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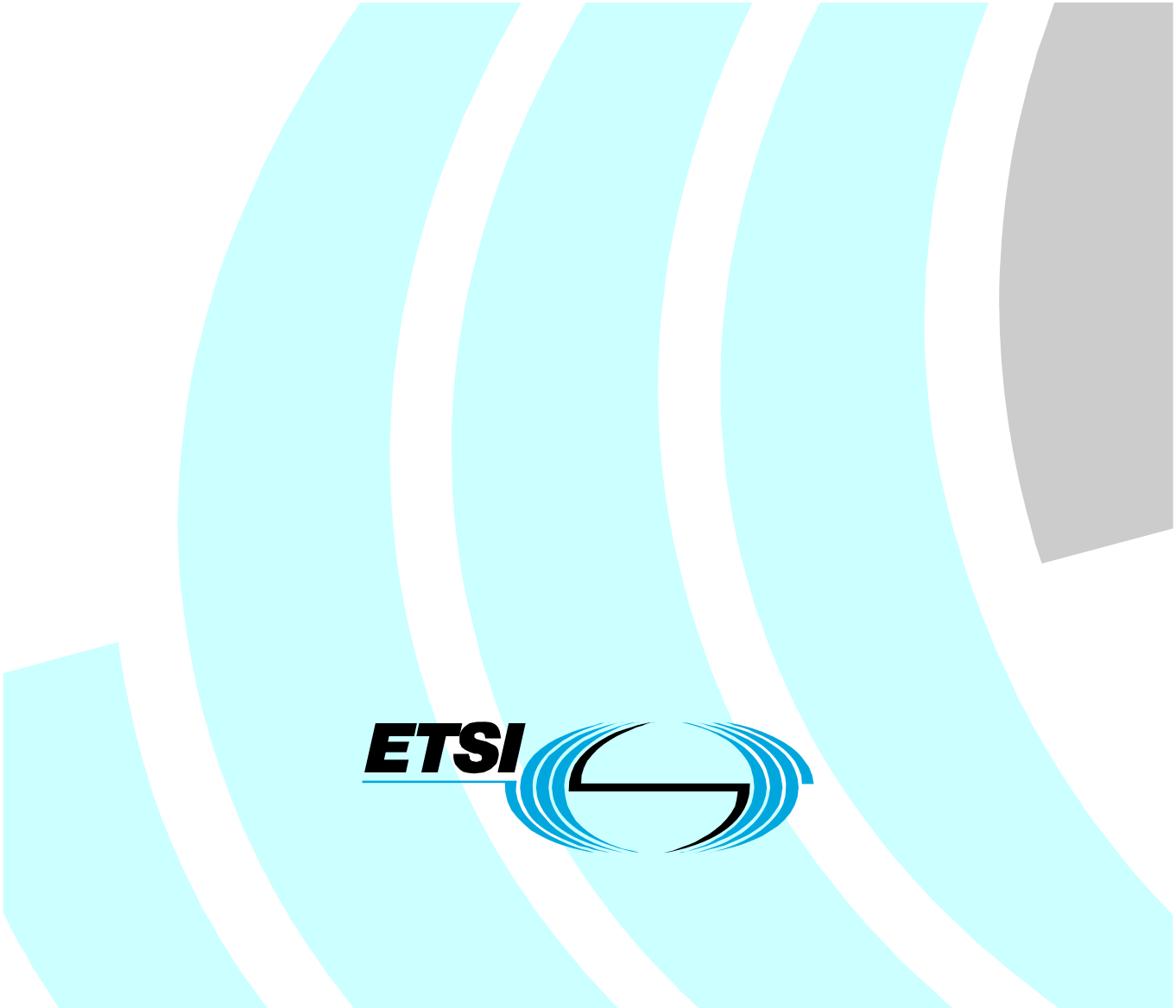
Technical Report

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN based IPTV mapping or interconnect between IPTV systems



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Foreword

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

1 Scope

The present document analyses existing NGN-based IPTV functional architectures (IMS based IPTV, NGN integrated IPTV) and its features.

The scope of the present document includes:

- comparison of architectural aspects between TISPAN NGN based IPTV and 3GPP MBMS/PSS (IMS based or non-IMS based MBMS/PSS) with aim to consider possible mappings of functionalities or feasibility of scenarios for interworking;
- consider IPTV work within other SDOs/Fora with relation to TISPAN NGN based IPTV architecture (e.g. relation with ITU-T IMS/non-IMS based IPTV);
- consider the impacts for providing selected TISPAN IPTV services to mobile UE over existing mobile access networks;
- consider the impacts to support IPTV interconnection models from TISPAN stage 2 specification.

2 References

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

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

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

2.1 Normative references

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

Not applicable.

2.2 Informative references

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

[i.1] ETSI TS 182 027: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IPTV Architecture; IPTV functions supported by the IMS subsystem".

[i.2] ETSI TS 182 028: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN integrated IPTV subsystem Architecture".

[i.3] ITU-T Recommendation Y.1910 (2008): "IPTV functional architecture".

[i.4] ETSI TS 126 237: "Universal Mobile Telecommunications System (UMTS); LTE; IMS based PSS and MBMS User Service; Protocols (3GPP TS 26.237 version 8.0.0 Release 8)".

[i.5] ETSI TS 123 506: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); TISPAN; IP Multimedia Subsystem (IMS); Stage 2 description [3GPP TS 23.228 Release 7, modified] (3GPP TS 23.506 version 8.1.0 Release 8)".

[i.6] ETSI TS 123 002: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Network architecture (3GPP TS 23.002)".

[i.7] ATIS-0800007: "ATIS IPTV High Level Architecture".

[i.8] Open IPTV Forum: "Open IPTV Forum - Functional Architecture - V2.0".

[i.9] ETSI TS 183 063: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS-based IPTV stage 3 specification".

[i.10] ETSI TS 183 064: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN integrated IPTV subsystem stage 3 specification".

[i.11] ETSI TR 102 469 (V1.1.1): "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Architecture".

[i.12] ETSI TS 102 796 (V1.1.1):"Hybrid Broadcast Broadband TV".

[i.13] ETSI TS 181 016 (V3.3.1): "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Service Layer Requirements to integrate NGN Services and IPTV".

[i.14] ETSI TS 102 034: "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks".

[i.15] ETSI TS 102 539: "Digital Video Broadcasting (DVB); Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)".

[i.16] IETF RFC 2326: "Real Time Streaming Protocol (RTSP)".

[i.17] ETSI TS 126 234: "Universal Mobile Telecommunications System (UMTS); LTE; Transparent end-to-end Packet-switched Streaming Service (PSS); Protocols and codecs (3GPP TS 26.234)".

[i.18] ETSI TS 123 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228)".

[i.19] ETSI TS 123 060: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); General Packet Radio Service (GPRS); Service description; Stage 2 (3GPP TS 23.060)".

[i.20] ETSI TS 123 203: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control architecture (3GPP TS 23.203)".

[i.21] ETSI TS 133 220: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (GBA) (3GPP TS 33.220)".

[i.22] ETSI ES 282 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Resource and Admission Control Sub-System (RACS): Functional Architecture".

[i.23] ETSI TS 123 246: "Universal Mobile Telecommunications System (UMTS); LTE; Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description (3GPP TS 23.246)".

[i.24] ETSI EN 302 304: " Digital Video Broadcasting (DVB); Transmission System for Handheld Terminals (DVB-H)".

[i.25] ETSI ES 282 004: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture; Network Attachment Sub-System (NASS)".

[i.26] ETSI TS 182 019: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Content Delivery Network (CDN) architecture - Interconnection with TISPAN IPTV architectures".

[i.27] ETSI ES 283 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) Stage 3 [3GPP TS 24.229 [Release 7], modified]".

[i.28] ETSI TS 102 471: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Electronic Service Guide (ESG)".

[i.29] ETSI TS 126 346: "Universal Mobile Telecommunications System (UMTS); LTE; Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs (3GPP TS 26.346 version 10.0.0 Release 10)".

3 Definitions and abbreviations

3.1 Definitions

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

IMS-based IPTV: IMS-based IPTV architecture that provides IPTV services to NGN users

NOTE: Defined in TS 182 027 [i.1].

NGN-based IPTV: multimedia system that provides IPTV services over the NGN architecture and may be implemented as an integrated subsystem with the NGN (NGN integrated IPTV) or may use the IMS subsystem (IMS-based IPTV) in the NGN

NGN integrated IPTV: IPTV subsystem integrated with the NGN architecture that provides IPTV services to NGN users

NOTE: Defined in TS 182 028 [i.2].

TISPAN IPTV services: interactive personalized multimedia IPTV services specified by ETSI TISPAN to provide selected IPTV services and features to NGN users

NOTE: Defined in TS 181 016 [i.13].

3.2 Abbreviations

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

BC	BroadCast
BCG	Broadband Content Guide
CFIA	Customer Facing IPTV Applications
CoD	Content on Demand
DVB	Digital Video Broadcasting
DVBSTP	DVB SD&S Transport Protocol
e-UTRAN/EPC	Evolved UTRAN Evolved Packet Core
GUP	Generic User Profile
HTTP	HyperText Transfer Protocol
IGMP	Internet Group Management Protocol
IMS	IP Multimedia Subsystem
IPTV	IP Television
IPTVC	IPTV Control
IUDF	IPTV User Data Function
MBMS	Multimedia Broadcast/Multicast Service
MCF	Media Control Function

MDF	Media Delivery Function
NASS	Network Attachment SubSystem
PSS	Packet-switched Streaming Service
RACS	Resource and Admission Control Subsystem
RTP	Real Time Protocol
SCF	Service Control Function
SD&S	Service Discovery and Selection
SDF	Service Discovery Function
SDO	Standard Development Organization
SIP AS	Session Initiation Protocol Application Server
SSF	Service Selection Function
UDP	User Datagram Protocol
UE	User Equipment
UPSF	User Profile Server Function
UTRAN	UMTS Terrestrial Radio Access Network
UTRAN/PS	UTRAN Packet Switched
VoD	Video on Demand
XCAP	XML Configuration Access Protocol

4 TISPAN NGN IPTV architectures - comparing of functionalities and services

When IMS based IPTV [i.1] is compared with NGN integrated IPTV [i.2] main differences between both solutions are following:

- Separation of service selection and discovery in IMS based IPTV (SIP based discovery).
- Similar service selection specs, IMS based IPTV additionally support OMA BCAST ESG.
- SIP based service initiation and service control.
- Support of the direct RTP encapsulation.
- Related differences in interfaces and protocols (from Tr to Ut, Xa and change from http based Ct, Ss, Sa to SIP based Gm, ISC, y2 interfaces).

