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SERIES Q: SWITCHING AND SIGNALLING

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

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Description of signalling protocols supporting next generation network capability sets

Recommendation ITU-T Q.3050

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Recommendation ITU-T Q.3050

Description of signalling protocols supporting next generation network capability sets

Summary

Recommendation ITU-T Q.3050 provides brief descriptions of signalling protocols supporting next generation network (NGN) capability sets in terms of the overall protocol Recommendations defined in ITU-T. The descriptions are from the aspects of NGN capability set, NGN functional architecture, NGN signalling architecture and protocol Recommendations that have been standardized in ITU-T.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Q.3050	2012-08-13	11

Keywords

Architecture, NGN, Protocol set.

FOREWORD

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1 Scope

This Recommendation provides brief descriptions of signalling protocols supporting next generation network (NGN) capability sets in terms of the overall protocol Recommendations defined in ITU-T. The descriptions are from the aspects of NGN capability sets, NGN functional architecture, NGN signalling architecture and protocol Recommendations that have been standardized in ITU-T.

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 Q.3221] Recommendation ITU-T Q.3221 (2008), *Requirements and protocol at the interface between the service control entity and the transport location management physical entity (S-TC1 interface).*

[ITU-T Q.3301.1] Recommendation ITU-T Q.3301.1 (2010), *Resource control protocol No. 1, version 2 – Protocol at the Rs interface between service control entities and the policy decision physical entity*.

[ITU-T Q.3302.1] Recommendation ITU-T Q.3302.1 (2010), *Resource control protocol No. 2 (rcp2) – Protocol at the Rp interface between transport resource control physical entities*.

[ITU-T Q.3303.0] Recommendation ITU-T Q.3303.0 (2007), *Resource control protocol No. 3 – Protocols at the Rw interface between a policy decision physical entity (PD-PE) and a policy enforcement physical entity (PE-PE): Overview*.

[ITU-T Q.3303.1] Recommendation ITU-T Q.3303.1 (2012), *Resource control protocol No. 3 – Protocol at the interface between a Policy Decision Physical Entity (PD-PE) and a Policy Enforcement Physical Entity (PE-PE): COPS alternative version 2*.

[ITU-T Q.3303.2] Recommendation ITU-T Q.3303.2 (2007), *Resource control protocol No. 3 – Protocol at the interface between a Policy Decision Physical Entity (PD-PE) and a Policy Enforcement Physical Entity (PE-PE) (Rw interface): H.248 alternative*.

[ITU-T Q.3303.3] Recommendation ITU-T Q.3303.3 (2012), *Resource control protocol No. 3 – Protocols at the Rw interface between a policy decision physical entity (PD-PE) and a policy enforcement physical entity (PE-PE): Diameter profile version 2*.

[ITU-T Q.3304.1] Recommendation ITU-T Q.3304.1 (2012), *Resource control protocol No. 4 (rcp4) – Protocols at the Rc interface between a transport resource control physical entity and a transport physical entity: COPS alternative*.

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[ITU-T Q.3402] Recommendation ITU-T Q.3402 (2008), *NGN UNI signalling profile (Protocol set 1).*

[ITU-T Y.2006] Recommendation ITU-T Y.2006 (2008), *Description of capability set 1 of NGN release 1*.

[ITU-T Y.2007] Recommendation ITU-T Y.2007 (2010), *NGN capability set 2*.

[ITU-T Y.2011] Recommendation ITU-T Y.2011 (2004), *General principles and general reference model for Next Generation Networks.*

[ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.

[ITU-T Y.2211] Recommendation ITU-T Y.2211 (2007), *IMS-based real-time conversational multimedia services over NGN emulation*.

[ITU-T Y.2271] Recommendation ITU-T Y.2271 (2006), *Call server-based PSTN/ISDN emulation*.

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

3 Definitions

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AF-PE	Application Function Physical Entity
ANI	Application Network Interface
ASS-PE	Application and Service Support Physical Entity
CD-PE	Content Distribution Physical Entity
COPS	Common Open Policy Service
COPS-PR	COPS usage for Policy Provisioning
DTMF	Dual Tone Multi-Frequency
IP PBX	Internet Protocol Private Branch eXchange
IPTV	IP Television
ISDN	Integrated Services Digital Network

NACF	Network Attachment Control Functions
NAC-PE	Network Attachment Control Physical Entity
NGN	Next Generation Network
NNI	Network-Network Interface
PD-PE	Policy Decision Physical Entity
PE-PE	Policy Enforcement Physical Entity
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RCIP	Resource Connection Initiation Protocol
RACE	Resource and Admission Control Entity
SC-PE	Service Control Physical Entity
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SNI	Service Network Interface
SNMP	Simple Network Management Protocol
TRC-PE	Transport Resource Control Physical Entity
T-PE	Transport Physical Entity
UE	User Equipment
UNI	User Network Interface
VoD	Video on Demand
VoIP	Voice over IP

5 Conventions

None.

