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SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for the NGN – Network signalling and control functional architecture

Signalling architecture for IPTV control plane

Recommendation ITU-T Q.3040

ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4, 5, 6, R1 AND R2	Q.120–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.799
Q3 INTERFACE	Q.800–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1699
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000	Q.1700–Q.1799
SPECIFICATIONS OF SIGNALLING RELATED TO BEARER INDEPENDENT CALL CONTROL (BICC)	Q.1900–Q.1999
BROADBAND ISDN	Q.2000–Q.2999
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR THE NGN	Q.3000–Q.3999
General	Q.3000–Q.3029
Network signalling and control functional architecture	**Q.3030–Q.3099**
Network data organization within the NGN	Q.3100–Q.3129
Bearer control signalling	Q.3130–Q.3179
Signalling and control requirements and protocols to support attachment in NGN environments	Q.3200–Q.3249
Resource control protocols	Q.3300–Q.3369
Service and session control protocols	Q.3400–Q.3499
Service and session control protocols – supplementary services	Q.3600–Q.3649
NGN applications	Q.3700–Q.3849
Testing for NGN networks	Q.3900–Q.3999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Q.3040

Signalling architecture for IPTV control plane

Summary

Recommendation ITU-T Q.3040 describes the overall signalling architecture for IPTV control plane. It identifies the functions, functional blocks, physical entities, interfaces, and protocols that will model the control plane for IPTV.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Q.3040	2010-08-06	11

Keywords

Control plane, IPTV, signalling.

FOREWORD

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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

CONTENTS

Introduction

The service control functions include call/session control, resource control, registration, and authentication and authorization functions at the service level for both mediated and non-mediated services. They may also include functions for controlling media resources, i.e., specialized resources and gateways at the service-signalling level. Recommendation ITU-T Q.3040 describes the overall signalling architecture for the IPTV control plane. It identifies the functions, functional blocks, physical entities, interfaces, and protocols that will model the control plane for IPTV.

Recommendation ITU-T Q.3040

Signalling architecture for IPTV control plane

1 Scope

This Recommendation describes the overall signalling architecture for IPTV control plane. It identifies the functions, functional blocks, physical entities, interfaces, and protocols that will model the control plane for IPTV.

The interfaces identified in this Recommendation include:

- interfaces between the service control entities and the IPTV application entities;
- interfaces between the service control entities and the control entities of service transport stratum;
- interfaces between the service control entities and the content delivery entities;
- interfaces between the service control entities and the end user.

Other interfaces (such as the interfaces between two IPTV application entities, internal interfaces of service transport stratum, etc.) are outside the scope of this Recommendation.

Appendix I provides functions and reference architecture of non-NGN IPTV architecture which are extracted from [ITU-T Y.1910]. This includes the reference points related and unrelated to service control functions, which may be helpful for the readers.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Q.1741.6] Recommendation ITU-T Q.1741.6 (2009), *IMT-2000 references to Release 8 of GSM-evolved UMTS core network.*

[ITU-T Y.1910] Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture.*

[IETF RFC 2326] IETF RFC 2326 (1998), *Real Time Streaming Protocol (RTSP).*

[IETF RFC 2616] IETF RFC 2616 (1999), *Hypertext Transfer Protocol – HTTP/1.1.*

[IETF RFC 3588] IETF RFC 3588 (2003), *Diameter Base Protocol.*

3 Definitions

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CD&LCF Content Distribution and Location Control Functions