Table 4.1: Informational Comparison of TISPAN characteristics for non-IMS and IMS based NGN IPTV concepts

General characteristics	IMS based IPTV architecture (NGN IMS based)	NGN integrated dedicated IPTV architecture (NGN Non-IMS)
ETSI TISPAN specification	TS 182 027 [i.1] TS 183 063 [i.9]	TS 182 028 [i.2] TS 183 064 [i.10]
1. SD&S	TS 102 034 [i.14] based SD&S model - separate SDF, SSF SIP based (Mandatory), HTTP (Optional), DVBSTP (Optional) via Xa to SSF - HTTP based	TS 102 034 [i.14] based SD&S model - single SD&S HTTP based (Mandatory) DVBSTP (Optional) via Tr to SD&S - HTTP based
2. Service selection information (e.g. program guides)	DVB SD&S (TS 102 034 [i.14]) DVB BCG (TS 102 539 [i.15]) OMA BCAST ESG TISPAN XML	DVB SD&S (TS 102 034 [i.14]) DVB BCG (TS 102 539 [i.15])
3. Multicast control - IGMP	SIP based initiation IGMP join to ECF/EFF IGMPv3, MDLDv2	Pure IGMP/MLD based IGMP join to ECF/EFF IGMPv3, MDLDv2
4. Unicast control - RTSP methods	SIP based initiation Mixture RTSP control (RFC 2326 [i.16]), partially TS 102 034 [i.14] based Method 1 - new coupled SIP/RTSP Method 2 - SIP and RTSP separated	RTSP based on TS 102 034 [i.14] Coupled, decoupled mode
5. Media Delivery	MPEG2TS over RTP MPEG2TS over UDP direct RTP encapsulation	MPEG2TS over RTP MPEG2TS over UDP
6. Service control (initialization, modification, teardown)	SIP based service control using IMS SIP Session based control	IPTV-C, CFIA control HTTP resp. RTSP based
7. Service configuration	Ut - XCAP	Tr - XCAP
8. Resource allocation & reservation	Via core IMS Gq' to RACS	IPTV-C Gq' to RACS
9. User profile, user data	Federated, Consolidated User Profile located: Federated (UPSF, SCF) (SSP located) Consolidated (UPSF)SCF (SIP AS) SSPUser Profile used (SSF, SDF via Sh)	User Profile located: Federated (UPSF, IUDF, CFIA, IPTV-C) Consolidated (UPSF) Federated, Consolidated UPSF (SSP located), IUDF CFIA (http AS), IPTVC User Profile SSP used (SD&S, IPTVC, CFIA)

Comparison of IPTV services and feature between TISPAN NGN based architecture (NGN integrated IPTV and IMS based IPTV).

NOTE: Table 4.2 has informative character and summarized and refer to table 1 in [i.1] and table 1 in [i.2].

Table 4.2: Informational Comparison of services and feature for non-IMS and IMS based NGN IPTV concepts

Service & Feature	IPTV Requirements		NGN dedicated/integrated IPTV subsystem		IMS based IPTV	
TISPAN Release	**R2**	**R3**	**R2**	**R3**	**R2**	**R3**
Linear/Broadcast TV	M	M	M	M	M	M
Linear/Broadcast TV with Trick Play	M	M	M	M	O	O
Time Shifted TV	O	O	O	O	O	O
Content on Demand	M	M	M	M	M	M
Push CoD	NA	O	M	M	NA	O
Near COD	M	M	M	M	NA	NA
Network PVR	M	M	M	M	M/O	M/O
Client PVR	NA	O	NA	O	NA	O
Audio	M	M	M	M	O	O
Pay-Per-View	NA	M	M	M	NA	O
Interactive TV	NA	M	M	M	NA	O
Service discovery	M	M	M	M	M	M
Service Information (EPG)	M	M	M	M	M	M
Parental Control	M	M	M	M	M	M
User Profiling & personalization	O	O	O	O	O	O
Communications and Messaging	NA	O	O	O	NA	O
Notifications	NA	O	O	O	NA	O
IPTV Presence	O	O	O	O	O	O
Interaction between users	NA	O	O	O	N/A	O
Interaction with NGN services	O	O	O	O	O	O
Advertising	M	M	M	M	M	M
Targeted Advertising	NA	O	NA	O	NA	O
User Generated Content	NA	M	NA	O	NA	O
Internationalization	O	O	O	O	O	O
Content recommendation	NA	O	NA	O	NA	O
Games	NA	O	NA	O	NA	O
Picture	NA	O	NA	O	NA	O
Bookmarks (Content Marking)	NA	O	NA	O	NA	O
Personalized channel	NA	O	NA	O	NA	O
Personalized Service Composition	NA	O	NA	O	NA	O
Service Portability	NA	O	NA	O	NA	O
Service Continuation between IPTV UEs	NA	O	NA	O	NA	O
Service Continuation fixed-mobile	NA	O	NA	O	NA	O
Remote Control of IPTV services	NA	O	NA	O	NA	O
Emergency Information	NA	O	NA	O	NA	O
Interaction with 3rd Party application (e.g. Parlay)	NA	O	NA	O	NA	O
Interaction with Internet Services	NA	O	NA	O	NA	O
Service synchronization	NA	O	NA	O	NA	O
Incoming call management	NA	O	O	O	NA	

5 Mapping and interworking with other IPTV systems

5.1 NGN Integrated IPTV

The clause provides mapping and interworking of NGN integrated IPTV with other SDOs IPTV systems.

5.1.1 NGN non-IMS based IPTV in ITU-T

The NGN Integrated IPTV subsystem architecture supports IPTV service level requirements defined in [i.1] and provides integration of new or existing IPTV solutions (such as those defined by DVB, ATIS IIF, ITU, etc.) into the TISPAN NGN architecture.

Comparing ITU-T IPTV architecture (ITU-T Recommendation Y.1910 [i.3]) with ETSI TISPAN NGN integrated IPTV (TS 182 028 [i.2]) the following mapping of functional entities can be identified.

Table 5.1: Mapping between ITU-T non-IMS IPTV functions and TISPAN NGN Integrated IPTV functional entities

ITU-T non-IMS NGN IPTV	Y.1910 [i.3]	TISPAN NGN Integrated IPTV
IPTV Application Functions	9.2.1	Customer Facing IPTV Application FE (CFIA), Service Discovery and Selection (SD&S) (see note 1) (in part)
IPTV Service Control Functional Block	9.3.1	IPTV Control (IPTV-C)
Service User Profile Functional Block	9.3.2	User Data Function (UPSF)
Content Distribution & Location Control Functions	9.4.1	Media Control Function (MCF)
Content Delivery & Storage Functions	9.4.2	Media Delivery Function (MDF) Media Control Function (MCF) (see note 2)
Content Preparation Functions	9.2.3	Content acquisition & preparation functions
Application Profile Functional Block	9.2.2	IPTV User Data FE (IUDF)
Service & content protection		Service & Content Protection (SCP)
NOTE 1: The in ITU-T non-IMS NGN IPTV application functions enable the UE to select and purchase content as well as provide content metadata and other information which are in TISPAN Integrated IPTV Service Discovery & Selection function. NOTE 2: Content Delivery & Storage Functions also perform some of the MCF tasks (e.g. managing interaction with the UE for trick mode commands).		

Figure 5.1 illustrates mapping between functional entities discussed in table 5.1.

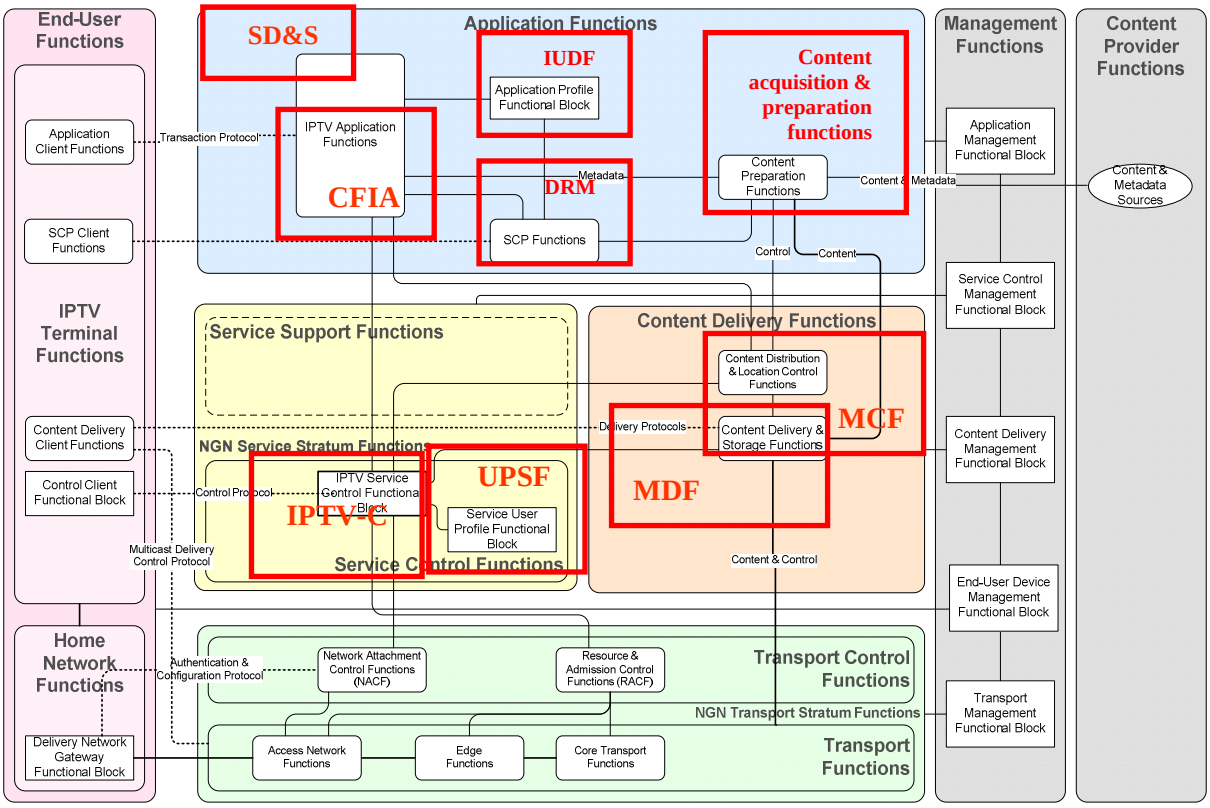

Figure 5.1: Mappings of ITU-T non-IMS functional architecture to TISPAN NGN integrated IPTV (Source: ITU-T Y.1910 (09/2008) [i.3], figure 10-2: NGN non-IMS IPTV architecture)