6 NGN capability sets

6.1 NGN capability set 1

Capability set 1 is primarily focused on session based conversational services such as telephony and video phone service. Services supported by capability set 1 include:

– PSTN/ISDN emulation services.

PSTN/ISDN emulation services are provided by an NGN to support legacy terminals and interfaces. The PSTN/ISDN emulation services are the same or better than those provided by circuit-switched networks. The PSTN/ISDN emulation services are defined in [ITU-T Y.2271].

– PSTN/ISDN simulation services

PSTN/ISDN simulation services provide PSTN/ISDN-like services. The requirements are independent of the media that is used during the communication. PSTN/ISDN simulation services requirements are defined in [ITU-T Y.2211].

Transport connectivity, communication modes, codecs and other capabilities for NGN capability set 1 are described in clause 7 of [ITU-T Y.2006].

6.2 NGN capability set 2

Capability set 2 includes features that are necessary to provide basic IPTV services (e.g., linear TV and VoD) in NGN. Therefore, capability set 2 includes ITU-T Recommendations related to NGN-based IPTV.

Internet Protocol Version 6 (IPv6) support, multicast support and other capabilities for NGN capability set 2 are described in clause 7 of [ITU-T Y.2007].

7 NGN functional architecture

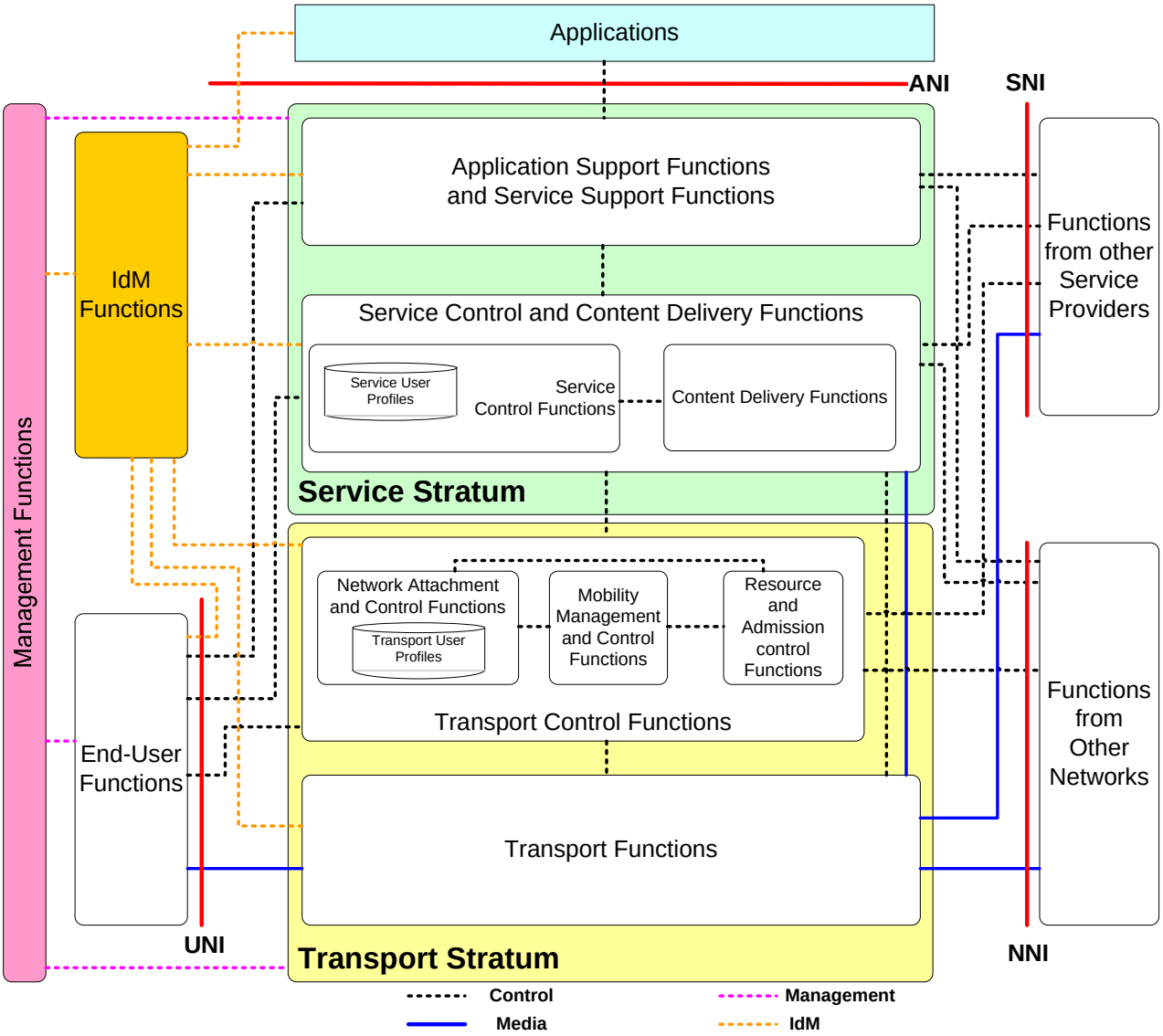
7.1 Overview of NGN architecture

NOTE – The following text is based on the text provided in clause 7 of [ITU-T Y.2012].

Figure 1 shows an overview of the NGN functional architecture.

The NGN functional architecture supports the UNI, NNI, ANI and SNI reference points as described in clause 6.2 of [ITU-T Y.2012].

The NGN functions are divided into service stratum functions and transport stratum functions according to [ITU-T Y.2011]. To provide these services, several functions are necessary in both the service stratum and the transport stratum, as illustrated in Figure 1. For detailed description of these functions, refer to [ITU-T Y.2012].



NOTE – Figure 1 is an exact replica of Figure 7-1 of [ITU-T Y.2012].