CD&SF Content Delivery and Storage Functions

DVBSTP DVB SD&S Transport Protocol

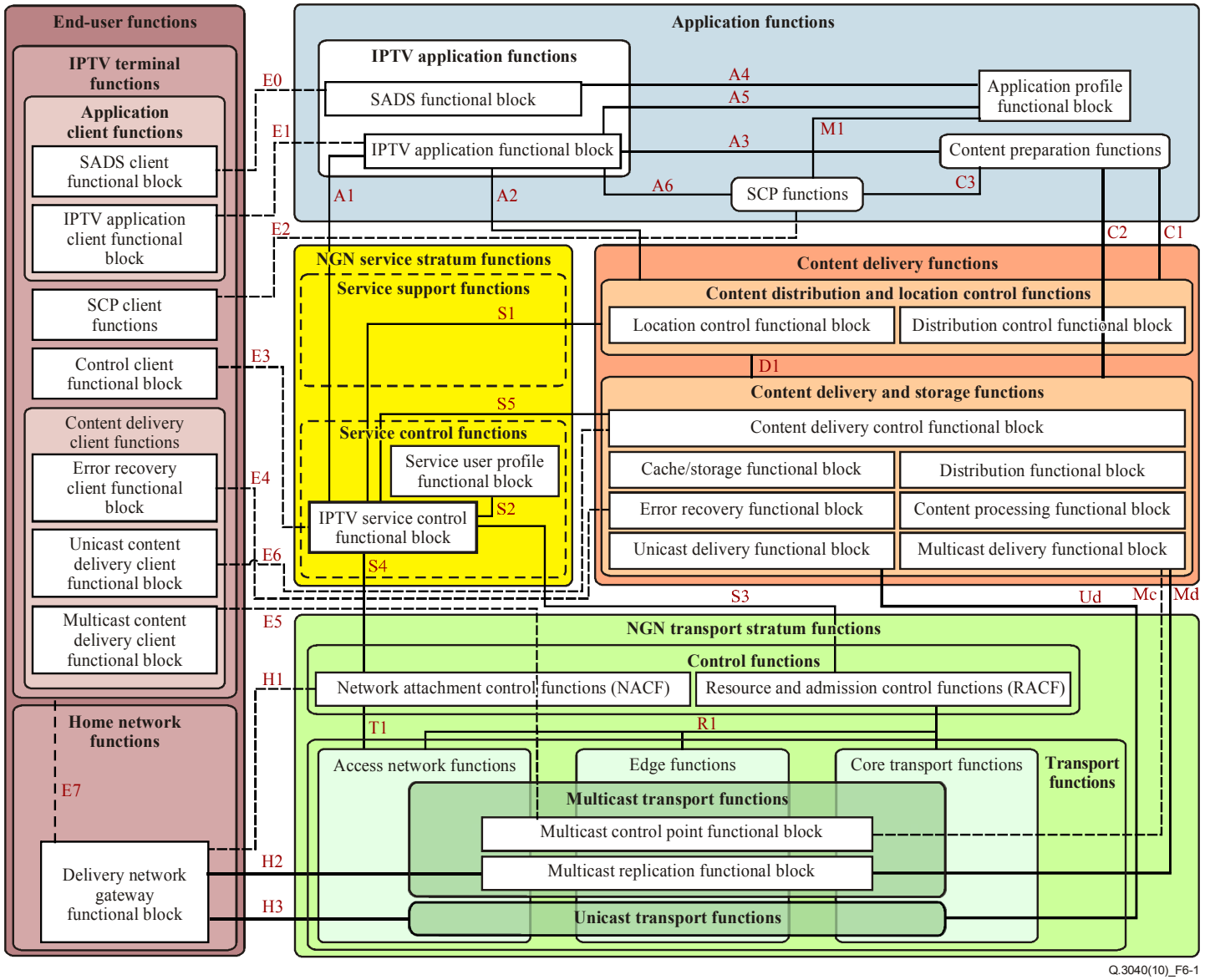
FLUTE File Delivery over Unidirectional Transport
IGMP Internet Group Management Protocol
IMS IP Multimedia Subsystem
IPTV Internet Protocol TV
ITF Internet Protocol Television Terminal Functions
MGCF Media Gateway Control Function
MLD Multicast Listener Discovery Protocol
NACF Network Attachment Control Functions
NGN Next Generation Networks
PE Physical Entity
RACF Resource and Admission Control Functions
RTP Real-time Transport Protocol
SADS Service and Application Discovery and Selection
SC&DF Service Control and Delivery Functions
SCP Service and Content Protection
TCP Transmission Control Protocol
UDP User Datagram Protocol

5 Conventions

None.

