possible: with MPEG2-TS encapsulation or without (then it is called direct RTP). MPEG2-TS based transport is done according to the DVB specification. TISPAN refers to 3GPP specs for direct RTP rather than **Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in DVB services delivered directly over IP protocols TS 102 005**.

The UE has to support at least one method. Furthermore when MPEG2-TS is used the UE must support both RTP/UDP and UDP-only methods, while the server (MDF) can support only one of them. This is equivalent to the DVB philosophy.

10.2.2 Dedicated Subsystem

Only MPEG2-TS is defined, following DVB specification. The UE must support RTP/UDP and UDP-only transport methods. The server (MDF) also must support both methods, so this is stronger than the DVB philosophy.

11 Reliable Delivery

11.1 FEC

Both the ETSI TISPAN IMS-based IPTV and dedicated IPTV subsystem Stage 3 specifications support an optional FEC scheme in accordance with the DVB specification.

The IMS-based specification only specifies the use of the DVB-IP AL-FEC Base layer. The enhancement layer of the DVB-IP AL-FEC is out of scope for the release 2 of IMS-based IPTV.

11.2 Retransmission

ETSI TISPAN dedicated IPTV subsystem Stage 3 specifications support an optional Retransmission scheme. The scheme takes the same approach as the work in DVB in accordance with the IETF RFCs 4585 and 4588 for guaranteeing the delivery of the unicast VoD service and broadcast TV services.

12 Interworking of DVB-IPTV systems with TISPAN NGN

The earlier sections of this document have described the differences between the DVB-IP and the ETSI TISPAN NGN IPTV solutions. This section addresses the issue of connecting a DVB-IP HNED to a TISPAN NGN.

The TISPAN dedicated IPTV subsystem is intended to describe “how to integrate DVB compliant UE without modifications and DVB compliant system with minimal modification to the service layer”[7]. However, in the case of connection to an IMS-based IPTV subsystem it will be necessary to adapt the UE (i.e. HNED and gateway). The interworking capabilities required in any particular case will be determined by the options supported by the IMS-based IPTV subsystem as there are many options to support features in a DVB-compliant fashion, as noted in the previous sections. However, at a minimum an interworking function to support the SIP control procedures will be required.

12.1 IMS-based IPTV interworking

The following picture presents the general summary of DVB-IPTV technologies as used in the TISPAN IMS-Based IPTV specification.

