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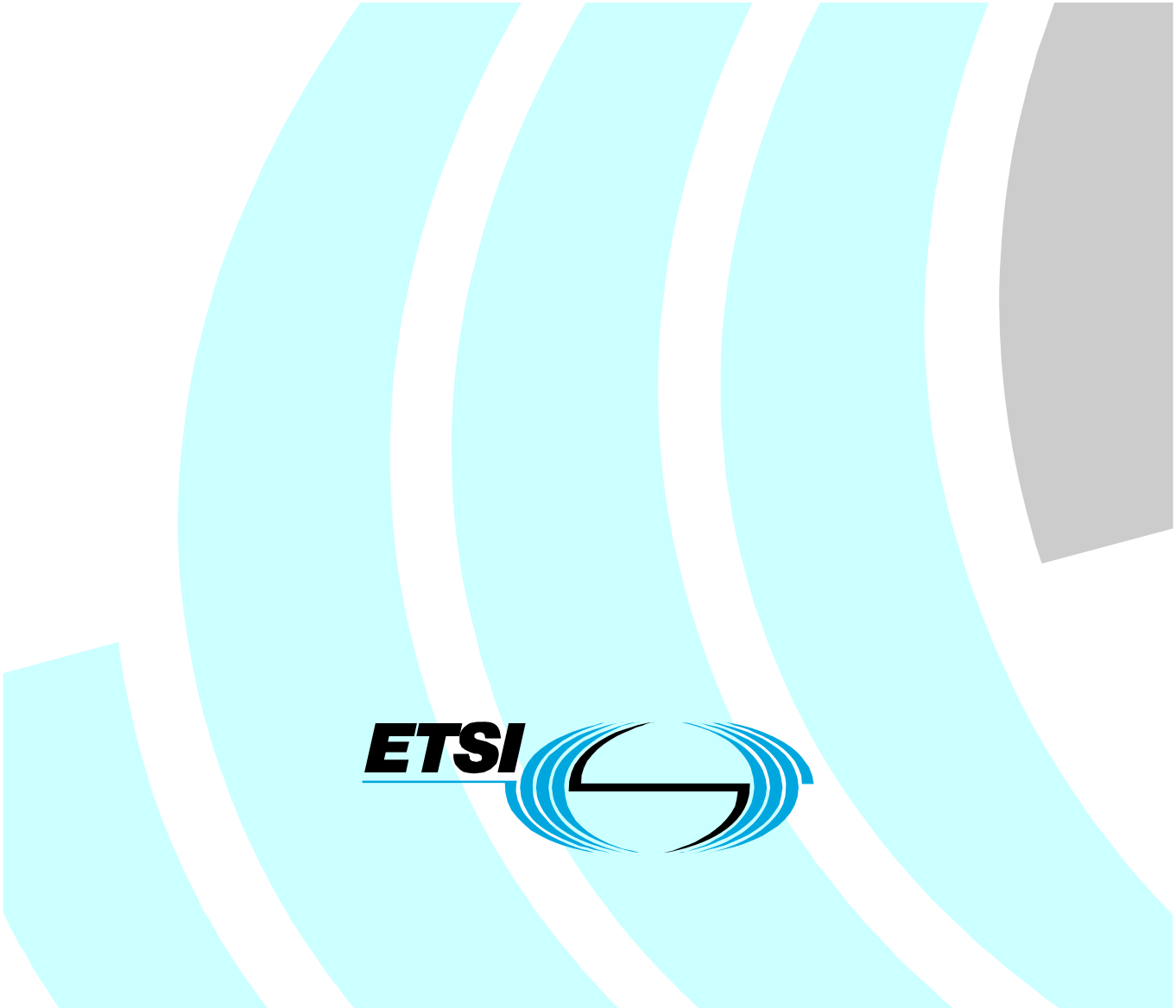
Technical Specification

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Dedicated IPTV subsystem stage 3 specification



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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

1 Scope

The present document provides the stage 3 description of the dedicated IPTV subsystem based on the architecture and stage 2 information flows described in TS 182 028 [4].

The protocol enhancements will form the scope of new or enhanced protocol specifications.

The interaction with other NGN subsystems such as PES, IMS and RACS will be considered.

The current release is applicable to:

- the interface between the User Equipment (UE) and the SD&S;
- the interface between the User Equipment (UE) and Customer facing IPTV Applications (CF-IPTV-Apps);
- the interface between the User Equipment (UE) and IPTV Control (IPTV-C);
- the interface between the User Equipment (UE) and Media Control Functions (MCF);
- the interface between the User Equipment (UE) and Media Delivery Functions (MDF);
- the interface between the Customer facing IPTV Applications (CF-IPTV-Apps) and IPTV Control (IPTV-C);
- the interface for access to IPTV User Data Function (IPTV UDF);
- the interface between the IPTV Control (IPTV-C) and Media Control Functions (MCF);
- the interface for access to NGN User Data Access Function (NGN UDAF).

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ETSI ES 282 001 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture".

[2] ETSI ES 282 004 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture; Network Attachment Sub-System (NASS)".

[3] ETSI ES 282 003 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control Sub-System (RACS): Functional Architecture".

[4] ETSI TS 182 028 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IPTV Architecture; Dedicated subsystem for IPTV functions".

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

[6] IETF RFC 2326 (April 1998): "Real Time Streaming Protocol (RTSP)".

[7] IETF RFC 2617 (June 1996): " HTTP Authentication: Basic and Digest Access Authentication".

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

[9] IETF RFC 2616 (June 1999): "Hypertext Transfer Protocol - HTTP/1.1".

[10] IETF RFC 3428 (December 2002): "Session Initiation Protocol (SIP) Extension for Instant Messaging".

[11] ETSI TS 183 041 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Messaging service using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3: Protocol specifications [Endorsement of 3GPP TS 24.247 Release 6]".

[12] IETF RFC 3856 (August 2004): "Presence Event Package for the Session Initiation Protocol (SIP)".

[13] ETSI TS 182 008 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Presence Service; Architecture and functional description [Endorsement of 3GPP TS 23.508 Release 7 and OMA-AD-Presence_SIMPLE-V1_0]".

[14] IETF RFC 4662 (August 2006): "Session Initiation Protocol (SIP) Event Notification Extension for Resource Lists".

[15] IETF RFC 4825 (May 2007): "The Extensible Markup Language (XML). Configuration Access Protocol (XCAP)".

[16] IETF RFC 5025 (December 2007): "Presence Authorization Rules".

[17] ETSI TS 183 063 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS-based IPTV stage 3 specification".

[18] IETF RFC 3265 (June 2002): "Session Initiation Protocol (SIP)-Specific Event Notification".

[19] IETF RFC 1321 (April, 1992): "The MD5 Message-Digest Algorithm".

[20] IETF RFC 3376 (October 2002): "Internet Group Management Protocol, Version 3".

[21] IETF RFC 3810 (June 2004): "Multicast Listener Discovery Version 2 (MLDv2) for IPv6".

[22] ETSI TS 183 017 (Release 2): "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control: DIAMETER protocol for session based policy set-up information exchange between the Application Function (AF) and the Service Policy Decision Function (SPDF); Protocol specification".

[23] IETF RFC 4585 (July 2006): "Extended RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback (RTP/AVPF)".

[24] IETF RFC 4588 (July 2006): "RTP Retransmission Payload Format".

[25] IETF RFC 3261: "SIP: Session Initiation Protocol".

[26] ETSI TS 184 009 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN) Rules covering the use of TV URIs for the Identification of Television Channels".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] ETSI TS 187 003 (Release 2): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Security; Security Architecture".

3 Definitions and abbreviations

3.1 Definitions

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

UE (converged): end user device, eg set top box or enhanced TV, capable of supporting IPTV services and services provided by other NGN subsystems

3.2 Abbreviations

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

ASF	Application Server Function
BC	BroadCast
BCG	Broadband Content Guide
BTV	Broadcast TV
CF	Customer Facing
CFIA	Customer Facing IPTV Applications
CoD	Content on Demand
CoD-MF	Content on Demand Media Functions
CSS	Cascading Style Sheets
Ct2	interfaces name defined in TS 182 028 [4]
Di	interfaces name defined in TS 182 028 [4]
DVB	Digital Video Broadcast
DVBSTP	Digital Video Broadcasting Service discovery and selection Transport Protocol
ECF	Elementary Control Function
EFF	Elementary Forwarding Function
EPG	Electric Program Guide
FB	FeedBack
FE	Functional Entity
HTTP	HyperText Transfer Protocol

IGMP	Internet Group Management Protocol
IGMPv2	Internet Group Management Protocol version 2
IGMPv3	Internet Group Management Protocol version 3
IMS	IP Multimedia Subsystem
IPTV	Internet Protocol TeleVision
IPTV-C	IPTV Control
IPv4	Internet Protocol version 4
IUDF	IPTV User Data Function
LMB	Linear Media Broadcast
MBwTM	Media Broadcast with Trick Modes
MC	MulitCast
MCF	Media Control Function
MDF	Media Delivery Function
MLD	Multicast Listener Discovery (protocol)
MLDv1	Multicast Listener Discovery version 1
MLDv2	Multicast Listener Discovery version 2
NGN	Next Generation Network
nPVR	network-side Personal Video Recorder
PS	Presence Server
PUA	Presence User Agent
RACS	Resources Admission Control Sub-system
RLS	Resource List Server
RR	Receiver Report
RSI	Receiver Summary Information
RTCP	Real Time Control Protocol
RTCPSSM	RTCP extension for Source Specific Multicast
RTP	Real Time transport Protocol
RTSP	Real Time Streaming Protocol
Sa	interfaces name defined in TS 182 028 [4]
SD&S	Service Discovery and Selection
SDES	Source Description RTCP Packet
SDP	Session Initiation Protocol
Sh	interfaces name defined in TS 182 028 [4]
SIP	Session Initiation Protocol
SMTP	Simple Mail Transfer Protocol
SSRC	Synchronization SouRCe
TCP	Transmission Control Protocol
Tr	interfaces name defined in TS 182 028 [4]
TsTV	Time-shift TV
Ud	interfaces name defined in TS 182 028 [4]
UDP	User Datagram Protocol
UE	User Equipment
UPSF	User Profile Server Function
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
WEB4CE	Web-based Protocol and Framework for Consumer Electronics
Xc	interfaces name defined in TS 182 028 [4]
XCAP	XML Configuration Access Protocol
Xd	interfaces name defined in TS 182 028 [4]
XDMS	XML Data Management Server
XML	Extensible Markup Language

4 Applicability

The following clauses explain the concept and approach used to define the protocols for the dedicated IPTV subsystem.

4.1 Concept and Approach

This clause outlines concept and approach adopted in the present document. The approach is then applied to protocol selections, mapping to interfaces and protocol extensions.

The document focuses on defining protocols for flexible functional architecture described in [4], which can:

- Allow development of new IPTV subsystem in NGN;
- Integrate existing IPTV subsystem in NGN;
- Extend both to support other NGN services.

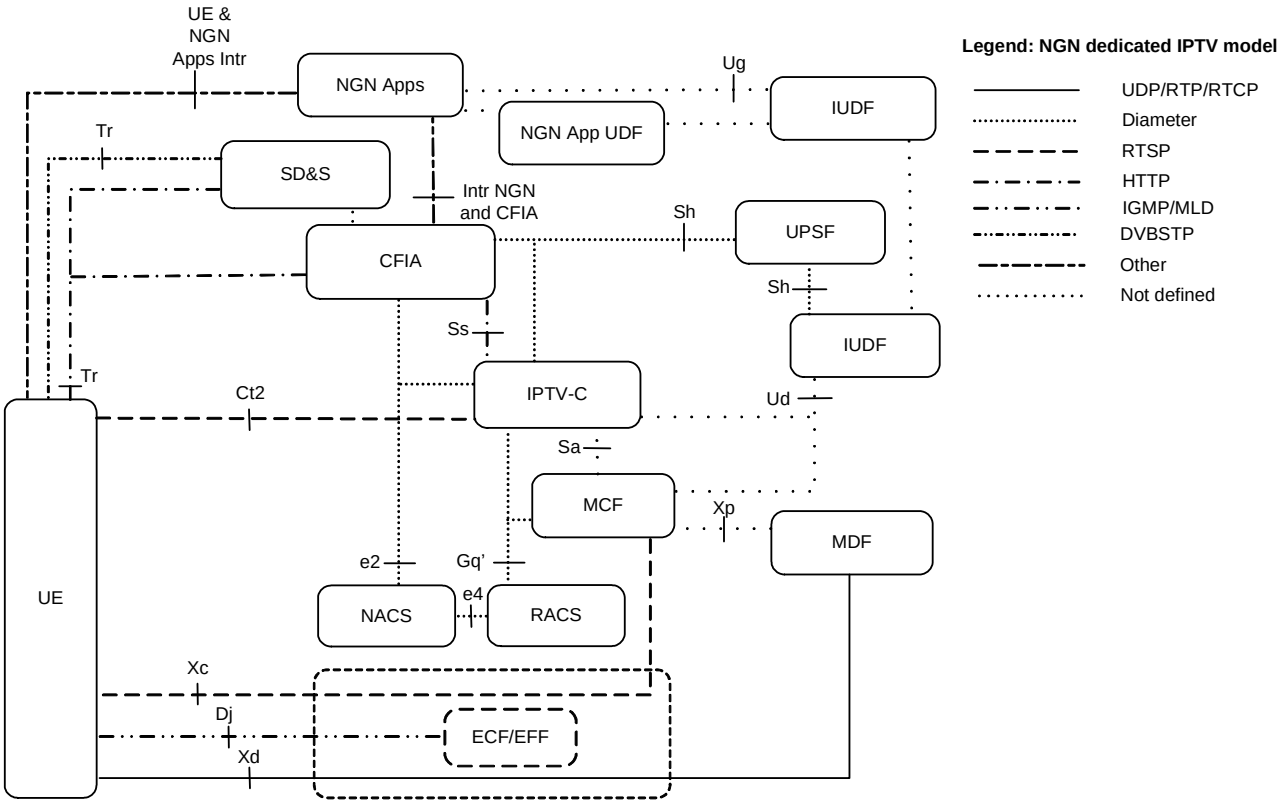
In order to achieve high level of flexibility and support integration of existing subsystems, the work is focused on evaluating and endorsing protocols already defined for similar functions in [5] and other standard bodies. Protocol extensions are defined where applicable as well as overall applicability to the end-to-end architecture [4].