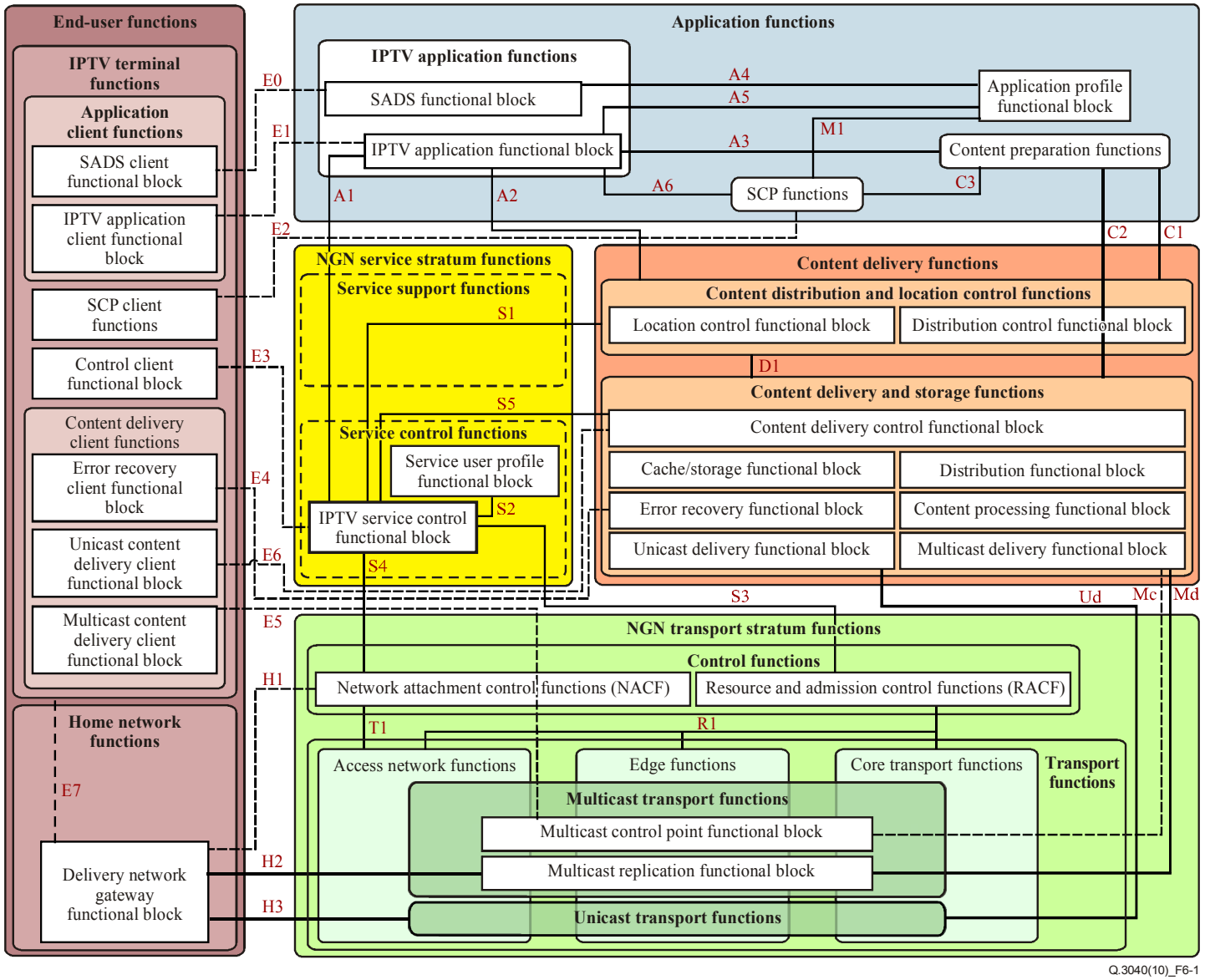
6 Control architecture and functions

This clause describes the details of the signalling architecture for IPTV. Figures 6-1 and 6-2 show respectively NGN non-IMS IPTV and NGN IMS IPTV architectural approaches as per [ITU-T Y.1910]. The service control functional entities are bordered (highlighted) in Figures 6-1 and 6-2.



NOTE – This figure is an exact replica of Figure 11-2 of [ITU-T Y.1910].

Figure 6-1 – Functions and reference points of NGN non-IMS IPTV architecture



NOTE – This figure is an exact replica of Figure 11-3 of [ITU-T Y.1910].