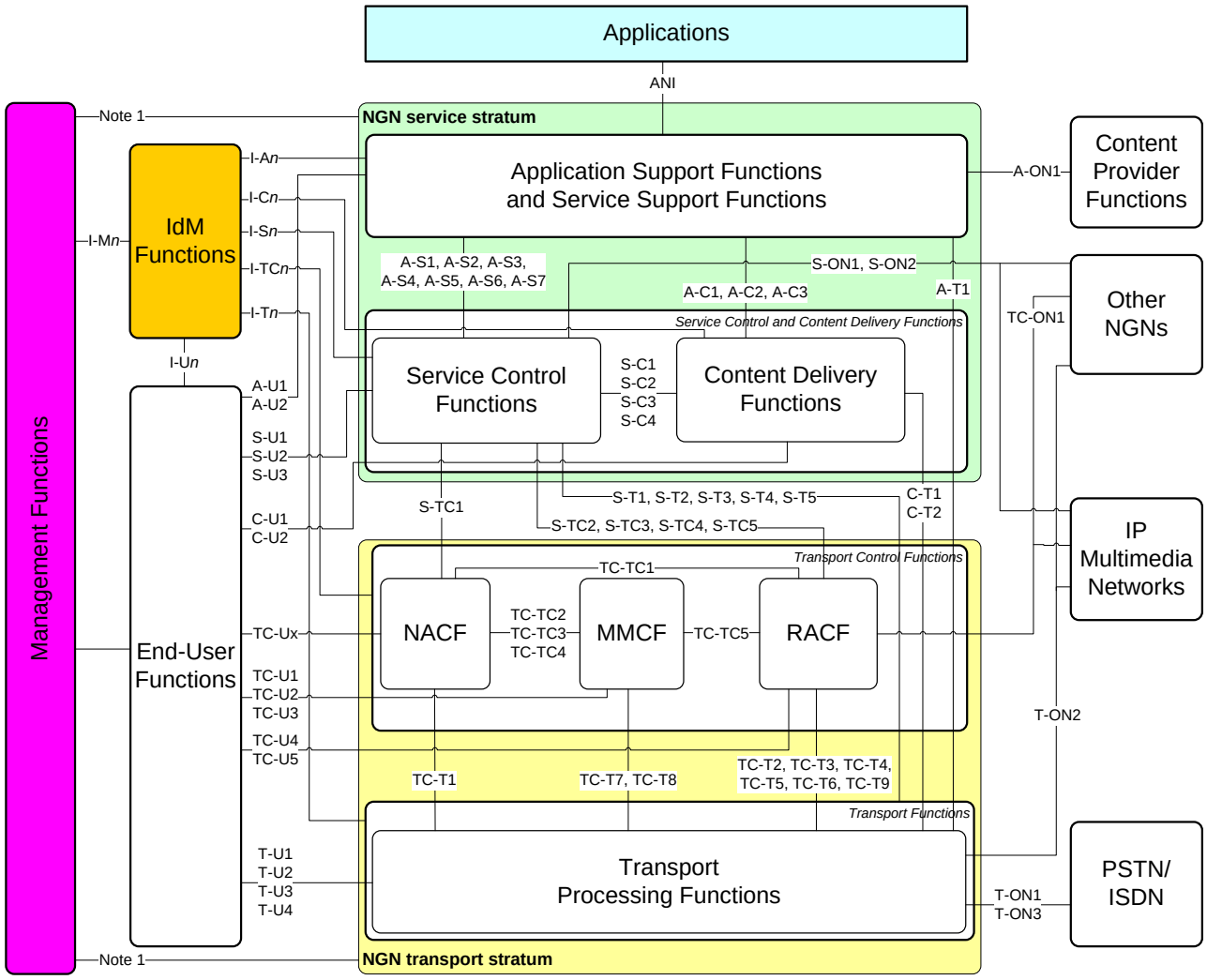
Figure 1 – NGN architecture overview

7.2 Generalized NGN functional architecture

Clause 9 of [ITU-T Y.2012] describes the generalized functional architecture for NGN, including the definitions of the generalized functional entities and reference points.

Figure 2 shows the NGN functional architecture framework.

For a detailed description of the functional entities and reference points of the generalized NGN functional architecture, refer to clause 9 of [ITU-T Y.2012].



NOTE – Figure 2 is an exact replica of Figure 9-1 of [ITU-T Y.2012].

Figure 2 – NGN functional architecture framework

8 NGN signalling architecture

When implementing NGN architecture, some functional entities may be integrated into one or more physical entities. Figure 3 provides an example of how functional entities could be grouped into physical entities in NGN architecture.