For example, recommendations are made how to integrate DVB compliant UE without modifications and DVB compliant system with minimal modification to the service layer.

4.2 Overview

The clause describes applicability of the protocols discussed further in the present document to reference points defined in TS 182 028 [4]. The overall functional architecture for the dedicated IPTV service conforms to [4].

Figure 1 presents mapping of protocols to interfaces in dedicated NGN-IPTV and to interworking with other NGN subsystems and common components.



NOTE: Xc and Xd are logical interfaces that can be decomposed into Dj and optionally Di, Ds or Iz interfaces depending on the location of the MCF or MDF as described in [4] clause 5.2.5 for Xc and clause 5.1.6 for Xd.

Figure 1: Protocols mapped to NGN dedicated IPTV functional architecture

Table 1: NGN dedicated IPTV functional entities and protocols used on interfaces

FE/ Reference .point (protocol)	UE	IPTV-C	CFIA	SD&S	UPSF	IUDF	MCF	MDF	ECF/ EFF
UE	---	Ct2 (RTSP), (HTTP, Optional)	Tr (HTTP)	Tr (HTTP, DVBSTP)	---	---	Xc (RTSP)	Xd (UDP/ RTP /RTCP)	Dj, Di IGMP/ MLD
IPTV-C	Ct2 (RTSP), (HTTP, Optional)	---	Ss (HTTP)	---	Sh (Diameter)	Ud (not defined)	Sa (RTSP)	---	---
CFIA	Tr (HTTP)	Ss (HTTP)	Sh (Diameter)	(not defined)	---	---	---	---	---
SD&S	Tr (HTTP, DVBSTP)	---	(not defined)	---	---	---	---	---	---
UPSF	---	Sh (Diameter)	Sh (Diameter)	---	---	---	---	---	---
IUDF	---	Ud (not defined)	---	---	---	---	Ud (not defined)	---	---
MCF	Xc (RTSP)	Sa (RTSP)	---	---	---	Ud (not defined)	---	Xp (not defined)	---
MDF	Xd (UDP/ RTP/RTCP)	---	---	---	---	---	Xp (not defined)	---	
ECF/ EFF	---	---	---	---	---	---	---	---	---

NOTE 1: NGN dedicated IPTV protocol model is required to comply with standards applicable for NGN dedicated IPTV as defined below.

Usage of the HTTP protocol across the following interfaces is described in clause 5:

- interface Tr;
- interface Xc;
- interface Ct2 (Optional).

Usage of the HTTP protocol for interactions between NGN Applications and UE is described in annex E.

Usage of the RTSP protocol across the following interfaces is described in clause 6:

- interface Ct2;
- interface Xc.

Usage of the IGMP/MLD protocol across the following interfaces is described in clause 7:

- interface Dj, Di.

Usage of the SIP protocol for interactions between NGN Applications and UE is described in the clause 8.

Usage of the DVBSTP across the following interfaces is described in clause 9:

- interface Tr.

Usage of the RTP/RTCP protocol across the following interface is described in clause 10:

- interface Xd.

Usage of the MPEG2 TS across the following interfaces is described in clause 10:

- interface Xd;
- interface Tr.

NOTE 2: Applications can be transferred as private data streams inside MPEG2 TS. Applicability of MPEG2 TS to Tr interface is outside the current release.

Usage of the AL-FEC protocol across the following interface is described in clause 10:

- interface Xd.

Use of Diameter shall comply to the following specifications:

- [22] and [3] for interface;
- [3] for e2 interface;
- [1] for Sh interfaces.

4.3 Functional Entities

The functional entities that constitute the NGN dedicated IPTV subsystem are defined in TS 182 028 [4]. The following clauses summarize the functionality of each functional entity.

4.3.1 User Equipment(UE)

The UE is a functional entity that provides the user with access to IPTV services.

4.3.2 Service Discovery and Selection (SD&S)

The Service Discovery and Selection (SD&S) is a functional entity that provides description information for discovery of the service as well as information required for description and selection of IPTV services.

4.3.3 Customer Facing IPTV Applications (CF-IPTV-Apps)

The Customer Facing IPTV Application (CFIA) is a functional entity that provides IPTV service provisioning, selection and authorization.

4.3.4 IPTV Control (IPTV-C)

The IPTV Control (IPTV-C) is a functional entity that checks if UE has been authorized by the Customer Facing IPTV Application to use IPTV Service Control and Delivery Functions (provides selection of the Media Control Function).

4.3.5 Media Control Function (MCF)

The Media Control Function (MCF) is a functional entity that provides the UE with functions required to control media flows and manages the MDFs under its control.

4.3.6 Media Delivery Function (MDF)

The Media Delivery Function (MDF) is a functional entity that delivers content data to the UE.

4.3.7 IPTV User Data Function (IPTV UDF)

IPTV user data (IUDF) functional entity is responsible for handling dedicated IPTV user data.

4.3.8 NGN User Data Access Function (NGN UDAF)

NGN Application User Data FE (NGN UDF) is a functional entity responsible for handling NGN application and user data.

5 Procedures using HTTP for dedicated IPTV

5.1 User Equipment (UE)

5.1.1 Procedures for SD&S

Mechanisms used to identify service providers and services in the context of service discovery shall apply conforming to TS 102 034 [5], clause 5.2.

5.1.1.1 Push mode

Push model delivery of BCGs using multicast shall use the DVBSTP protocol for this purpose in alignment with clause .4.1.2 of TS 102 034 [5].

5.1.1.2 Pull Mode

In the pull model of unicast delivery of a DVB SD&S data, the HTTP protocol shall be used conforming to TS 102 034 [5], clause 5.4.2.

In the pull model of unicast container-based delivery of DVB BCG data, the HTTP protocol shall be used conforming to TS 102 539 [8], clause 4.1.2.2.2.

In the pull model of unicast query mechanism of DVB BCG data, the HTTP protocol is used to transport SOAP messages. This shall be conforming to TS 102 539 [8], clause 4.2.

NOTE: Some services such as network PVR, notification may fall outside current [5] SD&S scope. In this case and for additional services the following mechanism may be used:

- The http request may contain other header fields conforming to the [9] and XML records specifying additional service name in the XML format;
- The response to the HTTP requests above shall contain matching XML service definition records or http URL of other SD&S server where this information can be discovered via alternative means.

The additional XML definitions may be discarded by the UE.

5.1.2 Procedure for Service Configuration

One of the following options should be supported.

- An Application Server may implement the role of an XCAP server as described in [15] with standard authentication mechanisms as discussed below.
- Standalone XDMS server may be used, in which case Tr interface is re-used between UE and the server. XCAP usage shall comply with [15].
- Service can be configured over standard http [9]. In this case UE normally implements WEB browser with JavaScript (v tbd) or higher support for running WEB applications.

5.1.3 Procedure for Authentication

HTTP Digest [7] is recommended on the Tr interface.

MD5 is recommended digest algorithm as defined in [19], MD5 Message Digest Algorithm.

5.1.4 Procedure for Customer Facing IPTV Applications

Application interface is based on http protocol between UE (converged) and ASF (Customer Facing IPTV applications).

UE should implement an http [9] compliant web browser with JavaScript support. Special requirement for CSS is to support to enable rendering capabilities.

A particular implementation of the Web Browser is outside the scope of the present document, however, most of widely used browsers can be supported.

Application Gateway may be used on the Tr interface; however, the gateway specification is outside the scope of the prestent document.

5.1.5 Procedure for Notifications

The UE may receive notifications from the CFIA using Tr interface between the UE (converged) and IPTV ASF (Customer Facing IPTV applications) via HTTP protocol [9].

5.1.6 Procedure for Messaging

The UE may initiate and present received messages via CFIA using Tr interface between UE (converged) and ASF (Customer Facing IPTV applications) via HTTP protocol [9].

The UE may initiate and present received messages through interactions with the Common NGN ASF as described in TS 182 028 [4], clause A.

5.1.7 Procedure for presence information

The UE may receive presence information via CFIA on Tr interface via HTTP protocol [9].

The CFIA may use the Presence User Agent (PUA) as described in [12] and [13].

Alternatively, presence Network Agent as described in [13] may be used for IPTV in the Common NGN ASF as a gateway to the NGN Presence Server (PS). The Presence Server or agent can be located in the network.

The PUA can request resource lists from a Resource List Server (RLS) as described in [14] to retrieve presence information from multiple users.

The PUA (or presence network agent if used alternatively) should provide the mapping of IPTV user account to IMS user identities.

UE may inform CFIA about presence status information.

Alternatively presence information may be collected by the PUA or network agent (in Common NGN ASF) and reported to the NGN presence server.

6 Procedures using RTSP for dedicated IPTV

The Real Time Streaming Protocol [6], or RTSP, is an application-level protocol for control over the delivery of data with real-time properties. RTSP provides an extensible framework to enable controlled, on-demand delivery of real-time data, such as audio and video. Sources of data can include both live data feeds and stored clips.

This clause defines usage of RTSP in dedicated NGN IPTV for interactive control between UE and IPTV service control functions: IPTV-C and MCF.

RTSP application for interactive service control over IP multimedia delivery is defined in DVB-IPI [5] and unless stated explicitly otherwise, the application defined in DVB-IPI [5] is used.

Service selection

The service discovery and selection process as defined in clause 5 provides UE with the RTSP URL for initializing interactive multimedia delivery session. The URL discovery methods are discussed in clause 6.1.1 of [5].

The format of RTSP URL shall comply with [7].

Session transport

A *transient* TCP connection is a temporary connection that exists only long enough to transmit one or more requests.

The UE should use *transient* connection for exchanging control messages on Ct2 interface for selecting most suitable MCF function. After MCF is selected there is no need to keep the connection.

A *persistent* TCP connection is a lasting connection between a client and RTSP server, all requests and replies are sent over the same connection, and the connection remains intact until the session is completed. The UE should use persistent connection for RTSP control over interactive media delivery on Xc interface. The usage of persistent connection is discussed in clause 6.1.2 of [5].

Optionally, transient connection can be used on Xc interface.

A method to keep a persistent connection active is discussed in clause 6.1.

Security considerations

Security considerations discussed in clause 6.1.4 of [5] apply.

Optionally HTTP Digest Access Authentication can be applied to RTSP control messages as defined in [7].

Mapping between DVB and TISPAN profiles

The services defined in the service level requirements and dedicated IPTV architecture is identical when mapped to DVB service profiles as defined in table 2.

Table 2: Mapping between TISPAN IPTV services and DVB service profiles

TISPAN Service	DVB Service profile
BTV	LMB
BTV with trick modes	MBwTM
CoD	CoD
Time-shift TV	CoD
Network PVR	CoD

RTSP Methods

RTSP methods supported for each profiles and their definitions are identical to clause 6.3 [5].

The requirement to support XML structures in clause 6.3 of [5] is optional. SDP parameters can be used instead.

RTSP Headers

The pause trick mode operation may be signalled by the standard RTSP PAUSE message as defined in [6].

RTSP scale header with 0 value is optional.

6.1 User Equipment (UE) and Control Functions

6.1.1 Procedure for BTV service

Usage of RTSP protocol for normal broadcast services without trick modes is not defined in the present document.

6.1.2 Procedure for CoD service

NGN dedicated IPTV uses RTSP protocol [6] for control over the delivery of multimedia with real-time properties.

Usage should be compliant with TS 102 034 [5] unless specified otherwise.

Table 3 illustrates RTSP methods in [6], [5] and NGN dedicated IPTV.

Table 3: RTSP methods in [6], [5] and NGN dedicated IPTV

RTSP Method	**Direction: C = client - UE; S = Server - MCF;**	**RFC 2326 [6]**	**DVB Requirement 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.
NOTE 1: N.A. - Not Applicable. The text in bold shows optional difference in the required support of RTSP methods in NGN dedicated IPTV and TS 102 034 [5]. NOTE 2: ANNOUNCE, DESCRIBE, OPTIONS are optional methods which are not shown explicitly on the NGN dedicated IPTV flows, but may be supported by UE and MCF.						

Coupled mode: In the coupled mode Customer facing IPTV applications reserves the delivery resources via IPTV Control on Ss interface and returns the UE RTSP URL with the exact location of the MCF to request interactive media delivery. The format of RTSP URL shall comply with [6].

The UE in the coupled mode shall send RTSP SETUP message containing at minimum RTSP URL, Sequence, and Transport headers to establish video delivery. Sample message flow in the coupled mode is shown in table 4.