Figure 6-2 – Functions and reference points of NGN IMS IPTV architecture

6.1 Functions

Functions identified in Figures 6-1 and 6-2 are described in detail in [ITU-T Y.1910].

6.2 Functional blocks

Functional blocks identified in Figures 6-1and 6-2 are described in detail in [ITU-T Y.1910].

6.3 Reference points for NGN non-IMS IPTV architecture

The reference points below are for NGN non-IMS IPTV architecture which is depicted in Figure 6-1.

6.3.1 Reference point A1

The A1 reference point is between the IPTV application functional block and the IPTV service control functional block.

6.3.2 Reference point E3

The E3 reference point is between the control client functional block and the IPTV service control functional block.

6.3.3 Reference point S1

The S1 reference point is between the IPTV service control functional block and CD&LCF.

6.3.4 Reference point S2

The S2 reference point is between the IPTV service control functional block and the service user profile functional block.

6.3.5 Reference point S3

The S3 reference point is between the IPTV service control functional block and RACF.

6.3.6 Reference point S4

The S4 reference point is between the IPTV service control functional block and NACF.

6.3.7 Reference point S5

The S5 reference point is between the IPTV service control functional block and the content delivery control functional block.

6.4 Reference points for NGN IMS IPTV architecture

The reference points below are for NGN IMS IPTV architecture which is depicted in Figure 6-2.

6.4.1 Reference point A0

The A0 reference point is between the SADS functional block and core IMS functions.

6.4.2 Reference point A1

The A1 reference point is between the IPTV application functional block and the core IMS functions.

6.4.3 Reference point E3

The E3 reference point is between the session client functional block and the core IMS functions.

6.4.4 Reference point S1

The S1 reference point is between core IMS functions and CD&LCF.

6.4.5 Reference point S2

The S2 reference point is between core IMS functions and service user profile functional block.

6.4.6 Reference point S3

The S3 reference point is between core IMS functions and RACF.

6.4.7 Reference point S4

The S4 reference point is between core IMS functions providing IPTV service control and NACF.

6.4.8 Reference point S5

The S5 reference point is between core IMS functions and content delivery control functional block.

7 Physical entities and interfaces in IPTV architecture

When implementing an IPTV architecture, some of the functional entities identified in clause 6 may be grouped and implemented in a number of physical entities. Figures 7-1 and 7-2 provide examples of how the functional entities could be grouped for both an IMS and non-IMS based NGN. These architectures are used to identify the signalling interfaces that are within the scope of this Recommendation.