5.1.2 NGN non-IMS based IPTV in ATIS

Comparing ATIS [i.7] non-IMS based IPTV architecture with ETSI TISPAN NGN integrated IPTV (TS 182 028 [i.2]) the following mapping of functional entities can be identified.

Table 5.2: Mapping between ATIS non-IMS IPTV functions and TISPAN NGN Integrated IPTV functional entities

ATIS non-IMS NGN IPTV	ATIS	TISPAN NGN Integrated IPTV
IPTV Applications	9.2.4	Customer Facing IPTV Application FE (CFIA), Service Discovery and Selection (SD&S) (see note) (in part)
IPTV Service Control Function	9	IPTV Control (IPTV-C)
User Profile Functions	9.2.5	IPTV User Data Function (IUDF)
Media Delivery Broadcast & VoD	9.2.2	Media Control Function (MCF) Media Delivery Function (MDF)
NOTE: The recommendation in ATIS non-IMS NGN IPTV applications enable to UE select and purchase content as well as provide content metadata and other information which are in TISPAN Integrated IPTV functions of Service Discovery & Selection function.		

5.2 IMS based IPTV

The clause provides mapping and interworking of IMS based IPTV with other SDOs IMS based IPTV systems.

5.2.1 IMS based IPTV in ITU-T

The NGN IMS based IPTV specifies the architecture and functions of an IPTV system that makes use of the NGN IMS architecture and its features, implementing the requirements defined in [i.1].

Comparing ITU-T IPTV architecture (ITU-T Recommendation Y.1910 [i.3]) with ETSI TISPAN NGN IMS based IPTV (TS 182 028 [i.2]) the following mapping of functional entities can be identified.

Table 5.3: Mapping between ITU-T IMS IPTV functions and TISPAN NGN IMS based IPTV functional entities

ITU-T IMS NGN IPTV	Y.1910 [i.3]	TISPAN NGN IMS based IPTV
IPTV Application Functions	9.2.1	Service Discovery Functions (SDF) Service Selection Function (see note 1) (in part)
Core IMS functions	10.2.2.2	Core IMS (Core IMS)
IPTV Service Control Functional Block	9.3.1	Service Control Function (SCF)
Service User Profile Functional Block	9.3.2	User Data Function (UPSF)
Content Distribution & Location Control Functions	9.4.1	Media Control Function (MCF)
Content Delivery & Storage Functions	9.4.2	Media Delivery Function (MDF) Media Control Function (MCF) (see note 2)
Content Preparation Functions	9.2.3	-
Application Profile Functional Block	9.2.2	-
Service & content protection		-
NOTE 1: The ITU-T IMS NGN IPTV application functions enable UE to select and purchase content, as well as provide content metadata and other information which are provided in the TISPAN IMS based IPTV Service Selection Function. NOTE 2: Content Delivery & Storage Functions also perform some of the MCF tasks (e.g. managing interaction with the UE for trick mode commands).		

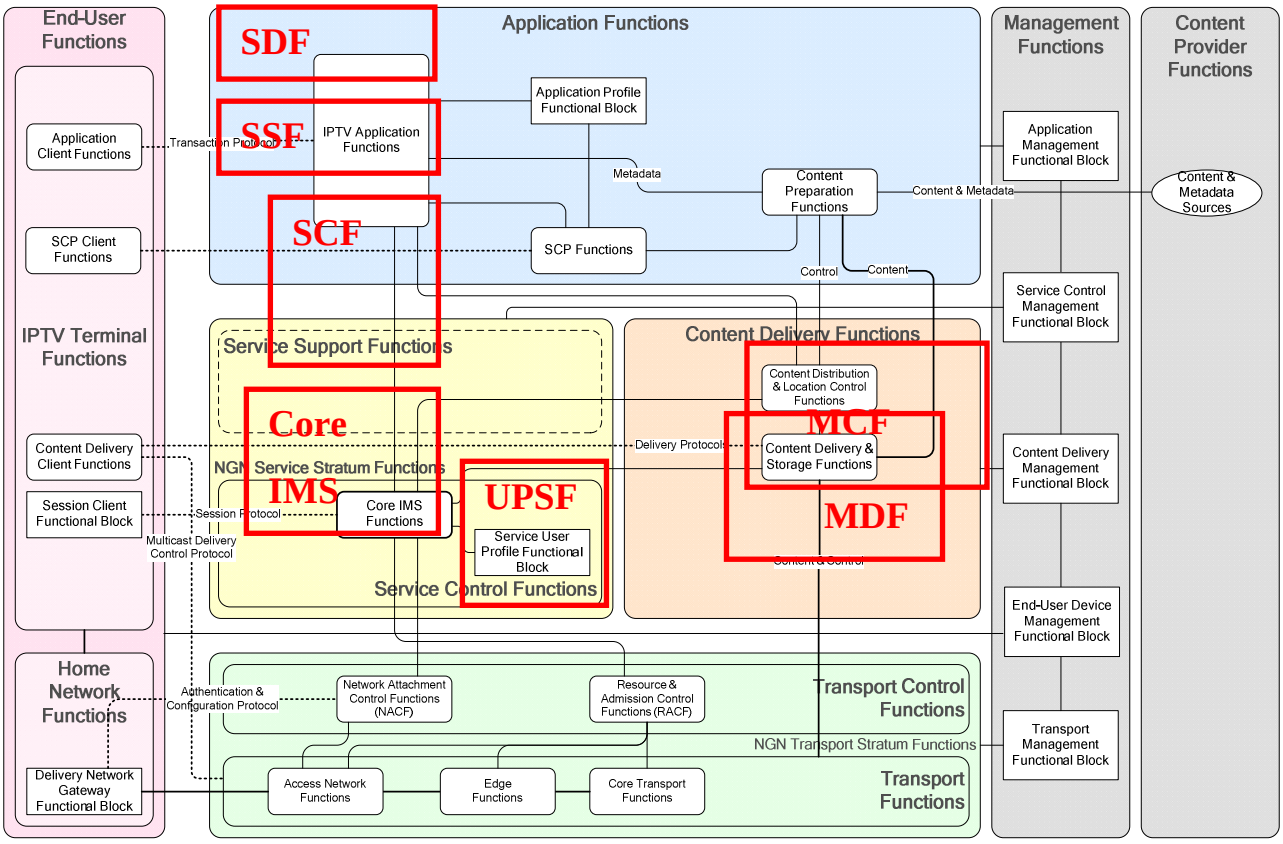

Figure 5.2: Mappings of ITU-T IMS functional architecture to TISPAN NGN IMS based IPTV (Y.1910 (09/2008) [i.3], figure 10-3: NGN IMS IPTV architecture)

5.2.2 IMS based IPTV in ATIS

Comparing ATIS [i.7] IMS based IPTV architecture with ETSI TISPAN IMS based IPTV (TS 182 027 [i.1]) the following mapping of functional entities can be identified.

Table 5.4: Mapping between ATIS IMS based IPTV functions and TISPAN IMS based IPTV functional entities

ATIS IMS based IPTV	ATIS	TISPAN IMS based IPTV
IPTV Applications	9.2.4	Service Discovery Functions (SDF) Service Selection Function (see note 1) (in part) IPTV Service Control Functions(SCF) (see note 2) (in part)
Core IMS	9.3.2	Core IMS
Service User Profile Function	9.3.2	User Profile Server Function (UPSF)
Media Delivery Broadcast & VoD	9.2.2	Media Control Function (MCF) Media Delivery Function (MDF)
NOTE 1: IPTV applications within ATIS IMS based IPTV enable the UE to select and purchase content as well as provide content metadata and other information; these functions are provided in TISPAN IMS based IPTV by the Service Selection Functions (SSF). NOTE 2: IPTV applications in ATIS IMS based IPTV perform service logic functions for IPTV services (e.g. Broadcast, CoD etc.), which are provided within TISPAN IMS based IPTV by the Service Control Functions (SCF).		

5.2.3 IMS based PSS and MBMS User Service in 3GPP

The IP Multimedia Subsystem (IMS) enables the deployment of IP multimedia applications. PSS and MBMS User Services are IP multimedia services, but they were specified by 3GPP prior to standardization of IMS. IMS brings enablers and features to operators and subscribers that can enhance the experience of PSS and MBMS User Services.

The main goal of this clause is principal concept for providing selected TISPAN IPTV services to mobile UE over 3GPP mobile access networks supporting unicast based streaming services (using PSS) or multicast based streaming services (using MBMS).

This clause will explain how IMS based IPTV from TISPAN may be combined with 3GPP IMS based PSS and MBMS [i.4].

NOTE: There should be a limitation which services could be provided over such a combined architecture (TISPAN IMS based IPTV with support for PSS or MBMS based streaming).