Table 4: Sample RTSP message flow in coupled mode

RTSP Method from UE	RTSP Method to UE	Reference point	Notes
SETUP		Xc	UE requested on-demand session from MCF
	RTSP 200 OK	Xc	
PLAY		Xc	UE requested the play-out to start
	RTSP 200 OK	Xc	
GET_PARAMETER		Xc	UE sends heartbeat to keep the session active
	RTSP 200 OK	Xc	
PAUSE		Xc	UE initiated trick mode
	RTSP 200 OK	Xc	
	ANNOUNCE	Xc	MCF made asynchronously announcement to the UE, e.g. "End of stream reached"
RTSP 200 OK		Xc	
TEARDOWN		Xc	UE closed on-demand session
	RTSP 200 OK	Xc	

Decoupled mode: In the decoupled mode Customer facing IPTV applications return the UE RTSP URL with the exact location of the IPTV control. Resource reservation, selection of the exact MCF and session recovery is done via IPTV control at the time when the delivery is requested.

The UE in the decoupled mode shall send RTSP SETUP message containing at minimum RTSP URL, Sequence, and Transport headers to establish video delivery. Sample message flow in the decoupled mode is shown in table 5.

Table 5: Sample RTSP message flow in decoupled mode

RTSP method from UE	RTSP method to UE	Reference point	Notes
SETUP		Ct2	UE requested on-demand session from IPTV control
	REDIRECT	Ct2	IPTV Control nominates MCF and reserves delivery resources
SETUP		Xc	UE requested on-demand session from MCF
	RTSP 200 OK	Xc	
PLAY		Xc	UE requested the play-out to start
	RTSP 200 OK	Xc	
GET_PARAMETER		Xc	UE sends heartbeat to keep the session active
	RTSP 200 OK	Xc	
PAUSE		Xc	UE initiated trick mode
	RTSP 200 OK	Xc	
	ANNOUNCE	Xc	MCF made asynchronously announcement to the UE, e.g. "End of stream reached"
RTSP 200 OK		Xc	
TEARDOWN		Xc	UE closed on-demand session
	RTSP 200 OK	Xc	

Decoupled mode can be used for on-demand session recovery in the real-time, e.g. due to MCF failure. The UE upon detection loss of stream repeats session initiation sequence from table 3, supplying the last position of the received video in the "Range" header of the first PLAY method. The newly allocated MDF continues media delivery from the interrupted position instead of the beginning. If the UE contains sufficient buffering, multimedia session is recovered without visible artefacts.

Using both transient and persistent connection the UE should keep the session active by sending heartbeats in the form of RTSP GET_PARAMETER method at the negotiated time inter RTSP. This method is applicable to any control session during CoD, BTW with trick modes, time-shift TV and nPVR.

6.1.3 Procedure for BTV with trick modes service

Dedicated NGN IPTV media broadcast with trick modes session is a service level aggregation of broadcast and on-demand sessions. Combined session flow is shown in clause 11.3 of [4].

Before starting the service, the UE shall request from the Customer facing IPTV applications RTSP URL from where the interactive media delivery can be requested using RTSP protocol.

The service is started by joining broadcast channel as specified in clause 7. The UE can pause the stream by leaving the broadcast stream as discussed and clause 7 and optionally setup interactive media delivery using identical procedure to the COD service, clause 6.1.2.

Both coupled and decoupled modes can be supported.

In the coupled mode Customer Facing IPTV application nominates a particular MCF for on-demand media delivery.

In the decoupled mode the selection is performed in the real-time during switch to the trick mode.

Sample message flow for BTV with trick modes in the decoupled mode is shown in table 6.

Table 6: Sample message flow for BTV with trick modes in the decoupled mode

from UE	to UE	Reference point	Notes
IGMP JOIN		Xd (Dj, Dl or Ds)	UE requested to join broadcast channel. The Access and Core network performs local admission control. Multicast channel is delivered
IGMP LEAVE		Xd (Dj, Dl or Ds)	UE requested trick mode. UE leaves multicast channel
RTSP SETUP		Ct2	UE requested on-demand session from IPTV control
	RTSP REDIRECT	Ct2	IPTV Control nominates MCF and optionally reserves delivery resources (previously reserved resources can be re-used)
RTSP PLAY		Xc	UE requested the play-out to start
TRICK MODE control on Xc			
TEARDOWN		Xc	UE switches from trick mode
	RTSP 200 OK	Xc	
	ANNOUNCE	Xc	MCF made asynchronously announcement to the UE, e.g. "End of stream reached"
RTSP 200 OK		Xc	
IGMP JOIN		Xd (Dj, Dl or Ds)	UE switches back to life stream. The Access and Core network optionally performs local admission control. (previously reserved resources can be re-used)

6.1.4 Procedure for time-shift TV

In order to provide time-shift TV service, MDF records TV programs available on the broadcast channels. The programs form a part of EPG (BCG) as discussed in clause 5 and should be requested on Tr interface.

After selecting time-shifted content from EPG/BCG, the UE requests from the customer facing IPTV applications RTSP URL for initializing multimedia delivery time-shifted content. The procedure from this point is identical to CoD service defined in clause 6.1.2.

6.1.5 Procedure for nPVR

In order to provide nPVR service, the UE initially selected from EPG/BCG via customer facing IPTV application what content should be recorded in the MDF as discussed in clause 5.

When the recording has been initiated, UE can request from the customer facing IPTV applications with the available recordings. The application of RTSP protocol for content delivery is identical to CoD procedure.

NOTE: Both coupled and decoupled modes are supported for nPVR.

In the coupled mode, client is allocated precise disk quote on a selected MDF. The MCF associated with the MDF is always selected for interactive control over nPVR services.

In decoupled mode, statistical optimizations are possible, e.g. only one or small number of content copies is created and users are redetected to the nearest copies via Ct2 interface using RTSP REDIRECT.

Content delivery's procedure is identical to time-shift TV service, MDF records TV programs available on the broadcast channels. The programs form a part of EPG (BCG) as discussed in clause 5 and should be requested on Tr interface.

6.2 IPTV Control (IPTV-C)

6.2.1 Procedure for BTV service

Usage of RTSP protocol for normal broadcast services without trick modes is not defined in the present document.

6.2.2 Procedure for CoD service

IPTV Control upon receiving SETUP message from the UE on Ct2 interface, responds with the RTSP REDIRECT message containing at minimum sequence and location header.

The location of the nominated MCF is passed in the location header. The header should comply with [6]:

"Location: rtsp://host:port"

"host = <A legal Internet host domain name of IP address (in dotted decimal form), as defined by clause 3.2 [6] >"

"port = *DIGIT"

7 Procedures using IGMP for dedicated -IPTV

During SD&S process the UE shall discover multicast address to access broadcast IPTV services, e.g. BTV, BTV with trick mode.

Broadcast IPTV services are based upon using multicast delivery and signalling as defined in the Internet Group Management Protocol [20]. The IGMP is applicable on the Xd interface.

Xd interface can be subdivided into Dj, Di and Ds [4]. UE should use IGMP on the Dj interface. If the multicast stream is not available at the access network, the access network will propagate IGMP messages on the Di interface.

7.1 User Equipment (UE)

If IPv4 is used for the transport, the UE shall support IGMP v3 as described in [20].

If IPv6 is used for the transport, the UE shall support MLDv2 as described in [21].

Backward compatibility rules between the UE and the Transport Function have to be done conforming [20] clause 7 and [21] clause 8.

7.1.1 Procedure for BTV service

The IGMP protocol shall be used conforming to [5], clause 7.3.1 for:

- initiating the BTV service on the discovered multicast address;
- leaving the BTV service.

7.1.1.1 Procedure for starting to receive multicast

In order to start receiving multicast media stream, the UE is required to join a multicast group.

The UE shall send a Membership Report Message (IGMP) or Multicast Listener Report Message (MLD) for joining in a multicast group.

The message shall be populated as follows:

- Multicast Address field is set to the multicast address to be joined in;
- Source Address field is set to the source address to include if such information is available to the UE and if the protocol version allows it.

7.1.1.2 Procedure for stopping to receive multicast

In order to stop receiving multicast media stream, the UE is required to leave the multicast group.

The UE shall send a Membership Report Message (IGMP) or Multicast Listener Report Message (MLD) for leaving a multicast group, if the multicast protocol version allows it.

The message shall be populated as follows:

- Multicast Address field is set to the multicast address to be left;
- Source Address field is set to the source address to exclude if source address had been included during the join procedure.

7.1.1.3 Procedure for channel switching

In order to operate channel switching, the UE is required to leave the old multicast group and join a new multicast group.

The UE shall send a Membership Report Message (IGMP) or Multicast Listener Report Message (MLD) for leaving and joining in a multicast group.

The message shall be populated as explained in clauses 8.1.1 and 8.1.2.

7.1.2 Procedure for BTV with trick modes service

The IGMP protocol shall be used conforming to [5], clause 7.3.1 for:

- initiating the BTV with trick mode service on the discovered multicast address;
- switching from unicast mode back to multicast delivery modes during trick mode operations as defined in [4];
- leaving the BTV with trick mode service.

7.2 Transport Functions

For IPv4 multicast IPTV service distribution, the network transport functions shall support minimally IGMPv2 or higher. The use of IGMPv3 is recommended, in which case the backwards compatibility rules of [20] clause 7 shall apply.

For IPv6 multicast IPTV service distribution, the network transport functions shall support minimally MLDv1 or higher. The use of MLDv2 is recommended, in which case the backwards compatibility rules of [21] clause 8 shall apply.

8 Procedures using SIP for dedicated -IPTV

8.1 User Equipment (UE)

8.1.1 Procedure for Notifications

SIP is optional on Tr interface between UE and CFIA or NGN Applications. SIP usage should comply with [25].

SIP enabled converged IPTV UE may receive notifications through interactions with the Common NGN ASF as defined in TS 182 028 [4], clause A.

The SIP message body may be used as a generic unified notification container when Common NGN ASF terminates notifications from multiples incoming sources, i.e. IMS-IM (SIP), MMS/SMS (MM7, SMPP), e-mail (SMTP), other for delivery to the UE via single mechanism. The SIP message body may optionally contain actions, which user are allowed to perform. The user can select action(s), which will be passed back to the Common NGN ASF for processing as described in clause A.9.

This procedure shall comply with mechanism described in [18] SIP SUBSCRIBE and SIP NOTIFY.

8.1.2 Procedure for Messaging

If the UE supports SIP protocol, then alternatively text messages may be delivered via SIP MESSAGE format as defined in [10]. SIP message body may be used as a generic unified message container. Common NGN ASF terminates messages from multiples incoming sources, i.e. IMS-IM (SIP), MMS/SMS (MM7, SMPP), e-mail (SMTP), other for delivery to the UE via single mechanism. The SIP MESSAGE body may optionally contain actions, which users are allowed to perform. The user can select action(s), which will be passed back to the Common NGN ASF for processing as described in clause A.5.

9 Procedures using DVBSTP for dedicated-IPTV

The DVBSTP may be supported by UE and SD&S functional entity.

9.1 User Equipment (UE)

9.1.1 Service Discovery and Selection (SD&S)

9.1.1.1 Request of DVB Service Discovery and Selection data

In the DVB push model of multicast delivery of DVB SD&S data, the UE shall attach to the multicast DVBSTP identified conforming to TS 102 034 [5], clause 5.2.

9.1.1.2 Request of DVB Broadband Content Guide

In the DVB push model of multicast delivery of a DVB BCG data, the UE shall attach to the multicast DVBSTP streams identified conforming to TS 102 034 [5], clause 5.2.

9.2 Service Discovery and Selection (SD&S)

9.2.1 Procedure for Service Selection

9.2.1.1 Delivery of DVB Service Discovery and Selection data

In the DVB push model of multicast delivery of DVB SD&S data, the DVBSTP protocol shall be used conforming to TS 102 034 [5], clause 5.4.1.

TS 184 009 [26], which specifies the TV URI as globally unique identifier to identify broadcast television channels may be used in the mapping of BC service for DVB Technology as follows. The ServiceName attribute of the TextualIdentifier of TS 102 034 [5], clause C.3.24, should be populated with the TV URI identifying the television channel [26]".

9.2.1.2 Delivery of DVB Broadband Content Guide

In the DVB push model of multicast delivery of a DVB BCG data, the DVBSTP protocol shall be used conforming to TS 102 539 [8], clause 4.1.2.2.1.

10 Procedures using RTP/RTCP and UDP for dedicated IPTV

10.1 User Equipment (UE)

10.1.1 Procedures for Real-Time Transport

10.1.1.1 Transport using MPEG2TS

The UE shall be able to receive the content encapsulated into MPEG2TS over RTP conforming to TS 102 034 [5], clause 7.1.1.

The UE shall be able to receive the content encapsulated into MPEG2TS over UDP conforming to TS 102 034 [5], clause 7.1.2.

If VBR is used, the VBR shall be capped and resource reservation performed at the cap rate. In this case fixed length GOP is recommended.

10.1.2 Procedure for Real-Time Transport Error Correction

The UE may support a transport error correction mechanism.

10.1.2.1 Unidirectional Transport Error Correction

When unidirectional transport error correction is used, the UE shall be able to receive an Application Layer FEC, conforming to TS 102 034 [5], annex E.

If VBR is used, the VBR shall be capped and resource reservation performed at the cap rate. In this case fixed length GOP is recommended.

10.2 Media Delivery Function (MDF)

10.2.1 Procedures for Real-Time Transport

10.2.1.1 Transport using MPEG2TS

The MDF shall be able to send the content encapsulated into MPEG2-TS. The MDF shall support:

- the transport of the IPTV content within MPEG2TS layer over RTP shall be done conforming to TS 102 034 [5], clause 7.1.1;
- the transport of the IPTV content within MPEG2TS layer over UDP shall be done conforming to TS 102 034 [5], clause 7.1.2.