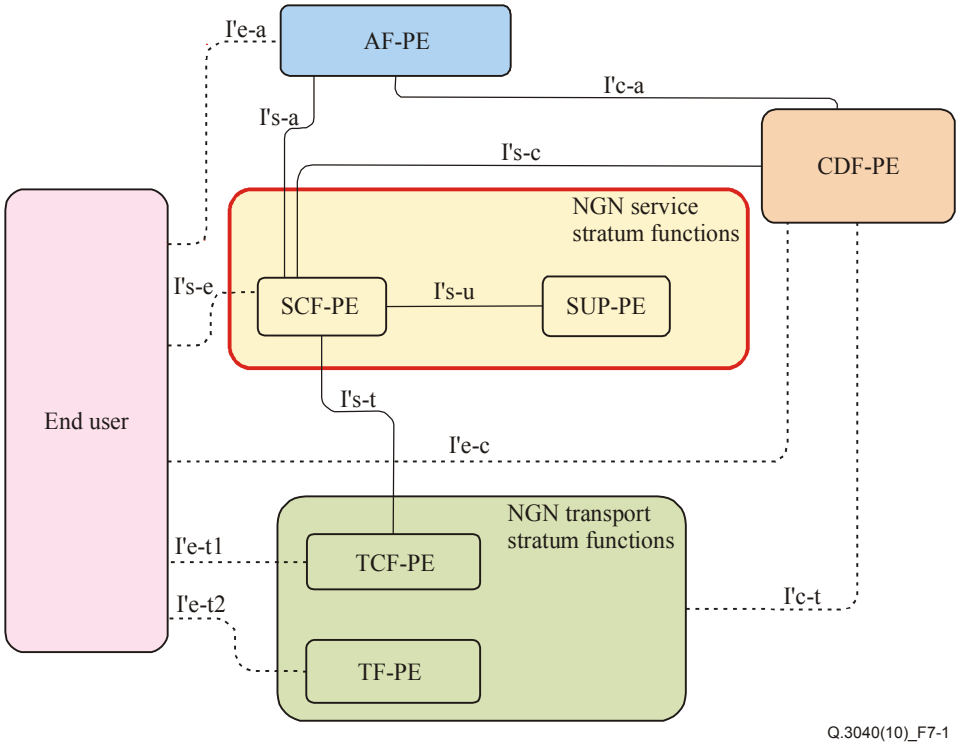


Figure 7-1 – Physical entities and interfaces of NGN non-IMS IPTV architecture

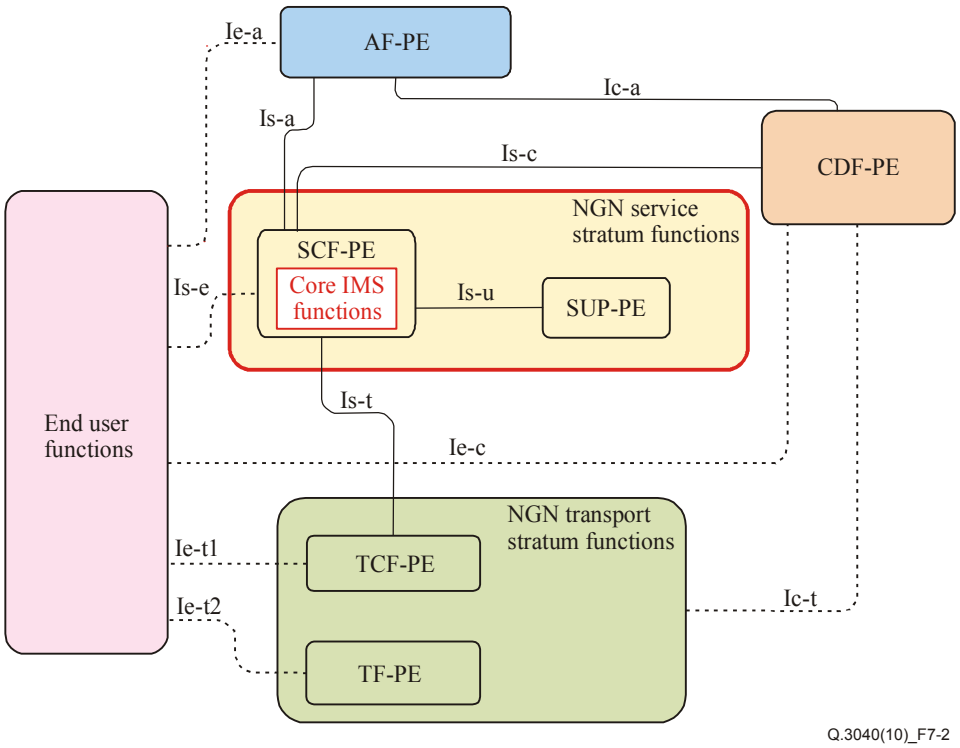


Figure 7-2 – Physical entities and interfaces of NGN IMS IPTV architecture

7.1 Mapping functions and functional blocks into physical entities

The mapping of functions and functional blocks into physical entities is shown in Table 7-1.

Table 7-1 – Mapping functions and functional block into physical entities

Physical entity	Description	Functions and functional blocks included
AF-PE	Physical entity for application function	SADS, IPTV application, SCF functions, application profile, content preparation functions, etc.
SCF-PE	Physical entity for service control function	IPTV service control functional block/core IMS functions, service user profile functional block
SUP-PE	Physical entity for service user profile	Service user profile functional block
CDF-PE	Physical entity for content delivery function	Content distribution and location control functions, content delivery and storage functions
TCF-PE	Physical entity for transport control function	Network attachment control functions (NACF), resource and admission control functions (RACF)
TF-PE	Physical entity for transport function	Access network functions, edge functions, core transport functions
End user	Physical entity for end-user function	Application client functions, session client functional block, SCP client functions, content delivery client functions, home network functions

7.2 Mapping reference points to interfaces

The mapping of reference points to interfaces is shown in Table 7-2.