5.2.3.1 Mapping between TISPAN entities and 3GPP IMS based PSS and MBMS

Table 5.5 shows entities defined in the 3GPP IMS based PSS and MBMS user services, their roles and relevant TISPAN entities.

Table 5.5: Conceptual mapping of functional entities

3GPP Entity	3GPP entity tasks TS 126 237 [i.4], clause 4.2.2	TISPAN Entity	TISPAN entity task covered
Service Discovery Function	This function provides an entry point to SSF for the client to attach to the service provided by the service provider.	SDF 5.1.5.1	Provides the service attachment information. Provides personalized service discovery
Service Selection Function	Provides a list of available PSS and MBMS User Services and relevant User Service Description information.	SSF 5.1.5.1	Provides the service selection information
Service Control Function	Provides service logic and functions required to support execution of such logic. Service authorization during session initiation and session modification, which includes checking PSS and MBMS user's service subscription in order to allow or deny access to the service. Selects the relevant PSS and MBMS media functions.	SCF 5.1.5.2	SCF is a SIP Application Server Service authorization during session initiation and session modification Select the relevant IPTV media functions
PSS Server (PSS adapter)	Packet Switch Streaming server function as described in TS 126 234 [i.17]. It functionally contains media control and media delivery functions.	MF 5.1.5.3 MCF &MDF	Handling media flow control Handling media flows delivery
UE	The UE contains a GBA/IMS/PSS/MBMS client, which performs service discovery and selection, handles service initiation, modification and termination, receives and presents the content to the user.	UE	The IPTV enabled UE terminates the IPTV control and media signals, and displays the corresponding information to the user
IM CN subsystem	IMS Core Network Subsystem (TS 123 228 [i.18])	Core IMS	Is a subset of the 3GPP IMS defined in TS 123 002 [i.6] (TS 123 228 [i.18])
PS Core/RAN	Packet Switch Core Network and Radio Access Network. See TS 123 060 [i.19].	TPF	IP-based transport layer
HSS	Home Subscriber Server as defined in TS 123 002 [i.6]. Contains the IMS User Profile. It also may contain PSS and MBMS User Service specific User and UE data.	UPSF	IMS user profile and possibly IPTV specific profile data (see clause 7)
PCRF	Policy and Charging Rules Function as defined in TS 123 203 [i.20]. This function controls the charging and the establishment of resources in the RAN and PS core network.	RACS	Resource and Admission Control Subsystem as defined in TISPAN ES 282 003 [i.22]. It provides policy control, resource reservation and admission control
BSF	Bootstrapping Server Function as defined in TS 133 220 [i.21] to perform GBA/GAA procedures with the UE.		3GPP's Generic Authentication Architecture (GAA) and Generic bootstrapping architecture(GBA) defined in TS 133 220 [i.21] should be used to perform GBA/GAA procedures with the UE
BM-SC	Broadcast Multicast Service Center function as defined in TS 123 246 [i.23] and TS 126 346 [i.29] provides a set of functions for MBMS User Services.	MF	MF acts as source for multicast streams of IPTV services e.g. BC media streams. Broadcast is not supported for this function
NOTE: The BM-SC Membership function and Proxy and Transport function are defined in TS 123 246 [i.23]. The BM-SC Membership function is invoked for the establishment and release of Multicast bearers. ECF/EFF have similar task in the TISPAN architecture to join IP multicasted media streams.			

For TISPAN MF entities to serve mobile (i.e. PSS or MBMS enabled) UEs, adaptation of MF related signalling and media streams is needed as indicated in figure 5.3.

5.2.3.2 Mapping between 3GPP IMS based PSS and MBMS and TISPAN IMS based IPTV architecture

Figure 5.3 shows the interfaces between the 3GPP IMS based PSS and MBMS specific entities and the TISPAN IPTV architecture.

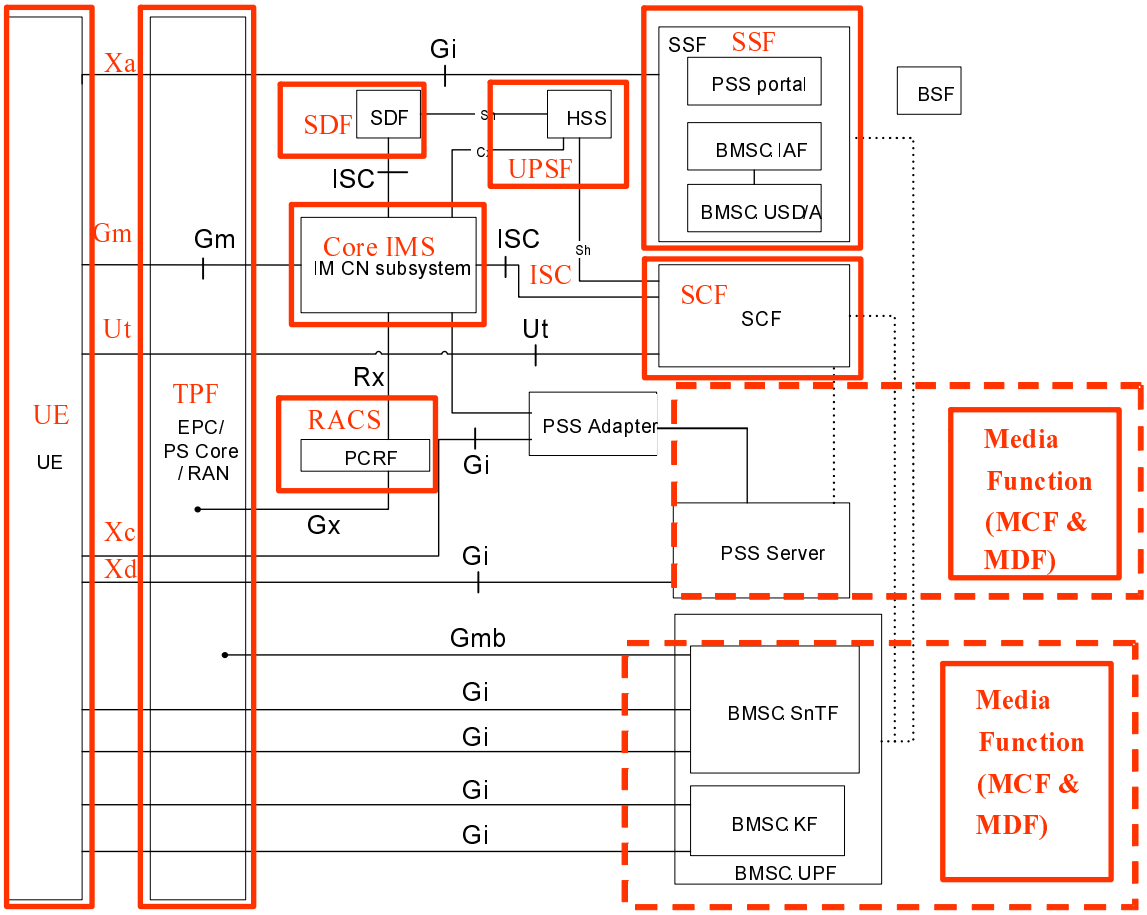

Figure 5.3: Conceptual mappings of 3GPP PSS and MBMS with TISPAN IMS based IPTV (Source: TS 126 237 [i.4], figure 2)

5.2.3.3 Mapping to TISPAN reference points

Table 5.6 shows the interfaces described in the 3GPP IMS based PSS and MBMS and their mapping with TISPAN reference points.

Table 5.6: Conceptual mapping of reference point

3GPP interface	Description of 3GPP interface TS 126 237 [i.4], clause 4.2.2	TISPAN ref. point	Note
1 Gi	between the UE and the SSF is used to retrieve service selection information	Xa	Equivalent to the Xa interface in TISPAN IPTV
2 Gm	between the UE (IMS Client) and the P-CSCF	Gm	TISPAN refer to Gm
3 Gi	UE (PSS Client) and the PSS Adapter allows media flow control	Xc	In TISPAN used to exchange media control messages for controlling media flow
4 Gi	between the PSS Server and the UE is for delivery of streaming data	Xd	In TISPAN used to deliver media data
8, 12 ISC	between IM CN subsystem the SCF/SDF is an ISC (IMS Service Control)	ISC	TISPAN refer to ISC
9	interface between the IM CN subsystem and the PSS adapter	Y2	service control signalling originating from the SCF to control the MCF
13 Ut	between the UE and SCF	Ut	equivalent to the Ut interface in TISPAN IPTV

NOTE 1: 3GPP interface no.5): This interface between the BMSC.UPF and the UE is for delivery of streaming data and traffic keys. This interface has no direct mapping to a TISPAN reference point,, but serves a similar purpose as the reference point between UE and ECF/EFF to deliver multicasted media stream (or to MDF if play role as source of multicast stream).

NOTE 2: 3GPP interface no.6) Gmb: This interface, between the BMSC.UPF and the GGSN, has no equivalent in TISPAN.

NOTE 3: Other Interfaces (10, 14, 15, 16, 17, 18) have no exact equivalent in TISPAN.

5.2.4 IMS based IPTV in OIPF

5.2.4.1 Mapping between TISPAN entities and OIPF IMS based IPTV

Comparing OIPF IMS based IPTV architecture with ETSI TISPAN IMS based IPTV (TS 182 027 [i.1]) the following mapping of functional entities can be identified.