10.2.2 Procedure for Real-Time Transport Error Correction

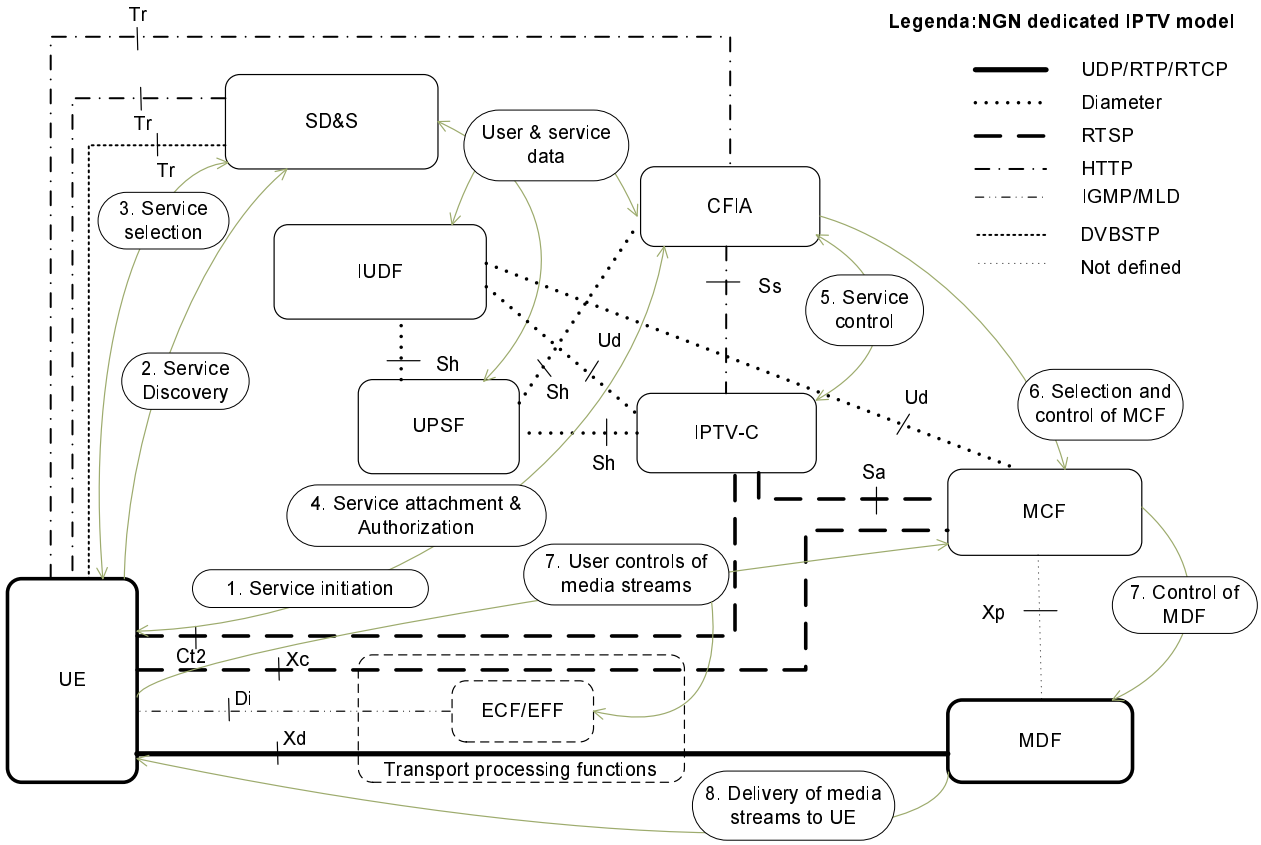
The MDF may support a transport error correction mechanism.

10.2.2.1 Unidirectional Transport Error Correction

For unidirectional transport error correction the MDF shall use an application Layer FEC mechanism, conforming to TS 102 034 [5], annex E.

Annex A (informative): Functional entity relations and example signalling flows of NGN based dedicated IPTV operations

A.1 Functional entities relations and overview of the NGN based dedicated IPTV procedures



NOTE: The above figure represents high level relationships and protocols between the functional entities. The detailed procedures and signalling flows are presented in the following sections of this clause.

Figure A.1: NGN dedicated IPTV - protocol model with FE relation

0) Initially, the UE is required to start or boot (i.e. a set-top-box, PC, mobile or any device with an IPTV client) and perform network attachment to obtain network parameters (i.e. an IP address, P-CSCF address, etc.).

1) After network attachment the UE is required to start service initiation steps.

2) UE performs service provider discovery in order to enable SD&S procedure followed by IPTV service selection and attachment as defined in [4]. SD&S can use HTTP over Tr as describe in clause 6 or DVBSTP over Tr as described in clause 9.

3) Then UE performs the service selection procedures with CFIA via Tr (using HTTP over Tr as describe in clause 6 to receive service selection information.

4) At this stage the IPTV UE needs to acquire and use collected service selection information to establish appropriate selected service via CFIA 5).

NOTE 1: The IPTV-C is able to initiate resource reservation process for network resources needed by the IPTV service according to the capabilities of the UE. The resource reservation and allocation is performed using standardized transport control functions of NGN RACS available to the IPTV-C.

5) Following the successful session initiation, the IPTV-C informs the MCF via Sa interface (or UE in some cases, i.e. BC) about identification of selected content from the Media Delivery Function (or ECF/EFF for BC services) to initiate delivery of the selected multimedia content (CoD, nPVR).

6) The UE may interactively control CoD media stream over the Xc interface (between the UE and the MCF) via RTSP protocol (as defined in clause 6). The UE may control BC media stream over the Di interface (between the UE and the ECF/EFF) with IGMP/MLD protocol (as defined in clause 7).

7) The MDF performs media delivery over the Xd interface is based on UDP/RTP stream delivery and several transport variants (as described in clause A.2).

NOTE 2: Fast Channel Change is being discussed by DVB-IPI for the next release.

A.2 Example signalling flows of service discovery and selection

SD&S mechanisms used for service discovery, selection and the delivery of service discovery information is based upon [5], clause 5.2.

Service discovery enables the discovery of IPTV services available over NGN dedicated IPTV subsystem. The service discovery results in the presentation of services with sufficient information for the user to make a choice and access the chosen service. Selection takes place after the user has made a service discovery.

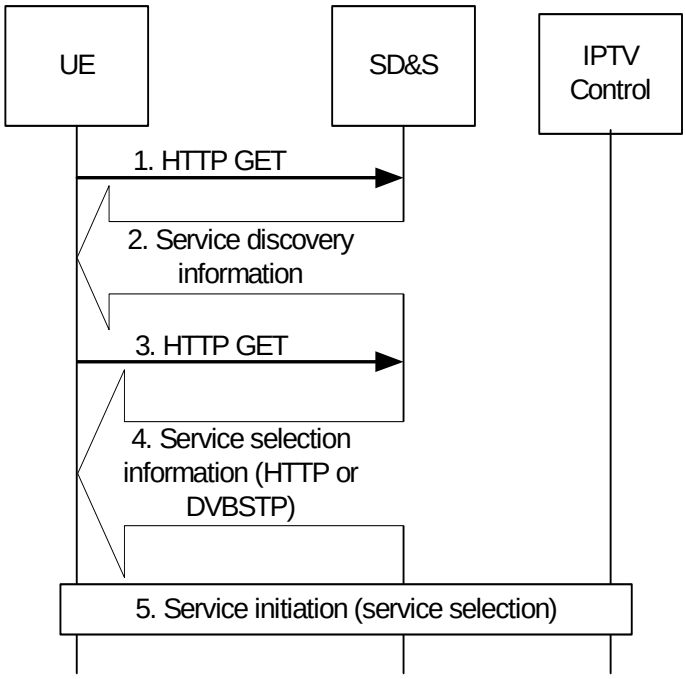


Figure A.2: Service discovery and selection procedures

1) The UE request service discovery information based on [5], clause 5.2. The request may contain other header fields conforming to [9].

2) The SD&S response with appropriate XML based answer to UE request with service delivery information. The response to the HTTP requests above returns the appropriate XML records defined in [5], clause 5.2.6.

3) In the pull model of unicast delivery of DVB SD&S data, the HTTP protocol is used conforming to [5], clause 5.4.2.2.

NOTE: In case of push mode this step is not required.

4) There are two mechanisms defined, one for multicast and one for unicast. The protocol DVB SD&S Transport Protocol (DVBSTP), clause 5.4.1 [5] is used. The protocol HTTP [9] is used to transport BCG [8] information over unicast.

A.3 Signalling flow and protocol RTP/RTCP for Retransmission

Protocol using RTP/RTCP for Retransmission (Retr)Retransmission solution is optional. Procedure may rely on the RTP retransmission solution as specified in [23] and [24], for guaranteeing the delivery of the unicast VoD service and broadcast TV services.

NOTE: RTP/RTCP could be applicable for Fast Channel Change. This work is being discussed by DVB-IPI for the next release.

This clause describes an example of signalling flow for Retransmission.

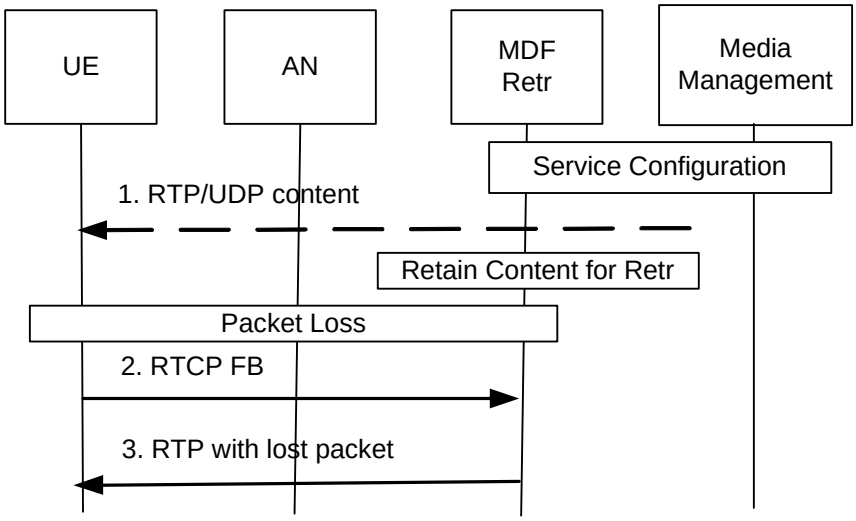


Figure A.3: Retransmission signalling

A.3.1 User Equipment (UE) procedure for BTV service

For BTV service delivered over RTP/UDP, retransmission service functionality may be signalled towards the UEs. The way this is signalled as well as which are the retransmission service configuration parameters is for further study.

When the UE notices that packet loss may have taken place (based on e.g. RTP sequence number gap detection), it may decide to request retransmission of the missing packet(s). This is done by issuing a unicast RTCP Feedback message to a feedback target. The RTCP Feedback message has the format of the generic NACK as defined in RFC 4585 [23]. The destination port and address of the feedback target is configured at the UE. Upon packet loss detection, the UE may wait some time delta T before issuing a retransmission request. This is to allow the feedback target (see further) to send a RTCP FB message. If such a FB RTCP message is received from the FB target indicating packet loss corresponding with the packet loss detection by the UE, the UE should not issue an RTCP FB message itself.

The RTCP FB messages do not have to be sent in compound RTCP messages by the UE (i.e. they can be sent stand-alone without SDES or RR). The feedback target for the RTCP FB messages can be different from the compound RTCP messages (carrying SDES and RR), and the compound RTCP messaging may be even suppressed upon configuration.

The feedback target also hosts the retransmission server from which the UE should expect the retransmissions. The packets that are retransmitted are formatted according to the [24]. The retransmissions can be sent either in unicast or in multicast. When the packets are retransmitted in multicast, they have the same multicast group address of the original MC RTP stream, but a SSRC identifier is used different from the one in the original stream. When the packets are sent in unicast, the SSRC identifier can be identical to the SSRC of the MC stream carrying the original RTP packets.

The UE supports reception of RTCP messages sent by the feedback target over MC with the same MC group address as the MC stream carrying the original RTP packets. These RTCP messages can be RR, SDES, FB messages [23]. As described above, a FB message sent out by the Feedback target towards the UE is used for packet loss signalling in order to have the UE abstaining from FB messages itself for the signalled packet loss.

The FB target may also send out Receiver Summary Information (RSI) RTCP messages. RSI messages are formatted according RTCPSSM draft (reference) and allow to signal e.g. maximum (upstream) RTCP bandwidth that can be consumed by the UE.

The UE can issue multiple retransmission requests to take into account loss of retransmission packets or retransmission requests (RTCP FB message), based on e.g. a time-out mechanism. The maximum number of retransmission requests associated with the same packet loss event that can be issued by the UE is application specific.

The way this is signalled as well as which are the retransmission service configuration parameters is for further study.

The candidate configuration parameters are:

- common IP address of the Feedback Target and Retransmission Server;
- destination Port number of RTCP upstream messages, Destination Port number of unicast RTP retransmissions.

NOTE 1: The above given parameters may be different for each corresponding MC original stream.Optional: separate IP address and port for compound RTCP messaging (RR and SDES).