Table 7-2 – Mapping reference points to interfaces

NGN non-IMS IPTV architecture		NGN IMS IPTV architecture		Interface description
Interfaces	**Mapping reference points**	**Interfaces**	**Mapping reference points**	
I's-a	A1	Is-a	A0, A1	Interface between SCF-PE and AF-PE
I's-e	E3	Is-e	E3	Interface between SCF-PE and end user
I's-c	S1, S5	Is-c	S1, S5	Interface between SCF-PE and CDF-PE
I's-u	S2	Is-u	S2	Interface between SCF-PE and SUP-PE
I's-t	S3, S4	Is-t	S3, S4	Interface between SCF-PE and TCF-PE

8 Protocols used for interfaces

8.1 Interfaces in NGN non-IMS IPTV architecture

The interfaces below are in NGN non-IMS IPTV architecture which is depicted in Figure 7-1.

8.1.1 Interface I's-a

For NGN non-IMS IPTV architecture, interface I's-a will use HTTP as per [IETF RFC 2616].

8.1.2 Interface I's-e

For NGN non-IMS IPTV architecture, interface I's-e will use HTTP as per [IETF RFC 2616], and RTSP as per [IETF RFC 2326].

8.1.3 Interface I's-c

For NGN non-IMS IPTV architecture, interface I's-c will use RTSP protocol as per [IETF RFC 2326].

8.1.4 Interface I's-u

For NGN non-IMS IPTV architecture, interface I's-u will use DIAMETER protocol as per [IETF RFC 3588].

8.1.5 Interface I's-t

For NGN non-IMS IPTV architecture, interface I's-t will use DIAMETER protocol as per [IETF RFC 3588].

8.2 Interfaces in NGN IMS IPTV architecture

The interfaces below are in the NGN IMS IPTV architecture which is depicted in Figure 7-2.

8.2.1 Interface Is-a

For NGN IMS IPTV architecture, interface Is-a will use SIP as per [b-ETSI TS 124 229], as indicated in [ITU-T Q.1741.6].

8.2.2 Interface Is-e

For NGN IMS IPTV architecture, interface Is-e will use SIP as per [b-ETSI TS 124 229], as indicated in [ITU-T Q.1741.6].

NOTE – Is-e interface relates to UNI defined by [b-ITU-T Q.3402]; however, IPTV services are not covered by [b-ITU-T Q.3402]. The relationship is for further study.

8.2.3 Interface Is-c

For NGN IMS IPTV architecture, interface Is-c will use SIP as per [b-ETSI TS 124 229], as indicated in [ITU-T Q.1741.6].

8.2.4 Interface Is-u

For NGN IMS IPTV architecture, interface Is-u will use DIAMETER protocol as per [IETF RFC 3588].

8.2.5 Interface Is-t

For NGN IMS IPTV architecture, interface Is-t will use DIAMETER protocol as per [IETF RFC 3588].

NOTE – Is-t interface partially relates to Rt interface defined in [b-ITU-T Q.3321.1]. Because some IPTV services use multicast capabilities, [b-ITU-T Q.3321.1] does not cover the multicast capabilities. The relationship is for further study.

10 Security considerations

The signalling architecture for IPTV control plane is required to support security mechanisms of session control, as supported by the protocols identified in clause 8. These mechanisms can be applied in both non-IMS and IMS-based IPTV architectures. Other service specific security requirements are out of scope of this Recommendation.