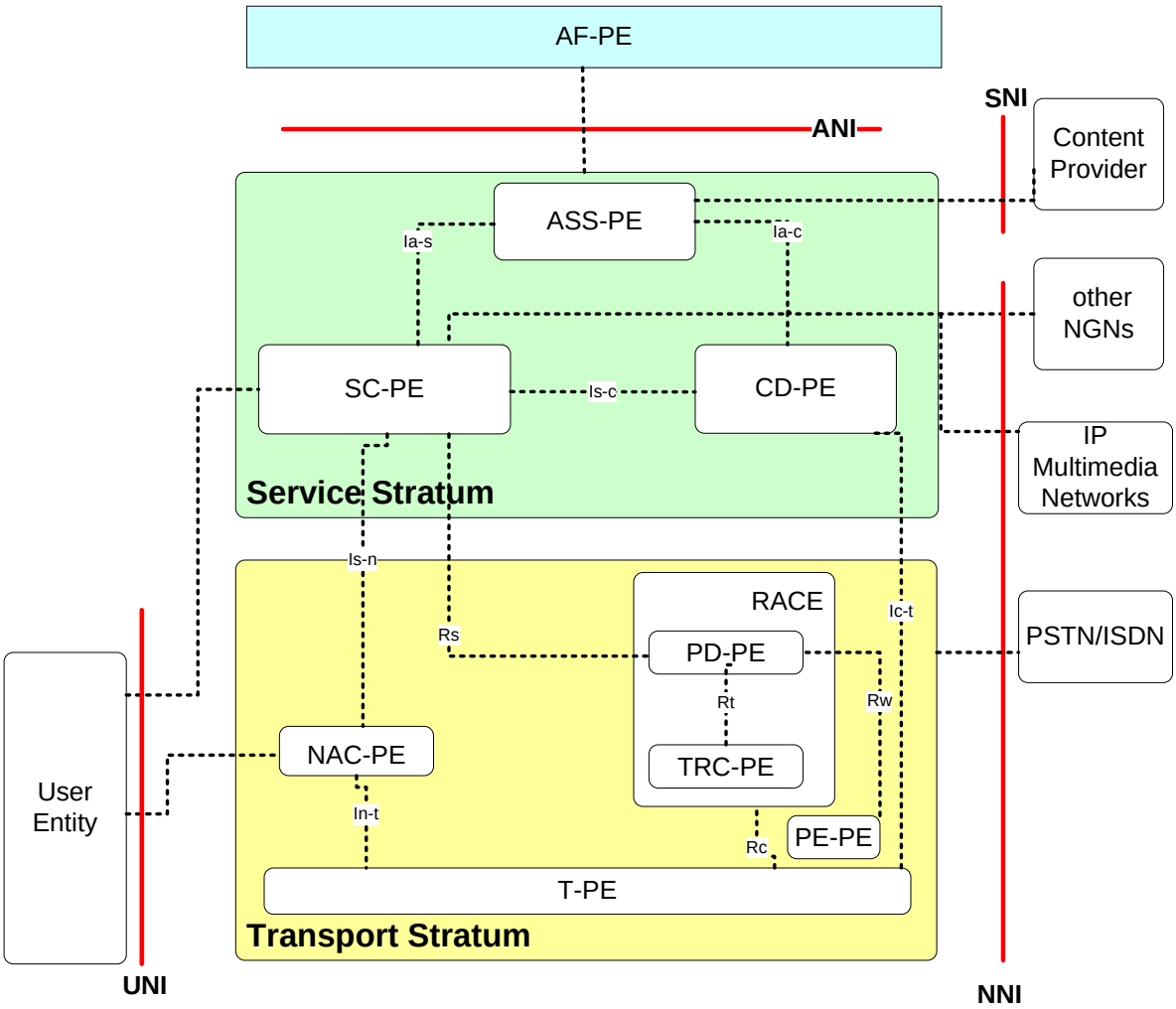


Figure 3 – Example of physical entities and interfaces in NGN architecture

8.1 Mapping functions and functional blocks into physical entities

The mapping of functions and functional blocks into physical entities is shown in Table 8-1.

Table 8-1 – Mapping functions and functional blocks into physical entities

Physical entities	Functions and functional blocks included
AF-PE	Application functions
ASS-PE	Application support functions, service support functions, etc.
SC-PE	Service control functional, service user profile functional block
CD-PE	Content distribution and location control functions, content delivery and storage functions
NAC-PE	Network attachment control functions (NACF)
PD-PE	Policy decision functional entity
TRC-PE	Transport resource control functional entity
T-PE	Access network functions, edge functions, core transport functions
PE-PE	Policy enforcement functional entity

Table 8-1 – Mapping functions and functional blocks into physical entities

Physical entities	Functions and functional blocks included
UE	Application client functions, session client functional block, SCP client functions, content delivery client functions, home network functions

8.2 Mapping reference points to interfaces

The mapping of reference points to interfaces is shown in Table 8-2.

Table 8-2 – Mapping reference points to interfaces

Interfaces	Interface description	Mapping reference points in NGN architecture
Ia-s	Interface between ASS-PE and SC-PE	A-S1, A-S2, A-S3, A-S4, A-S5, A-S6, A-S7
Ia-c	Interface between ASS-PE and CD-PE	A-C1, A-C2, A-C3
Is-c	Interface between SC-PE and CD-PE	S-C1, S-C2, S-C3, S-C4