Table 5.7: Mapping between OIPF IMS based IPTV functions and TISPAN IMS based IPTV functional entities

OIPF IMS based IPTV	OIPF	TISPAN IMS based IPTV
IPTV Metadata Control	5.2.1	Service Selection Functions (SSF)
Authentication and Session Management	5.2.1	Core IMS
IPTV Service Discovery	5.2.1	Service Selection Functions (SSF)
IPTV Service Provider Discovery	5.2.1	Service Discovery Function(SDF)
User Database	5.2.1	User Profile Server Function (UPSF)
IPTV Service Profile	5.2.1	User Profile Server Function (UPSF)
IPTV Applications	5.2.1	IPTV Service Control Functions(SCF)
IPTV Control	5.2.1	IPTV Service Control Functions(SCF)
Content Delivery Network Controller	5.2.1	Media Control Function (MCF) or Content Delivery Network Control Function (CDNCF) (see note)
Cluster Controller	5.2.1	Media Control Function (MCF) or Cluster Controller Function (CCF) (see note)
Content Delivery Function	5.2.1	Media Control Function (MCF) Media Delivery Function (MDF) or Content Delivery function (CDF) (see note)
Multicast Content Delivery Function	5.2.1	Media Delivery Function (MDF)
NOTE: Mapping to CDN entities have to refer to TS 182 019 [i.26].		

Figure 5.4 illustrates mapping between functional entities discussed in table 5.7.

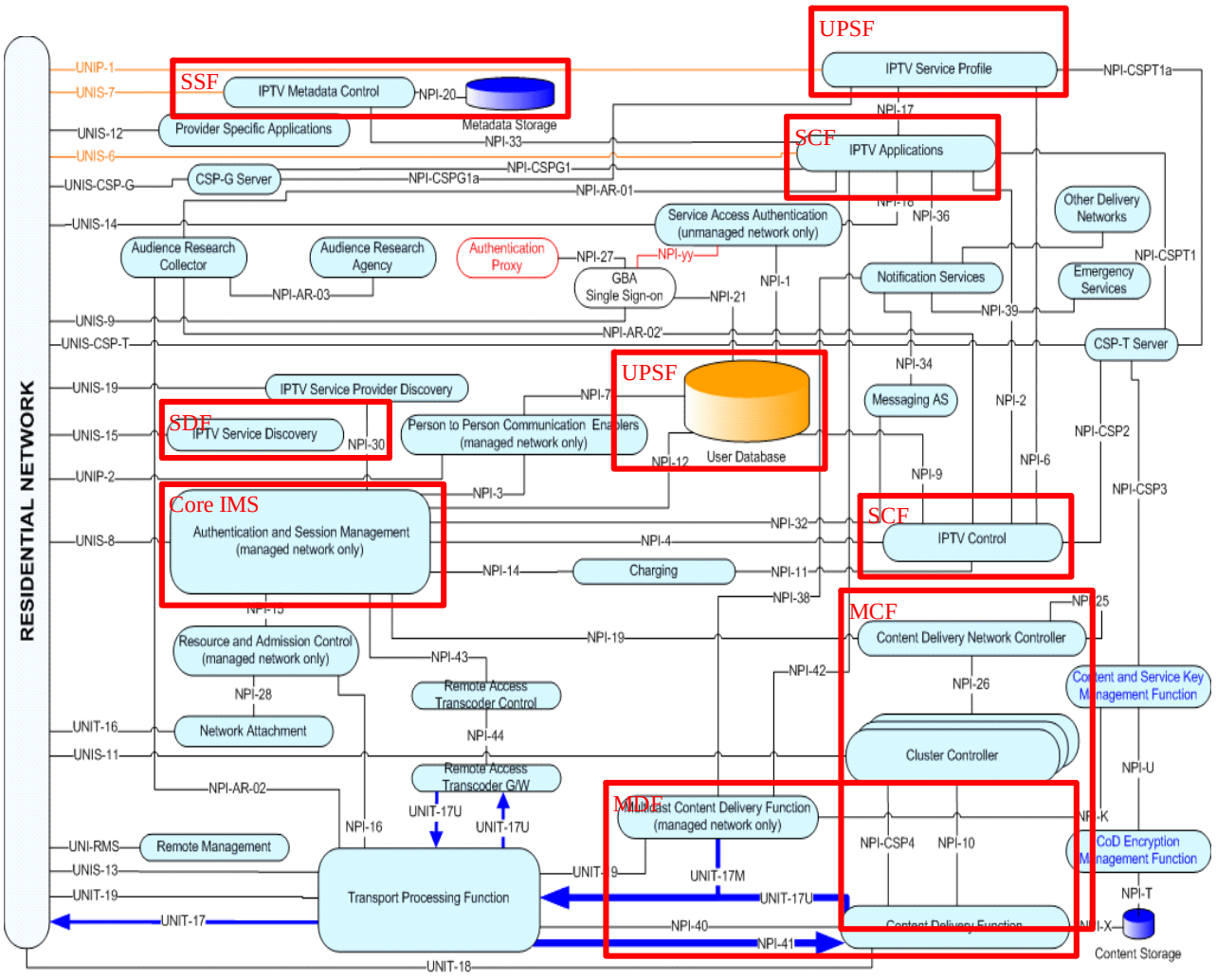

Figure 5.4: Mappings of OIPF IMS functional architecture to TISPAN IMS based IPTV (Source: [i.8], figure 2: IMS IPTV architecture)

5.2.4.2 Mapping to TISPAN reference points

Table 5.8 shows the interfaces described in the OIPF IMS based IPTV and their mapping with TISPAN reference points.

Table 5.8: Conceptual mapping of reference point

OIPF interface	Description of OIPF interface	TISPAN ref. point	Note TISPAN ref.point
UNIS-7	interface between the RESIDENTIAL NETWORK and the IPTV Metadata Control is used to retrieve service selection information	Xa	Xa reference point between UE and SSF for service discovery and service selection.
UNIS-15	interface between the RESIDENTIAL NETWORK and the IPTV Service Discovery	Xa	Xa reference point between UE and SSF for service discovery and service selection.
UNIS-19	interface between the RESIDENTIAL NETWORK and the IPTV Service Provider Discovery	Gm or Xa'	TISPAN refer for service provider discovery using SIP via Gm & ISC towards SDF as SIP AS, but OIPF use HTTP (HTTP/DVB based service provider discovery is only optional in TISPAN via Xa' reference point).
NPI-12	interface between the Authentication and Session Management (P-CSCF) and User Database	Cx	Cx ref. point between IMS core and UPSF.
NPI-19	interface between the Authentication and Session Management (P-CSCF) and Content Delivery Network Controller	y2, Cu (see note)	y2 ref. point between IMS core and MCF used for control of MCF Cu reference point between CDNCF and IMS based IPTV.
UNIT-17	interface between Content Delivery Function and RESIDENTIAL NETWORK	Xd Xd' (see note)	Xd ref. point between MDF and UE for deliver media data Xd' ref. point from CDF to UE*.
NPI-4	interface between the Authentication and Session Management (P-CSCF) and the IPTV Control	ISC	ISC ref. point between IPTV Service Control Function and Core IMS.
UNIS-11	interface between the Cluster Controller and the RESIDENTIAL NETWORK	Xc, Xc' (see note), Xc'' (see note)	Xc ref. point between UE and MCF for controlling the IPTV Media flow Xc ref. point from UE to CCF, CDF*.
NOTE: Mappings applicable only when CDN is used and CDN entities are refer as in TS 182 019 [i.26].			

6 Selected TISPAN IPTV services to mobile UE over existing mobile access networks

TISPAN NGN based IPTV services are IP access independent and because TISPAN Release 3 architecture supports multiple access networks, it also may provide selected TISPAN IPTV services over a cess network. The examples of existing access technologies are described in this clause.

6.1 3GPP mobile access network

If TISPAN IPTV services are provided over 3GPP mobile access networks then 2 scenarios are possible:

1) use generic IP access without specific multicast support in this case all TISPAN IPTV services are provided to UE as unicast streams over UTRAN/PS core or e-UTRAN/EPC;

2) if 3GPP mobile access supports multicast/unicast streaming like MBMS/PSS technologies then can also support appropriate delivery of multicast/unicast services for IPTV. Examples of such a configuration and mapping of TISPAN IMS based IPTV with IMS based MBMS/PPS are described in clause 5.2.3.

The proposed 3GPP integration with TISPAN IPTV depending also on supported 3GPP technologies because basic low band media streaming over PS core/UTRAN was supported after Release 3 (R99) but more advanced multimedia streaming delivery technologies like MBMS/PPS are supported just after Release 6. In future also broadband mobile networks like Release 8+ based LTE with EPC can support IPTV service delivery with higher quality and bandwidth.

NOTE: Specific limitations of using 3GPP access technologies, and the integration with 3GPP access and core technologies is out of scope of the present document.

6.2 DVB-H access network

DVB-H is a transmission system (EN 302 304 [i.24]) using DVB standards to provide an efficient way of carrying multimedia services over digital terrestrial broadcasting networks to handheld terminals. IP Datacast over DVB-H is additional technology allowing deliver IP datagram over an end-to-end broadcast system. An inherent part of the IPDC over DVB-H system is that it comprises of a unidirectional broadcast path that could be used to deliver some of the IP based non-interactive streaming services (like Live TV broadcast, Near VoD or Broadcast based Push CoD), that may be combined with a bi-directional mobile/cellular or fixed interactivity path (also other TISPAN IPTV services have to be delivered over IP networks like unicast or interactive services). IP Datacast over DVB-H [i.11] is thus a platform that can be used for enabling the convergence of services from broadcast/media and telecommunications domains (e.g. mobile/cellular).