Appendix I

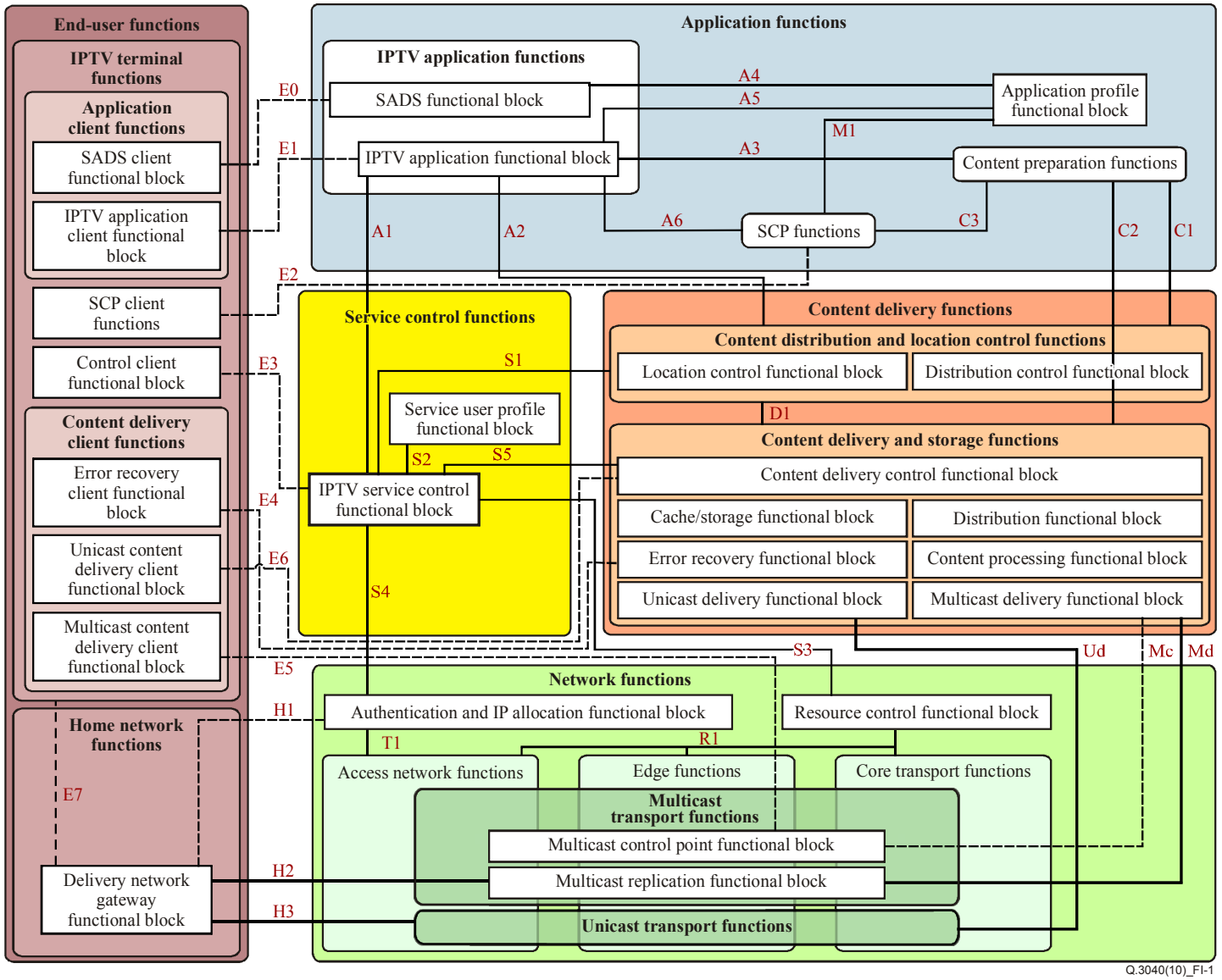
Functions and reference points of non-NGN IPTV architecture

(This appendix does not form an integral part of this Recommendation)

This appendix provides functions and reference architecture for non-NGN IPTV architecture which are extracted from [ITU-T Y.1910]. This describes all reference points including the reference points related and unrelated to service control functions.

I.1 Control architecture and functions

This clause describes the signalling and control plane architecture for non-NGN IPTV. Figure I.1 shows non-NGN IPTV architectural approach as per [ITU-T Y.1910].



NOTE – This figure is an exact replica of Figure 11-1 of [ITU-T Y.1910].

Figure I.1 – Functions and reference points of non-NGN IPTV architecture

I.1.1 Functions

Functions identified in Figure I.1 are described in detail in [ITU-T Y.1910].

I.1.2 Functional blocks

Functional blocks identified in Figure I.1 are described in detail in [ITU-T Y.1910].

I.2 Reference points

The following reference points are those identified in [ITU-T Y.1910].

I.2.1 Reference point A1

The A1 reference point is between the IPTV application functional block and the IPTV service control functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point will use HTTP as per [IETF RFC 2616].