- Payload type number of RTP retransmission packets.
- Delta T = Minimum waiting time between packet loss event detection and sending out RTCP FB message by UE (to allow reception of RTCP FB messages from Feedback target, which cancel the outstanding UE RTCP FB message).
- Upstream RTCP bandwidth that can be consumed by the UE.
- The time a packet is available for retransmission.

NOTE 2: If DVB-IPI is extended to include configuration parameters they should be applicable.

A.3.2 User Equipment (UE) procedure for CoD service

For CoD service delivered over RTP/UDP, retransmission service functionality may be signalled towards the UEs. RFC 4585 [23] and and RFC 4588 [24] define how retransmissions is supported:

When the UE notices that packet loss may have taken place (based on e.g. RTP sequence number gap detection), it may decide to request retransmission of the missing packet(s). This is done by issuing a unicast RTCP Feedback message to a FB target which may coincide with the CoD server. The RTCP Feedback message has the format of the generic NACK as defined in RFC 4585 [23]. The destination port and address of the feedback target (when different from the CoD server) is configured at the UE.

The RTCP FB messages do not have to be sent in compound RTCP messages by the UE (i.e. they can be sent stand-alone without SDES or RR).

NOTE 1: Compound RTCP messages (carrying SDES and RR) may be even suppressed upon configuration. If used they are sent to the CoD server.

The feedback target also hosts the retransmission server from which the UE should expect the retransmissions. The packets that are retransmitted are formatted according to the RFC 4588 [24]. The SSRC identifier in the unicast retransmission packets is different from the SSRC of the original RTP packet stream, and the same session address/port is used.

The UE can issue multiple retransmission requests to take into account loss of retransmission packets or retransmission requests (RTCP FB message), based on e.g. a time-out mechanism. The maximum number of retransmission requests associated with the same packet loss event that can be issued by the UE is application specific.

The way this is signalled as well as which are the retransmission service configuration parameters is for further study.

The candidate configuration parameters are:

- common IP address of the Feedback Target and Retransmission Server;
- destination Port number of RTCP upstream messages;
- payload type number of RTP retransmission packets;
- upstream RTCP bandwidth that can be consumed by the UE;
- the time a packet is available for retransmission.

NOTE 2: If DVB-IPI is extended to include configuration parameters they should be applicable.

A.4 Example signalling flows of nPVR

This clause describes an example of nPVR signalling . nPVR service as typically delivered as CoD service and the CoD flows from annex C apply.

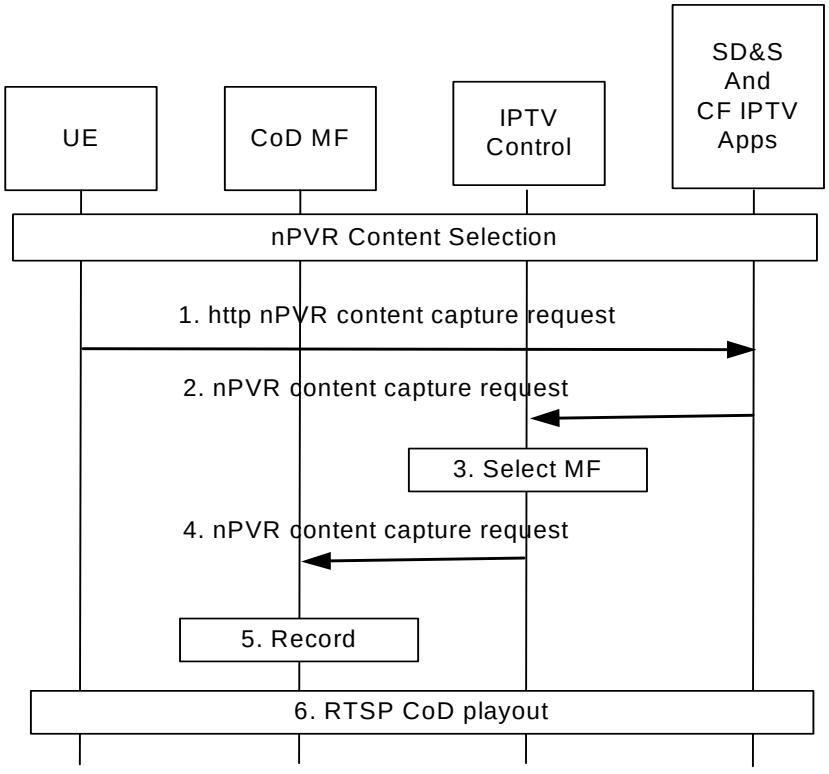


Figure A.4: nPVR signalling flows

User selected Asset from the list of Assets available for nPVR from Customer Facing IPTV application.

1) The UE sends an http request to initiate content capture to the CF IPTV Apps.
2) The CF IPTV Apps asks IPTV control to record the Asset and create recording schedule.
3) The IPTVC selected MDF for the recording.
4) The IPTVC passes the recording schedule to MDF.

5) The MDF records the program.

After the recording has started the program is available as normal CoD asset. Flows defined in annex C are applicable.

A.5 Example signalling flows of IPTV service for messaging

Common NGN ASF should be used for messaging as discussed in clause 5.1.6.

In case messages are delivered via CFIA as shown in figure A.5, the role of Common NGN ASF is to terminate and process multiple incoming messages (i.e. SIP, MM7, SMTP, other) into generic XML schemas, which are then passed to CFIA for presentation to the UE. The responses from the UE via CFIA should be passed back to Common NGN ASF, which will route the messages to the appropriate destination.

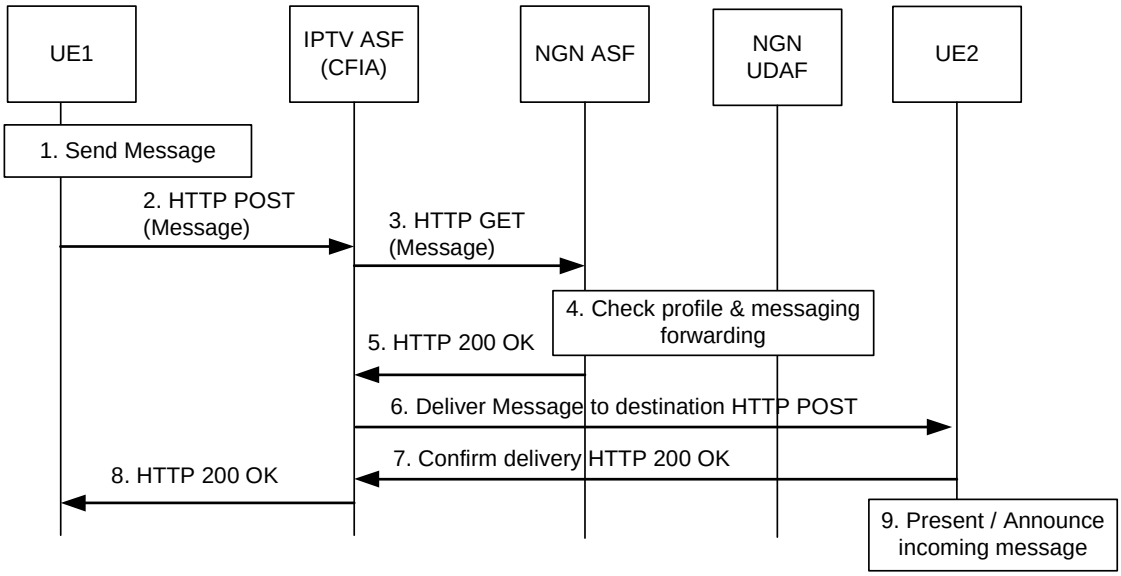


Figure A.5: Messaging between IPTV UEs using HTTP for messaging

The detailed description of the protocols and messages flows:

1) User 1 sends message to the IPTV user 2.

2) The UE1 sends HTTP request with attached message and destination identifier to the CFIA.

3) The CFIA forwards message to the NGN ASF messaging server.

4) According to policies the NGN ASF may request IPTV sub-profile of federalized user profile from NGN UDAF if this information is not stored in NGN ASF. The NGN ASF identified destination UE based on policy and destination information.

5) If based on policies the message could be forwarded to the IPTV UE2, the Common NGN ASF informs CFIA about the incoming message.

6) The CFIA delivers message to UE 2.

7-8) Successful delivery is confirmed to UE 1 via CFIA.

9) The message is presented to user 2.

NOTE 1: The message can be directly delivered from and to Common NGN ASF.

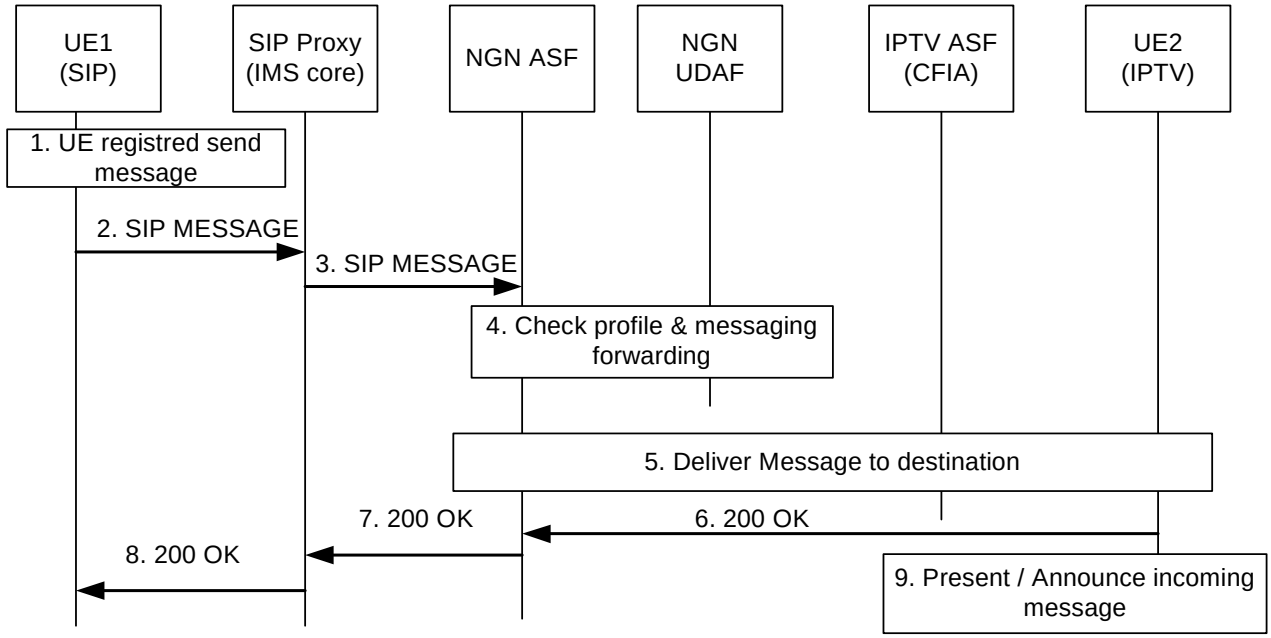


Figure A.6: Messaging between from SIP capable UEs to IPTV UE

1) The UE1 is a SIP capable device, compliant with [10] or for interaction with IMS core compliant with [11].

2) The UE1 generates and sends a SIP MESSAGE to the SIP proxy.

3) The SIP proxy forwards message to NGN ASF.

4) The NGN ASF checks user profile and policy for incoming messages and based on this information it forwards the message to IPTV UE2 network.

5-6) The Message is delivered and presented or stored in message box of the UE2.

7-9) The response is replied back to the UE1 via Common NGN ASF.

NOTE 2: The delivery to the IPTV UE can be both directly from the Common NGN ASF and via the CFIA as described in the above flow.

The flows above are applicable to the delivery of messages from other sources such as IMS-IM (SIP), MMS/SMS (MM7, SMPP), e-mail (SMTP), other to IPTV UE via a single notification interfaces utilizing either HTTP or SIP.