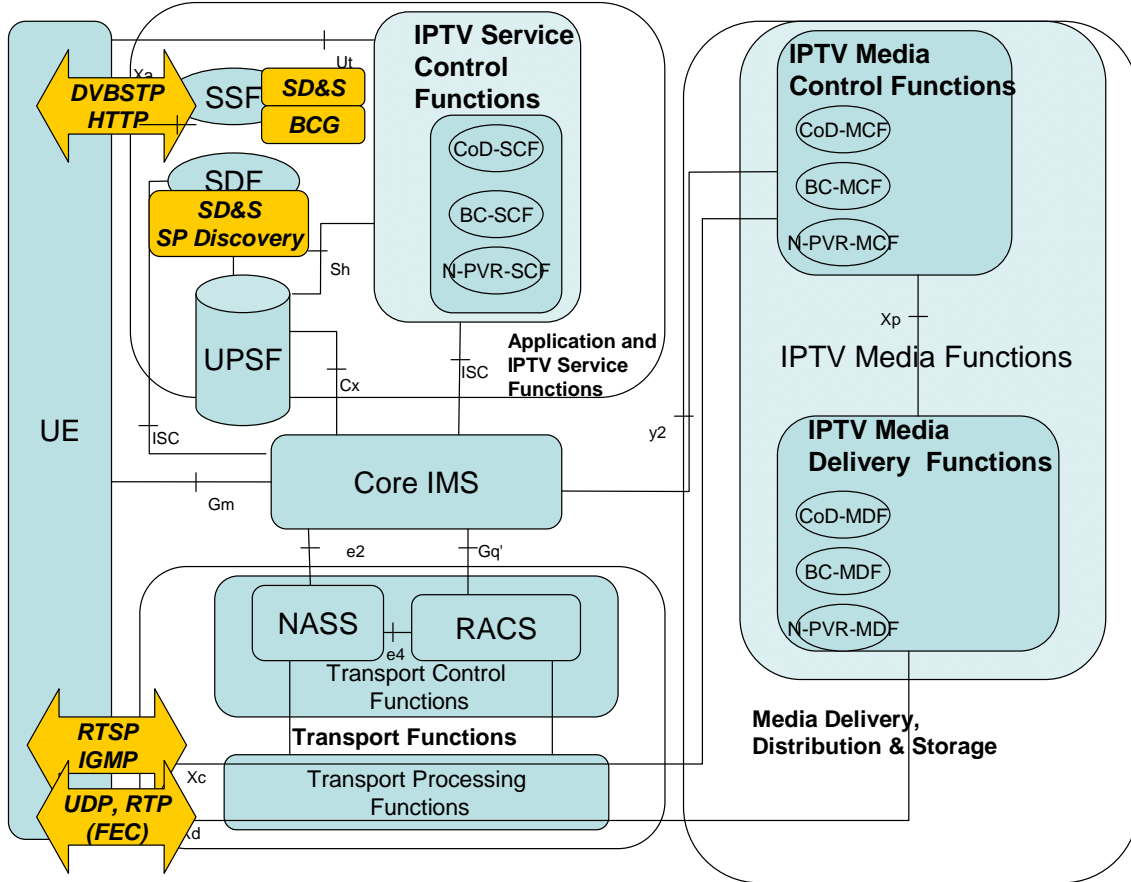


Figure 5 : Interaction between DVB technologies and TISPAN IMS-based architecture

The following table presents parts where DVB technologies are reused, and parts where they are overridden by TISPAN technologies:

Functionality	DVB or TISPAN	Comment
Network Attachment	TISPAN	TISPAN mechanism is based on several steps, close to the DVB approach
Registration	TISPAN	Pure TISPAN technology, nothing similar in DVB
Service Discovery	TISPAN	Done in 2 steps : - SDF discovery done by TISPAN, based on XML schema close to DVB SP Discovery

	DVB	- SSF discovery is the DVB technologies (HTTP, DVBSTP)
Service Connection	TISPAN DVB or TISPAN	Done in 2 steps : - Session initiation is done by TISPAN, based on SIP - Actual Service Selection is done by DVB for LMB (IGMP) and sometimes for CoD (RTSP). TISPAN can also do the RTSP session on its own.
Interactive Delivery Control	DVB	RTSP is used to control the stream (subject to some constraints – see tables 1 and 2).
Service Transport	DVB TISPAN	DVB MPEG2TS over UDP or RTP is used. DVB AL-FEC Base layer is supported. Direct RTP can also be used.

12.2 Integrating a DVB-IP HNED in NGN dedicated IPTV

ETSI TISPAN dedicated IPTV specification “allows integration of new or existing IPTV solutions (such as those defined by DVB, ATIS IIF, ITU etc) within the NGN architecture”. As such, maximum compatibility with DVB-IPTV has been targeted and all applicable DVB technologies have been reused as shown in the following table:

Functionality	DVB or TISPAN	Comment
Network Attachment	DVB	DVB-IPTV (initial SD&S)
Registration	IETF	HTTP Digest Authentication (RFC 2617) and MD5 digest algorithm (RFC 1321) are recommended. DVB has not defined registration.
Service Discovery & Selection	DVB	DVB-IPTV (mandatory HTTP, optional DVBSTP) DVB-BCG
Service Setup and Control	DVB	DVB-IPTV, IETF
Service Transport	DVB	DVB-IPTV: MPEG2TS over UDP or RTP. DVB AL-FEC and Retransmission are optionally supported.