I.2.2 Reference point A2

The A2 reference point is between the IPTV application functional block and the content distribution and location control functions (CD&LCF).

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.3 Reference point A3

The A3 reference point is between the IPTV application functional block and the content preparation functions.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.4 Reference point A4

The A4 reference point is between the SADS functional block and the application profile functional block that is used by the SADS functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.5 Reference point A5

The A5 reference point is between the IPTV application functional block and the application profile functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.6 Reference point A6

The A6 reference point is between the IPTV application functional block and SCP functions.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.7 Reference point C1

The C1 reference point is between the content preparation functions and the content distribution and location control functions (CD&LCF).

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.8 Reference point C2

The C2 reference point is between the content preparation functions and the content delivery and storage functions (CD&SF).

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.9 Reference point C3

The C3 reference point is between the content preparation functions and the SCP functions.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.10 Reference point E0

The E0 reference point is between the ITF SADS client functional block and the SADS functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point will use DVBSTP as per [b-ETSI TS 102 034], HTTP as per [IETF RFC 2616], or FLUTE as per [b-IETF RFC 3926].

I.2.11 Reference point E1

The E1 reference point is between the ITF application client functional block and the IPTV application functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point will use HTTP as per [IETF RFC 2616].

I.2.12 Reference point E2

The E2 reference point is between the SCP client functions and the SCP functions.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.13 Reference point E3

The E3 reference point is between the control client functional block and the IPTV service control functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point will use HTTP, as per [IETF RFC 2616], or RTSP as per [IETF RFC 2326].

I.2.14 Reference point E4

The E4 reference point is between error recovery functional block and error recovery client functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.15 Reference point E5

The E5 reference point is between the multicast content delivery client functional block and the multicast control point functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point will use IGMP V3 as per [b-IETF RFC 3376] or MLDv2 as per [b-IETF RFC 3810].

I.2.16 Reference point E6

The E6 reference point is between the unicast content delivery client functional block and the content delivery control functional blocks.

For non-NGN IPTV architecture, interfaces supporting this reference point will use RTSP as per [IETF RFC 2326].

I.2.17 Reference point H1

The H1 reference point is between the delivery network gateway functional block and the authentication and IP allocation functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.18 Reference point H2

The H2 reference point provides multicast-based IP connectivity between delivery network gateway functional blocks.

For non-NGN IPTV architecture, interfaces supporting this reference point will use MPEG-2 TS over RTP over UDP as per [b-ETSI TS 102 034], [b-IETF RFC 3550] and [b-IETF RFC 768].

I.2.19 Reference point H3

The H3 reference point provides unicast-based IP connectivity between the delivery network gateway functional block and the access network functions.

For non-NGN IPTV architecture, interfaces supporting this reference point will use:

- MPEG-2 TS over RTP over UDP as per [b-ETSI TS 102 034], [b-IETF RFC 3550] and [b-IETF RFC 768] for content flow streams.
- TCP as per [b-IETF RFC 793] for file delivery.

I.2.20 Reference point M1

The M1 reference point is between SCP functions and the application profile functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.21 Reference point Md

The Md reference point is between the multicast delivery functional block and the multicast transport functions.

For non-NGN IPTV architecture, interfaces supporting this reference point will use RTP over UDP as per [b-IETF RFC 3550] and [b-IETF RFC 768].

I.2.22 Reference point R1

The R1 reference point is between the resource control functional block and the network transport functions.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.23 Reference point S1

The S1 reference point is between the IPTV service control functional block and CD&LCF.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.24 Reference point S2

The S2 reference point is between the IPTV service control functional block and the service user profile functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.25 Reference point S3

The S3 reference point is between the IPTV service control functional block and the resource control functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.26 Reference point S4

The S4 reference point is between the IPTV service control functional block and the authentication and IP allocation functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.27 Reference point S5

The S5 reference point is between the IPTV service control functional block and the content delivery control functional block.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.28 Reference point T1

The T1 reference point is between the authentication and IP allocation functional block and access network functions.

For non-NGN IPTV architecture, interfaces supporting this reference point are for further study.

I.2.29 Reference point Ud

The Ud reference point is between the unicast delivery functional block and the unicast transport functions.

The same protocols indicated for reference point H3 apply at reference point Ud.

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