To simplify the message processing, user actions can be packed together with the messages, e.g. to reply to the message or to store the received message in the user message box. The user selection can be passed back to the Common ASF for processing, i.e. to remove message specific processing from the UE. In this case the following XML schema is recommended.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:uep="urn:org:etsi:ngn:params:xml:ns:iptvnotification"
elementFormDefault="qualified"
attributeFormDefault="unqualified">

    <xs:element name="IPTVNotification" type="tIPTVNotification"/>
    <xs:complexType name="tIPTVNotification">
        <xs:annotation>
            <xs:documentation>XML Schema for representing  Notification identified in TS 182 028
clause 5.1.X</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element name="Action" type="tIPTVNotificationAction" minOccurs="1"
maxOccurs="unbounded"/>
            <xs:element name="NotificationDescription" type="tIPTVNotificationDescription"
minOccurs="1" maxOccurs="1"/>
        </xs:sequence>
    </xs:complexType>
```

```
    <xs:element name="tIPTVNotificationAction" type="tIPTVNotificationAction"/>
    <xs:complexType name="tIPTVNotificationAction">
        <xs:sequence>
            <xs:element name="ActionType" type="tIPTVNotificationActionType" minOccurs="1"
maxOccurs="1"/>
            <xs:element name="ActionTypeDescription" type="tIPTVNotificationDescription"
minOccurs="1" maxOccurs="1"/>
        </xs:sequence>
    </xs:complexType>

    <xs:simpleType name="tIPTVNotificationActionType" final="list restriction">
        <xs:restriction base="xs:string">
            <xs:minLength value="0"/>
            <xs:maxLength value="16"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tIPTVNotificationDescription" final="list restriction">
        <xs:restriction base="xs:string">
            <xs:minLength value="0"/>
            <xs:maxLength value="128"/>
        </xs:restriction>
    </xs:simpleType>