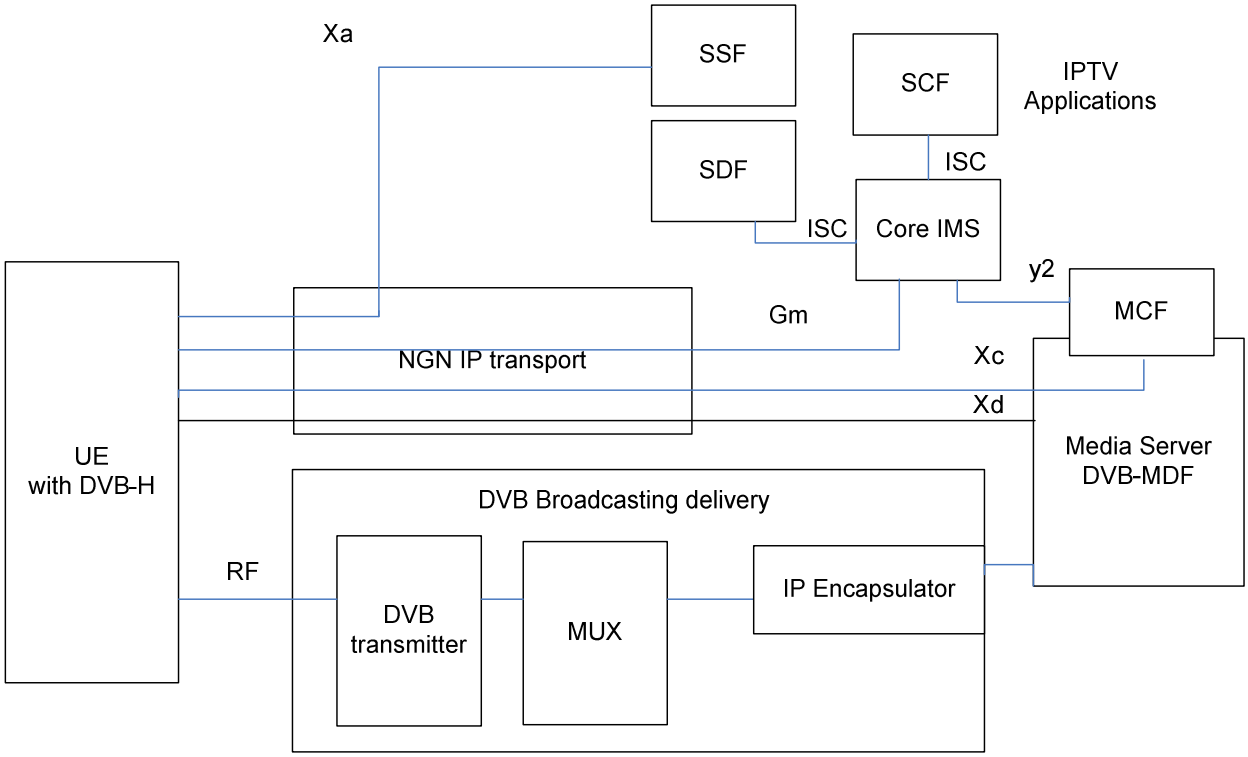

Figure 6.1: Conceptual example for delivery of selected TISPAN IMS based IPTV services over DVB-H

7 TISPAN IPTV Interconnection models and support for mobility

7.1 Use cases

TISPAN IMS based IPTV and NGN integrated IPTV can recognize at least the following basic use cases for roaming and interconnection to home network (not need support all of them):

a) remote pure data access to IPTV SP/content provider

b) IMS/IPTV Control interconnect to home IPTV provider (described in clause 7.3.1)

c) visited - home network roaming between IPTV providers (served only from home network)

d) visited - home network roaming between IPTV providers (served from home and/or visited network)

e) visited - home network roaming between IPTV providers (served from visited network)

7.1.1 Remote pure data access to IPTV provider

Because the UE accessing home IPTV SP from remote network without IMS/IPTV Control, the user has to use to connect UE to his home network some remote data IP connection (e.g. VPN or secure remote access). Over this connection can be transferred all media and signalling to the subscriber directly from his Home Network. Because such a connection should going over any IP network (also best effort) also without resource reservation mechanisms, no QoS can be really ensured.

NOTE: This use case is out of scope of the current release.

7.1.2 Interconnect to home IPTV provider

This use case is the simplest one with using core IMS/IPTV Control. User will use IPTV services provided from IPTV functional elements from his Home Network. The IMS/IPTV Control elements of visited network have to do just NGN roaming via network attachment in visited network and forward all other request to home network and its IMS IPTV SP (e.g. registration, service discovery/selection, service initiation/modification/termination). Service selection information and media are delivered from Home network over interconnection.

The quality of the IPTV service for the end customer should be same as in home network (when interconnection and visited network assure enough resources and QoS), but no reuse of local media delivery resources for the provider is possible (because in visited network have no IMS based IPTV or NGN integrated IPTV platform).

NOTE: This use case is described in clause 7.3.1.

7.1.3 Visited - home network roaming between IPTV providers -served only from home network

Additionally to the previous use case the following one expects the IMS based IPTV or NGN integrated IPTV platform is available in Visited Network, however all content and services are delivered only from Home Network. This solution expect that delivery of the content, metadata and service discovery, selection and service initiation, modification and termination will be done from home network. Also it could be required from Home Network IMS based IPTV or NGN integrated IPTV solution to provide transcoding and content adaptation to adapt media to parameters required for entering the Visited Network (or this could be done in edge of visited network).

7.1.4 Visited - home network roaming between IPTV providers -served from home and/or visited network

If there is an IPTV solution in Visited Network, possibly having similar content for CoD, BC, PVR service, it is useful and more efficient to use this local resources in visited network as deliver all content over interconnection. The content which is available in Visited Network is not needed to be transferred over an interconnection network and allocate interconnection bandwidth/resources. For this purpose both providers should agree on the same identification of content, sharing service discovery and selection information, content security, billing clearing, and for sure about all parameters required for roaming agreements (e.g. QoS, Service Level Agreement). Other IPTV services or content not available in offer of visited IMS IPTV or NGN integrated IPTV SP are provided as in previous use case by home network and by user home IPTV service provider.

NOTE: This interconnection model and its impacts are for future studies.

7.1.5 Visited - home network roaming between IPTV providers -served only from visited network

If there is an IPTV solution in Visited Network, possibly having similar content for CoD, BC, PVR service, it is useful and more efficient to use this local resource in visited network to deliver all content. The visited network can recognize the user when the user is moving to the Visited Network automatically, then the user can discover all the IPTV services which is available is the IPTV SP in the Visited Network. All content is delivered by the Visited Network. For this purpose both providers should have a business agreement on the sharing of services and billing mechanism.

NOTE: This interconnection model and its impacts are for future studies.

7.2 IPTV interconnection mechanisms for mobility support

1) The IPTV Solution provides a mechanism for a user in an area with IPTV Service Provider in visited network to discover the available IPTV services.

2) The IPTV Solution provides a mechanism for a user in an area without IPTV Service Provider in visited network to discover the available IPTV services of their home network.

3) When the appropriate business and service interconnection agreements are in place and a user who has an account with their IPTV Service Provider of home network is connected in roaming scenario to IPTV Service Provider in visited network:

   a) possible to access services offered by the original home IPTV Service Provider of using home network user account/profile;

   b) possible to access services offered by the IPTV Service Provider in visited network using the original home Service Provider user account/profile in roaming scenarios.

4) IPTV Solution provides the means to share the required user information (e.g. user profile, charging information, authorization, etc.) based on roaming agreement of the user in a secure manner between IPTV Service Providers only when the business and service agreements are in place using a proper security and privacy assurance mechanisms.

5) IPTV Solution optionally provides the mechanism to guarantee QoS according to the business and service interconnection agreements when user access to another IPTV Service Provider.

7.3 IMS based IPTV Interconnection model and related signalling flow

The clause provides examples for IMS based IPTV Interconnection model (based on TS 182 027 [i.1], annex H) and related signalling flow support mobility.

7.3.1 Interconnection model using IMS roaming to home IMS IPTV

Figure 7.1 illustrates the model of interconnection with the Visited Network within Core IMS involved. UE can request IPTV services in the Home Network by connecting to the Visited Network. Core IMS in the Visited Network can request resources from the RACS in the Visited Network through the interface Gq'. Core IMS in the Home Network can request resources from the RACS in the Home Network through the interface Gq'. UE can attach to the Visited Network through the interface e1 so that the NASS in the Visited Network can assign IP address for the UE and discovery the address of P-CSCF in the Visited Network. Core IMS in the Visited Network can transfer the IPTV service request from the UE through the interface Ic to the Core IMS in the Home Network through the connection of their own IBCF(Intermediate Breakout Control Function). UE can connect the SSF to select IPTV services through the interface Xa which is already defined. UE can connect to the IPTV SCF to configure parameters through the interface Ut which is already defined. Core IMS in both network connect to their own UPSF to get user profiles through their own interface Cx.

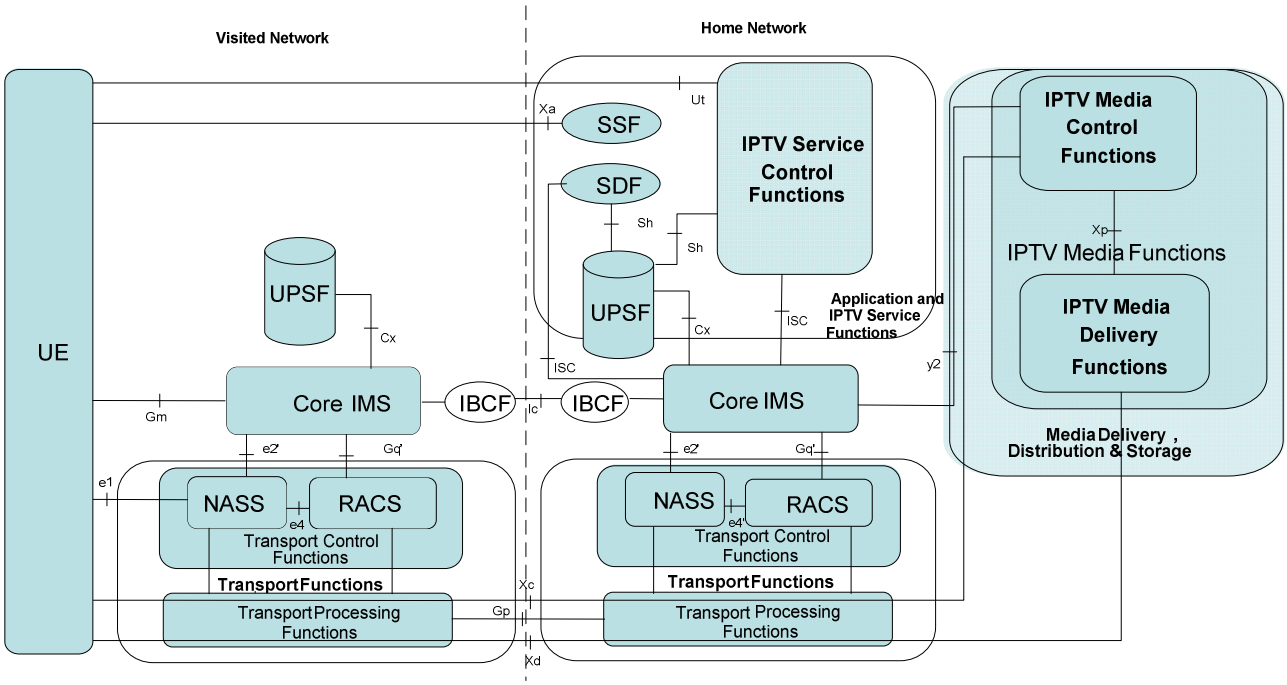

Figure 7.1: Interconnection model using IMS roaming to home IMS IPTV

NOTE: This interconnection model and its impacts to signalling flows are for future studies.