</xs:schema>
```

A.6 Example signalling flows of IPTV presence services

A.6.1 Example signalling flows of IPTV presence notification using PA

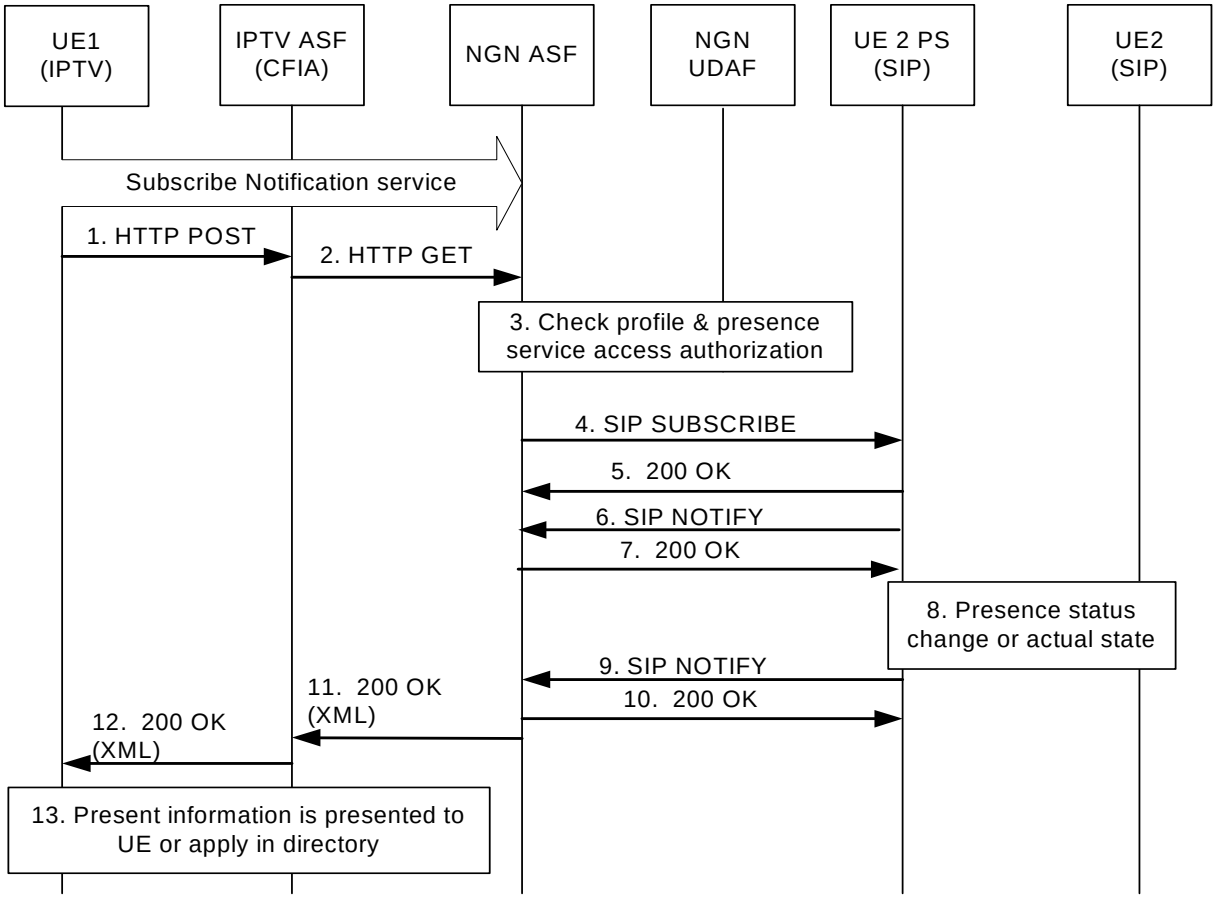


Figure A.7: Presence services to IPTV UE using PA

1) The UE1 may subscribe to presence service information and use HTTP POST to request the information via CFIA.

2) The CFIA forwards the request to NGN ASF to check the user profile.

3) The NGN ASF may check profile and perform authorization for usage of presence service within the IPTV.

NOTE 1: Authorization regarding the submission of presence information from the presence service may use [15] with authorization rules content [16] independently. The exact procedure is outside the scope of the present document. For the current flows it is assumed that UE2 authorized access to the presence.

4) The NGN ASF subscribes to the presence information on behalf of the user.

5) The subscription is confirmed to the NGN ASF.

6) After the initial subscription PS sends initial presence status via SIP NOTIFY (actual presence if any available).

7) The notification is confirmed to the PS.

8) The presence state changes or is published for first time.

9) The PS informs the NGN ASF about presence state change using SIP NOTIFY.

10) Notification is confirmed to the PS.

11) The NGN ASF generates http 200 OK with attached presence information in XML document.

12) The presence information is forwarded to the UE1

NOTE 2: For steps 11 and 12 HTTP POST may be alternatively used to deliver presence information to the UE.

13) The UE1 displays information or updates presence status on user interface.

The Presence User Agent in the Common NGN ASF may report presence directly to the converged IPTV UE in step 11.

The Presence User Agent may perform presence status collection and reporting from NGN IPTV to NGN Presence Server.

A.6.2 Example signalling flows of IPTV presence notification using RLS

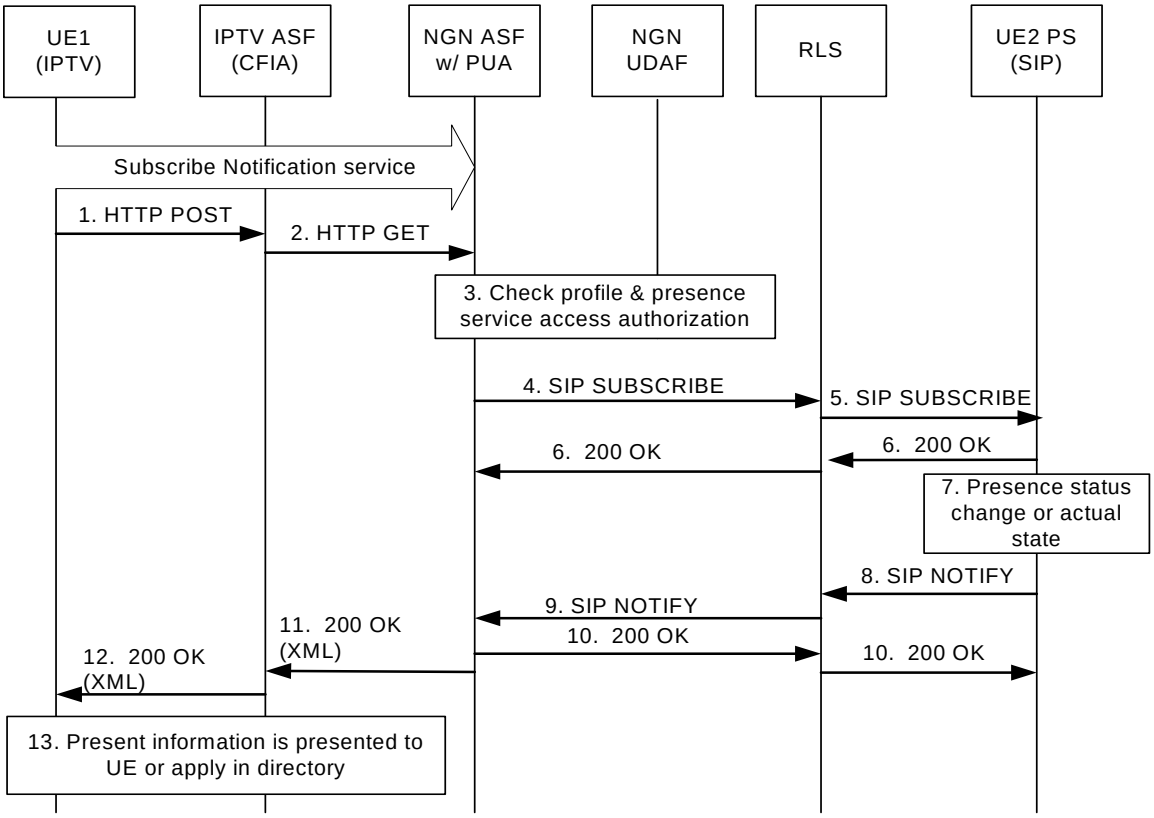


Figure A.8: Presence services to IPTV UE using RLS

1) The UE1 may subscribe to presence service information and use HTTP POST to request the information via CFIA.

2) The CFIA forwards the request to NGN ASF to check the user profile.

3) The NGN ASF may check profile and perform authorization for usage of presence service within the IPTV.

NOTE 1: Authorization regarding the submission of presence information from the presence service may use [15] with authorization rules content [16] independently. The exact procedure is outside the scope of the present document. For the current flows it is assumed that UE2 authorized access to the presence.

4) The NGN ASF subscribes to the presence information on behalf of the user. The request is sent to a Resource List Server as described in [14].

5) The RLS subscribes on behalf of the user also to presence information of all users, In this particular case, the user supplying presence is the UE2.

6) The subscription is confirmed to NGN ASF.

7) After the initial subscription the PS sends presence via SIP NOTIFY (if any is available).

8) The UE2 informs the RLS about changes in the presence state via SIP NOTIFY

9) The RLS sends resource-list notification as described in the [14].

10) The notification is confirmed via SIP 200 OK.

11) The NGN ASF generates http 200 OK with attached presence information in XML document.

12) The presence information is forwarded to the UE1.

NOTE 2: For steps 11 and 12 HTTP POST may be alternatively used to deliver presence information to the UE.

13) The UE1 displays information or updates presence status on user interface.

The Presence User Agent in the Common NGN ASF may report presence directly to the converged IPTV UE in step 11.

The Presence User Agent may perform presence status collection and reporting from NGN IPTV to NGN Presence Server.

A.6.3 Example signalling flows of IPTV presence updates

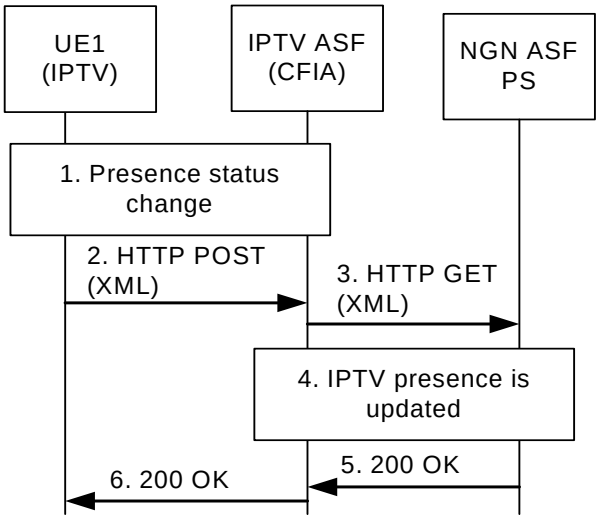


Figure A.9: Presence information about IPTV services used by UE1

The IPTV UE1 may inform IPTV application server about state of services used by the UE1.

1) When new event occurs or IPTV application server makes an update request, the UE1 may send related presence information in XML format.

2) The UE1 generates and sends XML presence state to the CFIA.

3) The information is processed and forwarded to the to the presence agent in the Common NGN ASF.

NOTE: Structure of XML document may follow XML schema defined in [17], annex E: "XML schema for IPTV presence document extension".

4) The presence information is updated.

5-6) The presence update is confirmed to the UE1 via HTTP 200 OK.

Alternatively, the Presence User Agent or Presence Network Agent may perform presence collection and reporting from NGN IPTV to NGN Presence Server.

A.7 Example signalling flows of IPTV service interaction with NGN/IMS services

This clause provides description about interaction procedures between IPTV and other NGN/IMS service level subsystems, e.g. IMS, for composite services. In the data flows it is assumed that both IMS users (IMS UE) are registered in IMS subsystem. The procedure describes several types of the interactive features in converged NGN IPTV applications (e.g. presenting a caller ID of an incoming call on the TV screen).

A.7.1 Example signalling flows of IPTV service handling of incoming calls

In this scenario User 1 calls towards User 2 and both have their IMS UEs in IMS domain. User 2 is subscribed to a converged IPTV service (e.g. caller ID notification with options to accept, forward or reject incoming call when his IPTV service is active) via the IPTV UE (which have service mapping/relationship with IMS UE 2).

There may be supported at least 3 cases for incoming call handling:

- confirm acceptance of incoming call;
- refuse call;
- forward call to voice mail or other terminal.

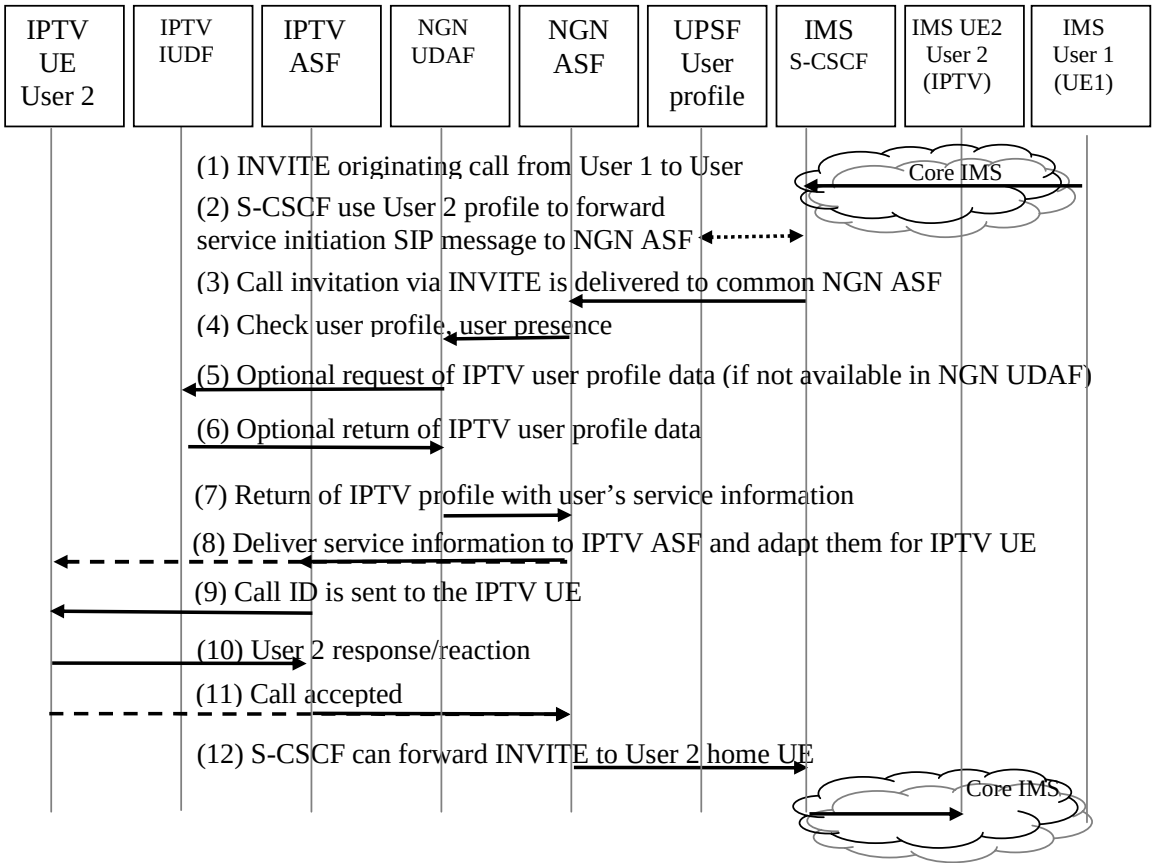


Figure A.10: High level interactions procedure between IPTV and other service level subsystems - NGN/IMS inter-working with NGN dedicated IPTV

NGN ASF should be used for mapping SIP messages to generic XML schemas which should be processed by IPTV ASF that will present information to IPTV UE (and receive/forward user reaction, e.g. confirmation for receiving call back to core IMS) related to user IMS UE.

The detailed description of the used protocols and messages is following:

1) A usual SIP INVITE message with information about destination user, call originating user, type of call, optionally further parameters is forwarded from NGN (core IMS).

2) S-CSCF access user profile data. Dotted line indicates that IMS user profile has been requested from UPSF (at regular IMS registration).

3) Based on IMS user profile the SIP INVITE is forwarded by the S-CSCF to the NGN ASF via ISC interface. NGN ASF acts for the S-CSCF as an IMS AS that can receive SIP messages. A mapping between the SIP identifiers from SIP INVITE message and corresponding IPTV UE device ID (of User 2) can be required. The mapping identifiers may be performed within NGN ASF using information about user stored locally or e.g. in the NGN UDAF (but detail process or place of storage for this information is out of scope for the present document).

NOTE 1: In case that user 1 sends messaging/notification information via SIP MESSAGE to user 2 same mapping of SIP identifiers could be applied for delivery information ant their transformation to presentable format to IPTV UE of user 2.

4) According to policies the NGN ASF may request IPTV sub-profile of federalized user profile from NGN UDAF if this information is not stored in NGN ASF.

5-6) Optionally the request can be also forwarded to IUDF. The exact specification of this is out of scope for the present document.

7) When required user data and service information are delivered and available for the NGN ASF. Further steps are performed if user has subscription for such converged service activated and IPTV UE is online.

8) A mapping from SIP messages to the XML message is performed by the NGN ASF. The XML notification message is used for that delivery and presentation service information to IPTV UE (directly or via Client Facing IPTV application - step 9).

The mapping of relevant information from SIP message to XML have to be generated by NGN ASF including required SIP identifiers and service information (e.g. call line ID transferred in the XML notification message) in form presentable by IPTV ASF (Client Facing IPTV Application) or finally to the IPTV UE. Mapping is following:

- SIP identifiers of destination URI mapped to IPTV UE ID of User 2 (the mapping has been already performed);
- SIP identifier of originating URI with information about User 1 (information who is calling or sending message);
- SDP parameters – optionally service information and parameters about the call like subject, type of call (emergency, priority), etc.

9) The service information can be then presented to IPTV UE from IPTV ASF (via Tr and using HTTP).