7.3.2 Signalling flows

The clauses below explain the signalling flows of UE start-up procedures and CoD procedures when the UE is located in the Visited Network. In Broadcast procedures, N-PVR and other services, they are similar as CoD procedures.

NOTE: Following procedure are indicative to show one possible way how should IMS roaming be handled between home and visited network.

7.3.2.1 UE start-up procedures

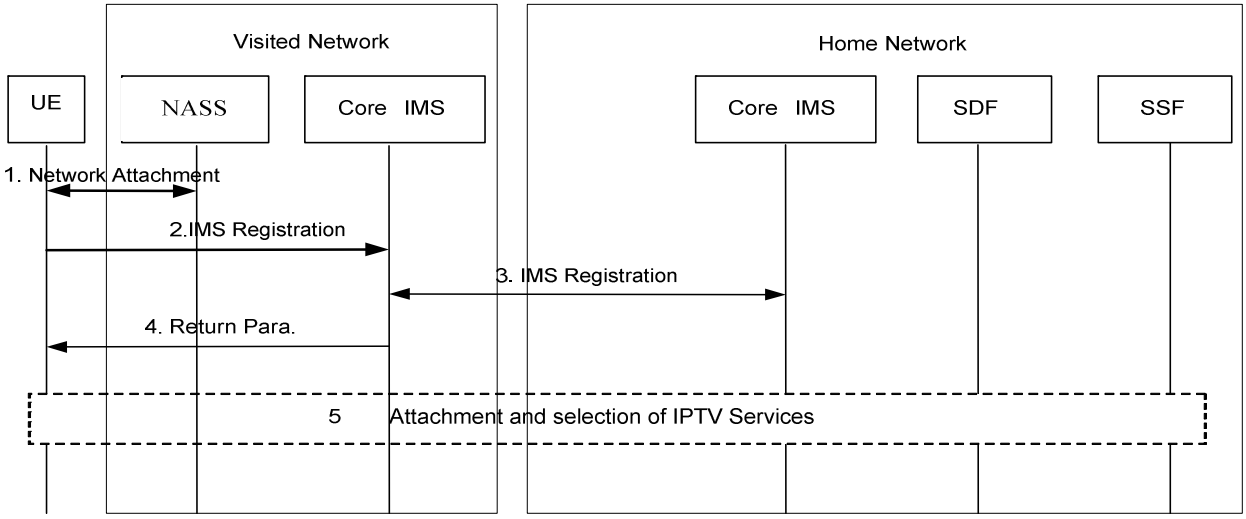

Figure 7.2: UE start-up procedures

1) Network Attachment
In this step the UE attaches to the network. The procedures for network attachment are defined in ES 282 004 [i.25]. This step includes IP configuration, P-CSCF address discovery of Visited Network, etc.

2) IMS Registration in Visited Network
In this step, the UE performs regular IMS Registration as defined in TS 123 506 [i.5].

3) P-CSCF within Core IMS in Visited Network submits the registration request to the I-CSCF within the Core IMS in the Home Network.
In this step, the UE performs regular IMS Registration as defined in TS 123 002 [i.6].

4) Core IMS in the Visited Network return parameters (e.g. P-CSCF address of Home Network) to the UE.

5) The step is the same as step 3~4 in figure 9 of clause 8.2 in [i.1].

7.3.2.2 CoD procedures

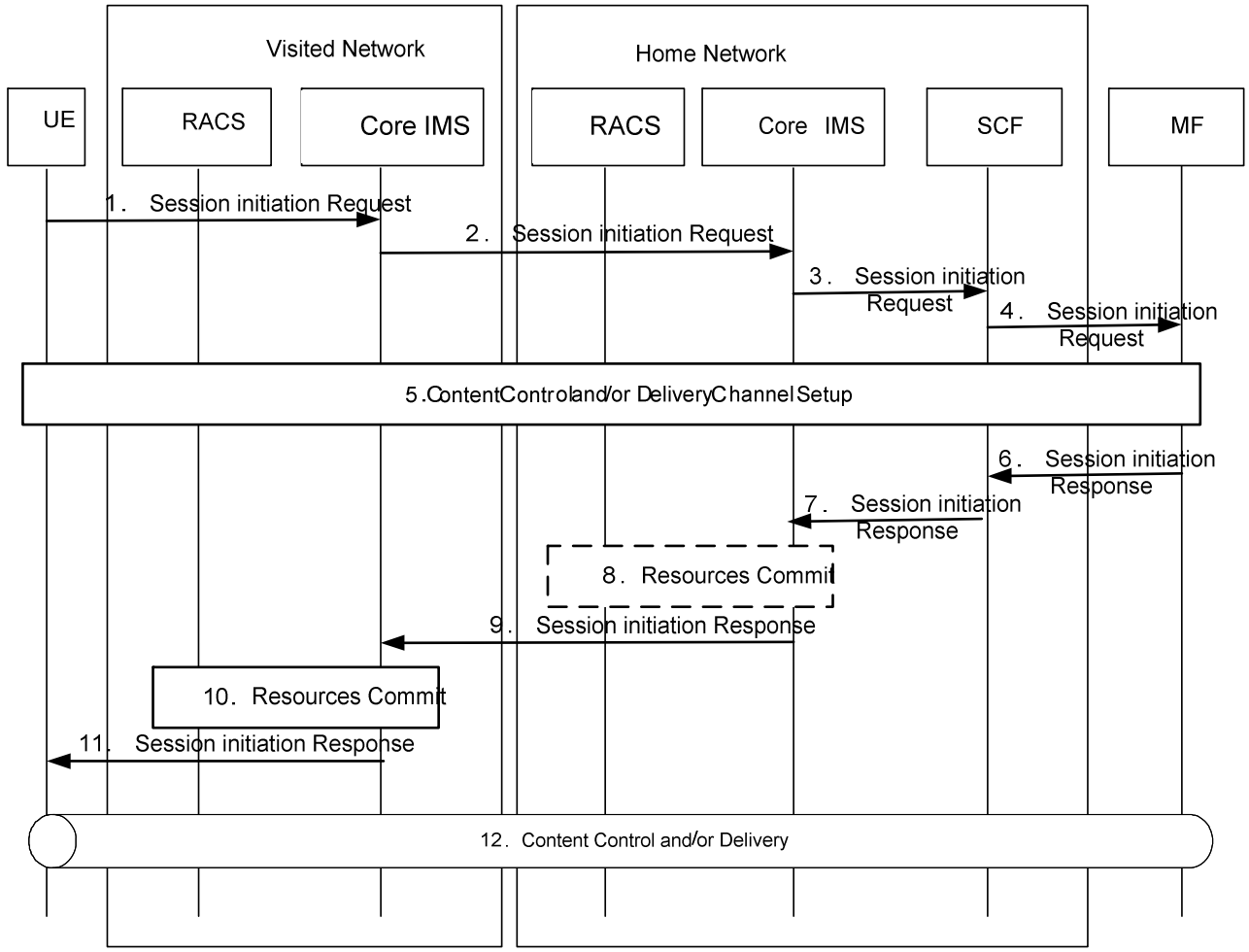

Figure 7.3: CoD procedures

1) The UE initiates a dialogue to the CoD service and submit the request to the Core IMS in the Visited Network, similar to steps 3-5 in clause 8.4.1.1.1 of [i.1].

2) Core IMS in the Visited Network forwards the request to the Core IMS in the Home Network.

3) The session initiation request is routed by the Core IMS in the Home Network up to the SCF.

4) The SCF performs service authorization as described in clause 5.1 of [i.1]. If the UE is allowed to access the content, the SCF forwards the session initiation request to the selected MF.

5) Signalling procedures for establishment of a content control channel and optionally content delivery channels take place between the UE and the MF (see similar clause 8.4.1.2.1 of [i.1]).

6~8) The steps are the same as step 7~10 not including step 8 of clause 8.4.1.1.1 of [i.1].

9) The Core IMS in the Home Network forwards this confirmation to the Core IMS in the Visited Network.

10) The P-CSCF within the Core IMS in the Visited Network interacts with the RACS in the Visited Network to commit all resources previously reserved. This includes opening pinholes for exchanging content control messages and/or content delivery.

11) The P-CSCF in the Visited Network forwards the dialogue confirmation to the UE.

After this point, UE may use the content control channel to request content to be streamed and the actual content will then be delivered to the UE. The content control channel will also be used to carry UE requests for controlling the streams, e.g. "pause", "fast forward", etc.

NOTE: Resources reserve/commit between Core IMS and RACS in the home network is optional when selected MF in the visited network servers the UE.

7.4 NGN integrated IPTV Interconnection model and related signalling flow

TISPAN NGN integrated IPTV subsystem consider the following scenarios for roaming and interconnection to the home network:

a) remote pure data access to IPTV SP/content provider

b) visited - home network roaming between IPTV providers (served only from home network)

c) visited - home network roaming between IPTV providers (served from home and/or visited network)

d) visited - home network roaming between IPTV providers (served from visited network)

NOTE 1: IMS interconnect to home IPTV provider not applicable for NGN integrated IPTV.

Scenario A: Remote IPTV user access to home IPTV SP via remote data connection

The remote IPTV UE can access home IPTV SP via remote IP connection (e.g. via VPN or secure remote access). The control signalling and media delivery can reach directly Home Network IPTV SP. However, remote IP connection goes via third party IP network relying on the functionality provided by the transport control layer and without agreement between home and visited networks the QoS cannot be ensured.

NOTE 2: This scenario is outside the scope of TISPAN for current release.

Scenario B: IPTV roaming to services of the IPTV Home Network via the IPTV Visited Network (home services)

In this scenario, IPTV platform is available in the Visited Network. However, it proxies service request to the IPTV SP in the home network and the content and services are delivered only from Home Network. In this scenario, the delivery of the content, metadata, service discovery, selection, service initiation, modification and termination is done from home network. It may require from Home Network IPTV SP to provide transcoding and content adaptation to adapt media to parameters required for entering the Visited Network (alternatively this could be done at the edge of visited network).

Scenario C: IPTV roaming to both services of the IPTV Visited Network and services of the IPTV Home Network (home and visited services)

As scenario B, but IPTV SP in the visited network only request content from the home network if it is not available in the visited network.

Scenario D: IPTV roaming to services of the IPTV Visited Network, where services and media delivery are served only in the visited network.

7.5 Support for hybrid services and related examples of signalling flow

Hybrid scenarios with alternative delivery over broadcasting networks enable provide selected TISPAN services to hybrid UEs:

- BC service
- Near CoD
- Push CoD
- Notification based services

7.5.1 Support for hybrid services with NGN integrated IPTV

NGN integrated IPTV support hybrid delivery of IPTV services as in [i.2]:

- Live TV (BC service) delivery over external TV delivery systems, including: DVB-T, DVB-S, DVB-C, DVB-H, 3GPP MBMS, or other.
- IPTV services delivered over NGN Integrated IPTV such as: CoD (also PushCoD), UGC, iTV, and others as defined above.

Additionally other interactive IPTV applications could be provided in hybrid scenarios, including those developed for other TV systems (e.g. based on CE-HTML developed for HbbTV [i.12] or OIPF [i.8]) using browser technologies similar to those specified for NGN integrated IPTV UE and supporting standards described in [i.10], annex D (UE capabilities).

The following scenario describes the case where the hybrid UE is capable of both receiving a broadcast stream via DVB and also providing TISPAN IPTV UE capabilities (described in [i.10], annex D (UE capabilities). This scenario enables other hybrid IMS based IPTV services that coordinate with existing mobile TV services, including access to broadcast data services which may be related to mobile TV content or totally independent content. These services may be implemented by integrating the interactivity features of NGN integrated IPTV with the features described in DVB or HbbTV.

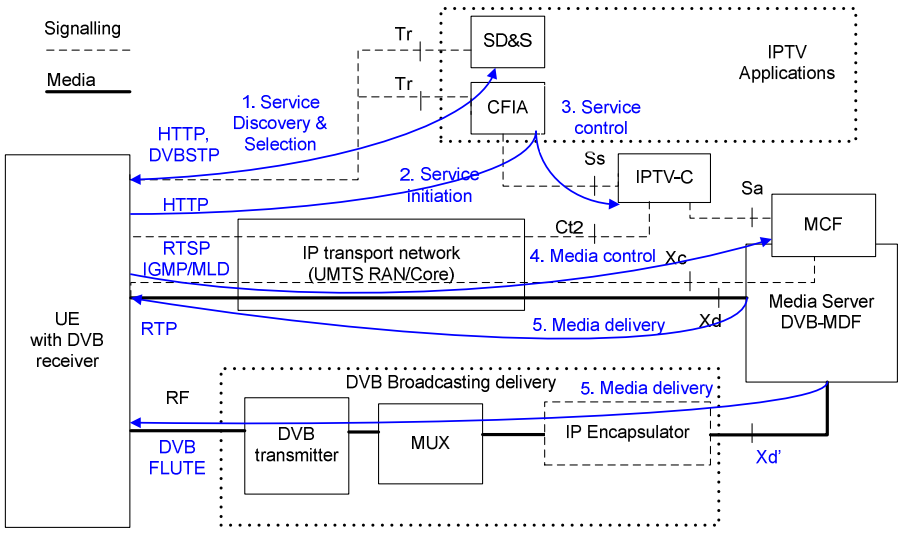

Figure 7.4: Hybrid NGN integrated IPTV services - UE with browser and DVB-H support

Initially the UE attaches to a mobile radio access network like UMTS, and service attachment and authorization is provided by NGN integrated IPTV (CFIA). The UE can then discover the IPTV service provider via SD&S (using a DVB compatible mechanisms).

1) UE performs service discovery and service selection via the Tr interface, to receive all necessary information about services (e.g. content identifiers, metadata, EPG, etc.). The service selection information may be personalized based on user profile, and may include additional information like content recommendations or content bookmarks. The delivery of service selection information could be based on DVB IPTV [i.14] (DVB SD&S or DVB BCG [i.15]).

2) UE requests IPTV service or selected content via Tr interface to the CFIA.

3) CFIA is responsible for service control and service logic execution for the personalized IPTV service, and also forwards content requests to IPTV-C and MCF.

4) The content control is performed directly between UE and MCF using RTSP over the Xc interface (for multicast services IGMP or MLD can also be used).

5) CFIA and MCF decide which delivery capability should be used for selected content based on UE and network capabilities:

   a) TISPAN delivery over IP access network (using MPEG2-TS).

   b) Alternatively in hybrid scenarios, selected content delivery over existing digital broadcasting technology (e.g. DVB-H, DVB-T, DVB-S, DVB-C, OMA BCAST).

NOTE: Optional IP adaptation and encapsulation specifically required by DVB broadcasting delivery are provided when other encapsulation/codecs differ from the MDF transport technologies supported over Xd.

7.5.2 Support for hybrid services with IMS based IPTV

Scenario where the hybrid UE is capable of both receive broadcast stream via DVB and include also IMS User Agent with TISPAN IPTV UE. This scenario enables also other kind of hybrid IMS based IPTV services that just plain mobile TV service, like access to broadcast data services which may be related to mobile TV content or totally independent content. This kind of services may be implemented by integrating interactivity features of IMS based IPTV and features described in DVB or OMA BCAST.

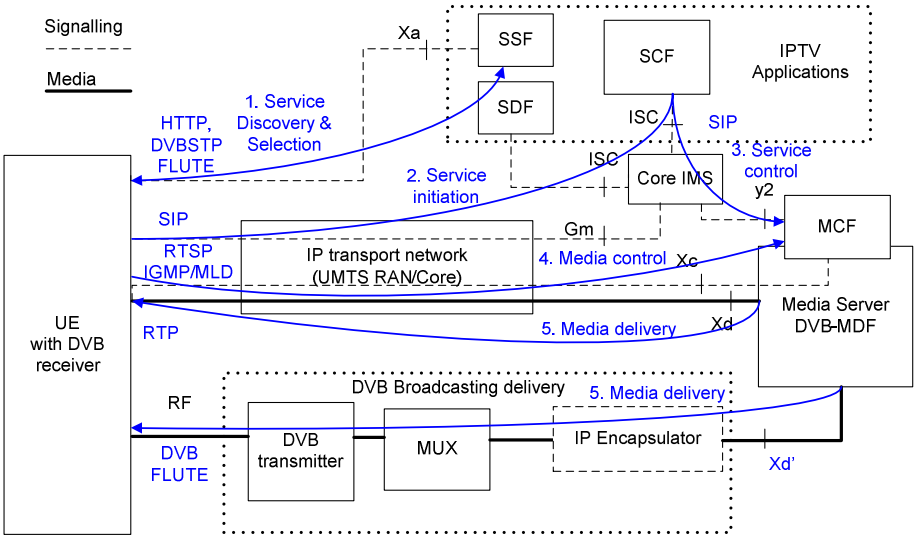

Figure 7.5: High level architecture for hybrid IMS based IPTV services using UE with IMS User Agent and DVB-H support

Initially UE attaches to a mobile radio access network like UMTS and register to IMS based NGN using SIP and SDP [i.27]. Then UE can discover IPTV service provider via SDF (using SIP [i.27] or optionally HTTP [i.13]). After then UE receives information about proper SSF to contact for IPTV service selection.

1) UE performs service discovery and service selection to receive all necessary information about services using Xa interface (e.g. content identifiers, metadata, EPG, etc.). The service selection information could be fully personalized based on user profile with additional information like content recommendations or content bookmarks. The delivery of service selection information could be based on DVB IPTV [i.14] (DVB SD&S or DVB BCG) or using OMA BCAST service guide (OMA BCAST BCG [i.15] and DVB-H ESG [i.28]).

2) UE is requested IPTV service or selected content via Gm interface of core IMS and SIP initiation request [i.27] is forwarded to IPTV application server (SIP AS called SCF) over ISC. The user request is authorized via IMS core (checking with user profile) and resources for service are reserved using existing NGN subsystem RACS (Resource and Admission Control Subsystem). After successful initiation UE and MCF is informed.

3) SCF is responsible for service control and service logic execution for personalized IPTV service and also forward content requests to MCF.

4) The content control is performed directly between UE and MCF using Xc interfaces by RTSP (for multicast services can be used also IGMP or MLD).

5) SCF and MCF also decide based on UE and network capabilities which delivery has to be used for selected content:

   a) Primarily TISPAN delivery over IP access network (using RTP and/or MPEG2-TS).

   b) Alternatively in hybrid scenarios is selected delivery over some existing digital broadcasting technology (e.g. DVB-H, DVB-T, DVB-S, DVB-C, OMA BCAST).

NOTE: Optional IP encapsulator is responsible for adaptation and encapsulation required specifically by DVB broadcasting delivery when there used other encapsulation/codecs differ from MDF transport technologies supported over Xd.

History

Document history		
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