10-12) The IPTV ASF may require future action from User 2 on IPTV UE whether user has for example accepted the call or rejected. This response messages are returned back to NGN ASF which will react appropriate way back towards IMS (e.g. forwarding back SIP INVITE to IMS UE of User 2).

NOTE 2: Similar mechanisms may be used also for interaction with other services such as presence or messaging.

NOTE 3: Similar procedure should be used for IPTV interaction with SIP based architecture based on RFC 3261 [25] (in this case SIP proxy is used instead of S-CSCF).

A.8 Example signalling flows of Notifications

Common NGN ASF may be used for notification services to the IPTV UE as described below, i.e. for emergency alerting, advertising or maintenance notification.

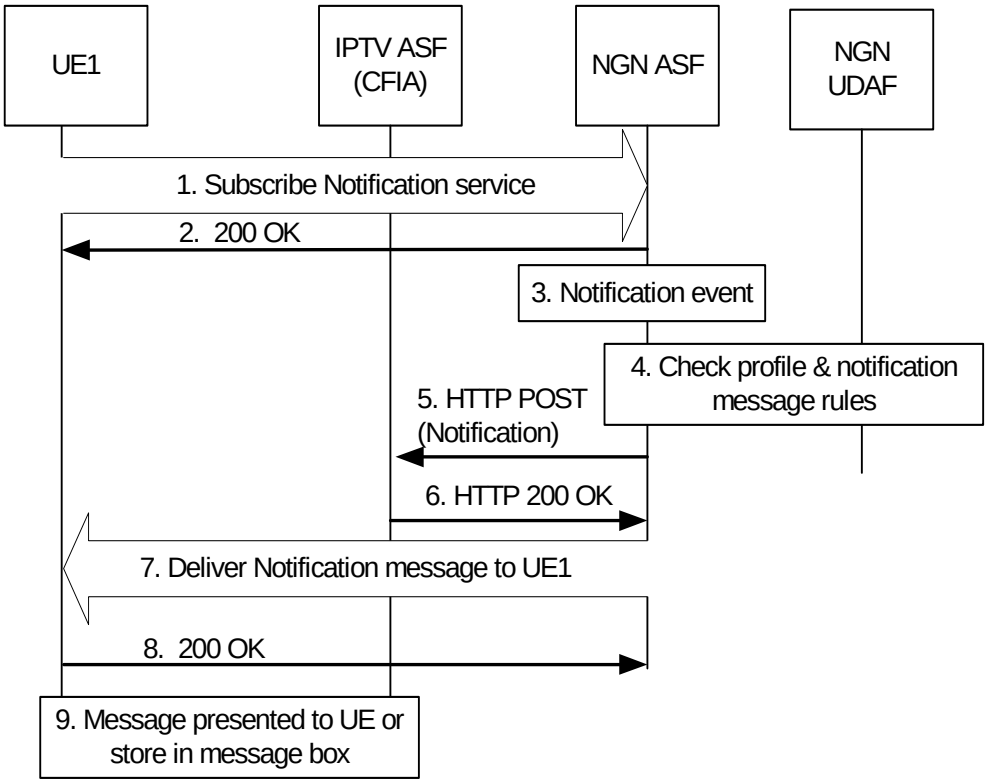


Figure A.11: Notification services to IPTV UE

The description of the protocols and messages illustrated below.

1) The User 1 subscribes to the Notification service.

2) The NGN ASF confirms successful subscription by 200 OK.

NOTE 1: Step 1 and 2 may be performed via CFIA, in this case the steps may be directly between NGN ASF and UE1.

3) The notification event occurs and the NGN ASF performs action to inform the User 1.

4) The NGN ASF may request IPTV sub-profile of federalized user profile from NGN UDAF and policies. The NGN ASF may decide, i.e. based upon received profile or policies, the right UE to send the notification to. In this case the IPTV UE1 is selected, but different UE, i.e. SIP based, may be used.

5) The NGN ASF informs the CFIA about notification event which should be presented to UE.

6) The IPTV ASF confirms receiving information with notification data in XML format (e.g. the UE identifier, notification message, etc.).

NOTE 2: Steps 5 and 6 are not required when direct notification to the UE is used, i.e. SIP based.

7) The notification message is delivered to the UE 1 (via HTTP and Tr interface).

8) The delivery is confirmed to the NGN ASF.

NOTE 3: Steps 7 and 8 may be performed via CFIA or directly between the NGN ASF and UE1.

9) The notification information is present to the user or stored in the UE message box.

NOTE 4: Notification methods should use HTTP over Tr interface. Optionally for SIP enabled UE, the SIP notification should comply with [18].

User actions can be delivered together with the notification and user selection passed back to the Common ASF for processing, i.e. to simplify message processing on the UE and remove specific message processing logic from the UE. In this case XML schema defined in clause A.5 is recommended.

Annex B (normative): UE capabilities and example signalling flows of NGN based dedicated IPTV operations

B.1 UE capabilities

UE supports following specifications:

- HTTP:
  - HTTP protocol shall be used conforming to [5] and follow standard HTTP [9];
  - HTTP Digest [7] is recommended on the Tr interface;
  - MD5 is recommended digest algorithm as defined in [19], MD5 Message Digest Algorithm;
  - UE should implement an http compliant web browser with JavaScript support;
- RTSP:
  - Support of RTSP methods in NGN dedicated IPTV as described in clause 6 (based on RTSP usage in [5]);
  - Optionally HTTP Digest Access Authentication can be applied to RTSP control messages as defined in [19];
- IGMP/MLD:
  - If IPv4 is used for the transport, the UE shall support IGMPv3 as described in [20];
  - If IPv6 is used for the transport, the UE shall support MLDv2 as described in [21];
- Transport and encapsulation based on [5]:
  - The UE shall be able to receive the content encapsulated into MPEG2TS over RTP conforming [5], clause 7.1.1 and MPEG2TS over UDP conforming [5], clause 7.1.2;
- DVBSTP:
  - If DVBSTP for multicast (which is optional for UE) is used then it shall conform to [5], clause 5.2;
- SIP:
  - For SIP capable UE interactions with messaging services, SIP MESSAGE should used conforming to [10];
  - For SIP capable UE interactions with notification services, SIP SUBSCRIBE and SIP NOTIFY should be used conforming to [18].

B.2 Signalling flows of BTV

This clause describes an example of signalling flow of session initiation and termination for BTV.

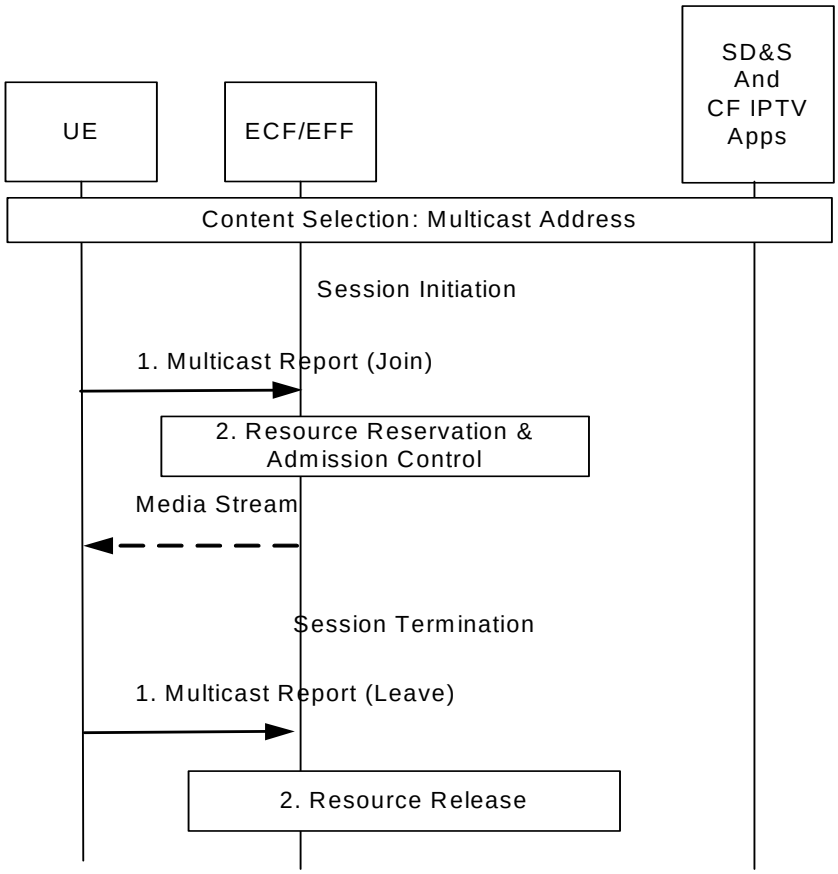


Figure B.1: Signalling flows for BTV operation

ECF/EFF is typically a part of the Access Network as shown on TS 182 028 [4], figure 4.

User selected BTV channel during SD&S process. UE has received multicast address to join.

To start the service:

1) The UE sends a multicast Join request (Membership Report Message (IGMP) or Multicast Listener Report Message (MLD)) to start receiving multicast media stream. The UE populates the message as follows:

   - multicast Address field is set to the multicast address to be joined;

   - if the protocol is IGMPv3 or MLDv2:

     - if source addresses have been advertised, the Record Type is set to "ALLOW_NEW_SOURCES" ECF/EEFd Source list is set to the source addresses;

     - if no source address has been advertised, the Filter mode is set to "EXCLUDE" and Source list is set to "empty".

2) Local resource reservation and admission controlled is performed by the ECF/EEF as defined in [3].

Media stream is delivered.

To leave the service:

1) The UE sends a multicast Leave request (Membership Report Message (IGMP) or Multicast Listener Report Message (MLD)) to stop receiving multicast media stream. The UE populates the message as follows:

   - multicast Address field is set to the multicast address to be left;

   - if the protocol is IGMPv3 or MLDv2:

     - if source addresses have been set in the Join message, the same source address list is excluded from the listening interface; the Record Type is set to "BLOCK_OLD_SOURCES" and Source list is set to the source address;

     - if no source address has been set in the Join message, Filter Change record is set to INCLUDE with an empty source list.

2) Local resource release is performed by the ECF/EEF as defined in [3].

B.3 Signalling flows of CoD

This clause describes an example of signalling flow of CoD session initiation and termination.

B.3.1 CoD Session initiation

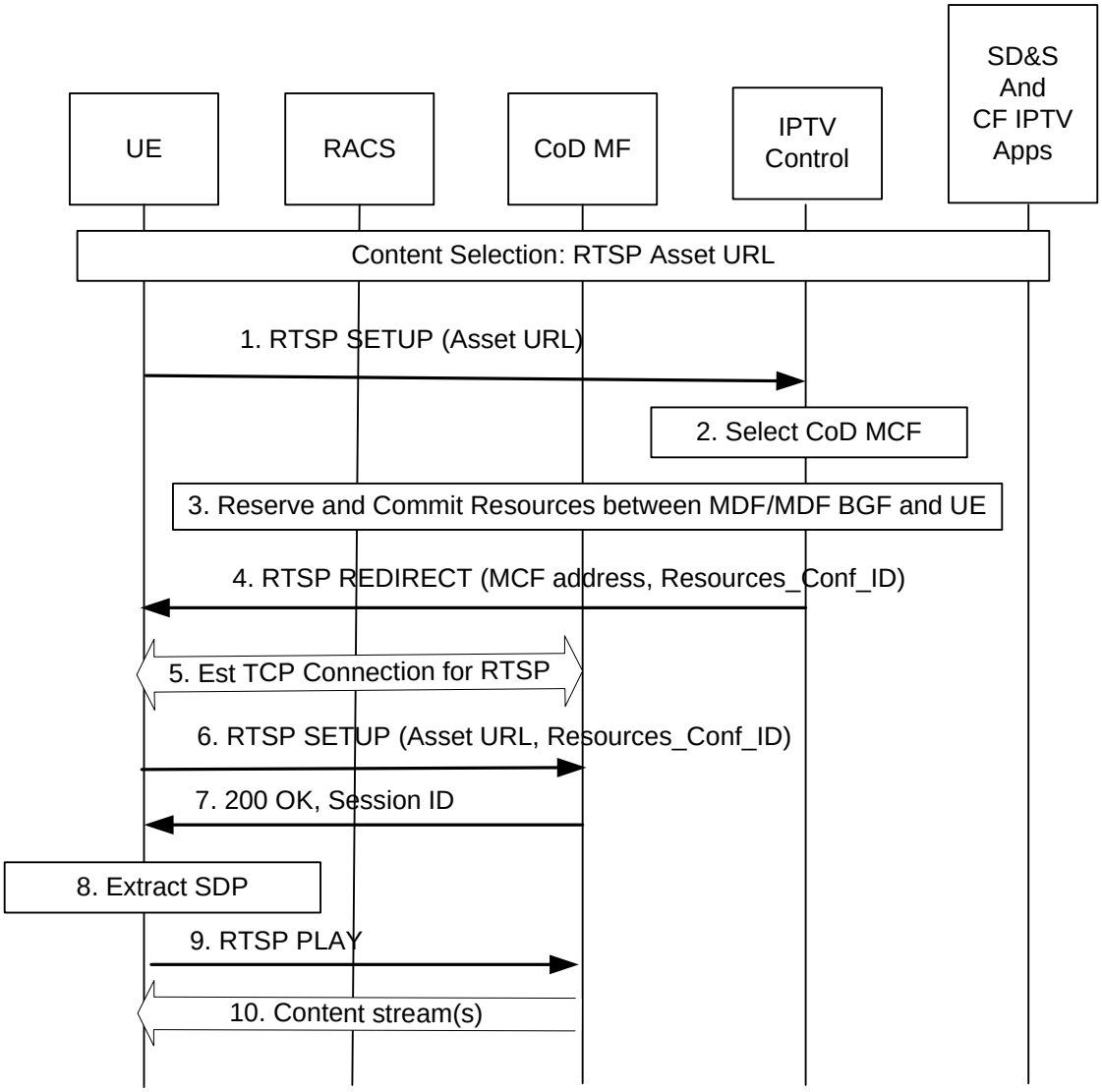


Figure B.2: CoD session initiation

User selected CoD asset during SD&S process. UE has received asset URL.

1) The UE sends RTSP SETUP to the IPTV control with the asset URL.

2) The IPTVC control selects MCF.

3) The IPTVC control reserves resources between MDF and UE.

4) The IPTVC control returns selected MCF in the REDIRECT message.

5) TCP connection for RTSP is established between UE and MCF.

NOTE 1: Optionally RTSP method DESCRIBE may be used before SETUP to request media delivery initialization information from MCF if the parameters have not been sent by IPTV control within REDIRECT sequence (1 to 5).

6) The UE sends RTSP SETUP to the IPTV control with the asset URL.

7) The CoD-MF sends 200 OK with SDP. The SDP contains the session descriptions of UDP/RTP stream to be used.

8) Optionally, the UE extracts the media descriptions from the SDP of 200 OK.

9) The UE sends RTSP PLAY command.

10) The CoD-MF starts sending UDP/RTP content streams to the UE.

NOTE 2: If coupled mode is used for CoD procedure the steps 1 to 4 are not needed (procedure start from step 5).

NOTE 3: After successful authorization of the service request, the key exchange and delivery of security metadata to the UE may be initiated in accordance with the media content protection model as described in TS 187 003 [i.1].

B.3.2 CoD Session termination

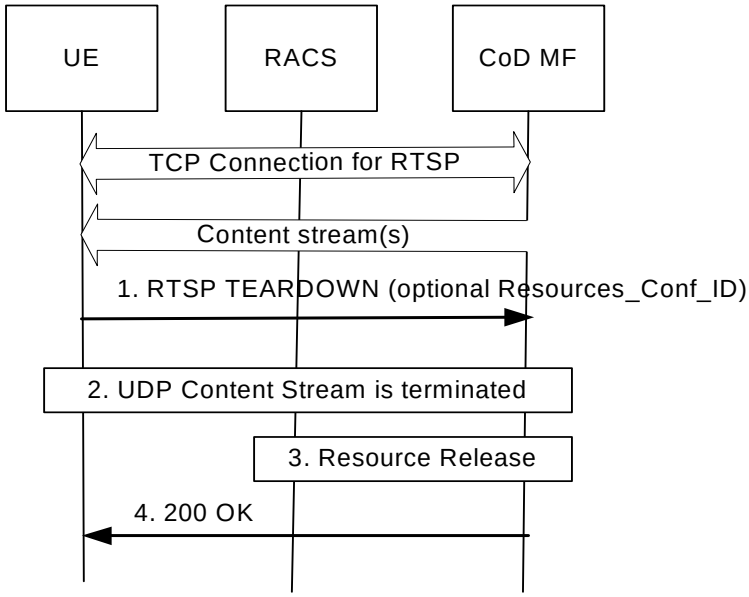


Figure B.3: CoD session initiation

1) TEARDOWN request is sent to CoD-MF.

2) CoD-MF stops sending UDP/RTP content streams.

3) The CoD MF requires for RACS to release resources.

4) The CoD MF responds with 200 OK response.

B.4 Signalling flows of BTV with trick modes

This clause describes an example of signalling flow of BTV session initiation and termination. BTV with trick modes is a superimposition of BTV and CoD sessions in a single service as discussed in [4].

The switch from BTV to trick modes is shown in figure B.4.

ECF/EFF is typically a part of the Access Network as shown on TS 182 028 [4], figure 4.

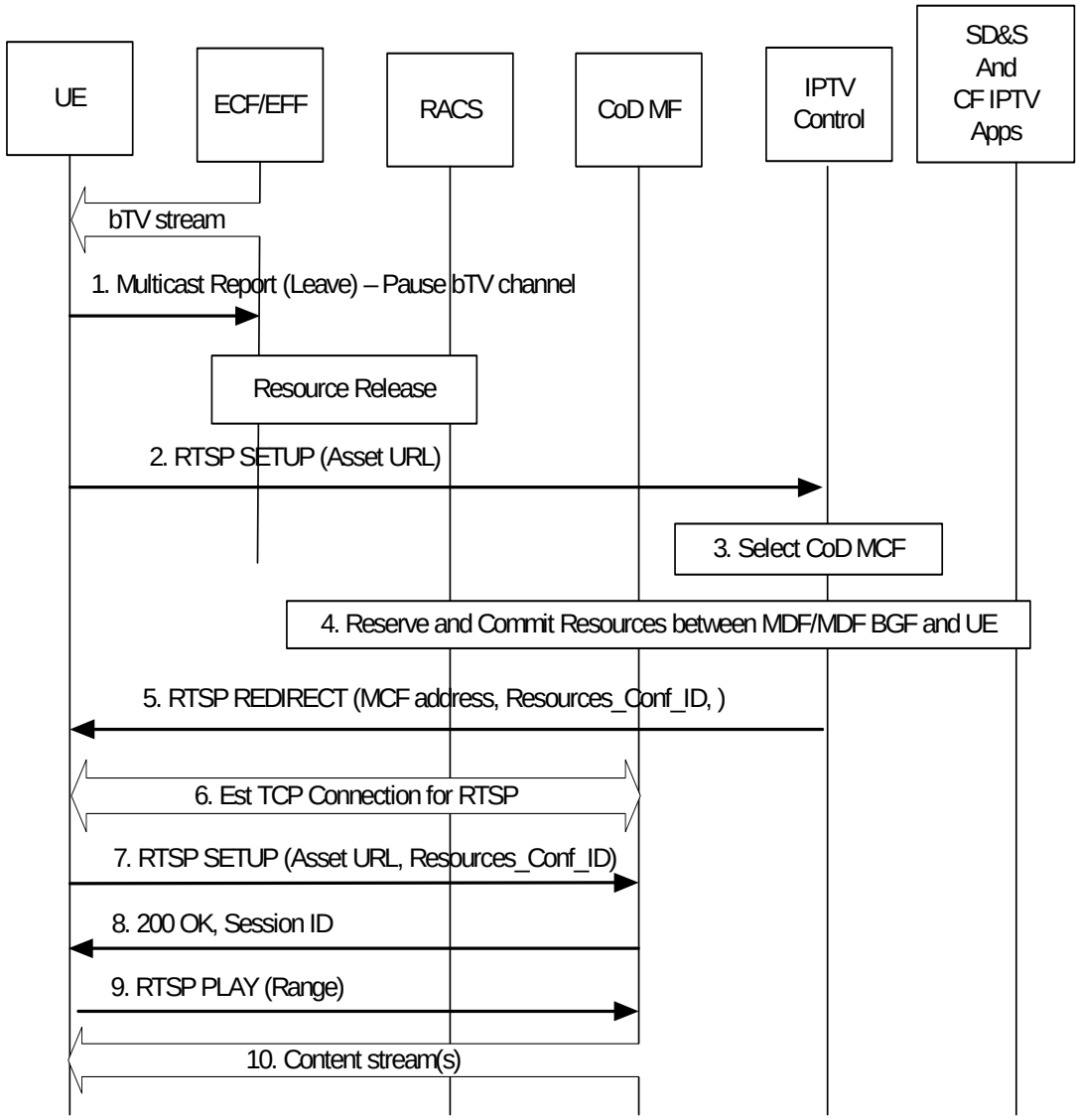


Figure B.4: BTV with trick modes: switch to trick modes

User is watching BTV channel and wants to initiate trick mode.

1) The UE sends a multicast leave request (Membership Report Message (IGMP) or Multicast Listener Report Message (MLD)) to stop receiving multicast media stream.

NOTE: Local resource reservation and admission controlled is performed by the ECF/EFF as defined in [3].

2) The UE sends RTSP SETUP to the IPTV control with the asset URL.

3) The IPTVC control selects MCF.

4) The IPTVC control reserves resources between MDF and UE.

5) The IPTVC control returns selected MCF in the REDIRECT message.

6) TCP connection for RTSP is established between UE and MCF.

7) The UE sends RTSP SETUP to the IPTV control with the asset URL.

8) The CoD-MF sends 200 OK.

9) The UE sends RTSP PLAY command.

10) The CoD-MF starts sending UDP/RTP content streams to the UE.

History

Document history		
V2.1.1	October 2008	Publication