Is-n	Interface between SC-PE and NAC-PE	S-TC1
Ic-t	Interface between CD-PE and T-PE	C-T1, C-T2
In-t	Interface between NAC-PE and T-PE	TC-T1
Rs	Interface between SC-PE and PD-PE	S-TC2 S-TC3 S-TC4 S-TC5
Rt	Interface between PD-PE and TRC-PE	–
Rw	Interface between PD-PE and PE-PE	TC-T1 TC-T2 TC-T5 TC-T6 TC-T9
Rc	Interface between TRC-PE and T-PE	Transport resource control physical entity (TRC-PE) and transport physical entity (T-PE)

9 Signalling protocols supporting NGN capability sets

9.1 External interfaces of NGN

External interfaces of NGN imply UNI, NNI, ANI and SNI. The technical specifications of external interfaces are listed as follows:

9.1.1 UNI as per ITU-T Q.3402

The following text is based on the text provided in clause 1 of [ITU-T Q.3402].

[ITU-T Q.3402] specifies a service-level profile, i.e., SIP/SDP interface description between a user and a network. It also specifies a transport-level profile, e.g., RTP.

Capability set 1 of NGN release 1 of the NGN UNI profile covers voice, video, and data, such as VoIP, multimedia telephony, DTMF, and ITU-T T.38 fax.

[ITU-T Q.3402] specifies common content for all terminal types, e.g., SIP residential gateway terminal adapter, SIP phone, soft phone/client, and SIP IP PBX.

Detailed aspects of the UNI are specified in [ITU-T Q.3402].

9.1.2 NNI as per ITU-T Q.3401

The following text is based on the text provided in clause 1 of [ITU-T Q.3401].

[ITU-T Q.3401] contains a service-level profile, i.e., SIP/SDP interface description, between two different network operators (NNI signalling profile), where the two different network operators may support different SIP/SDP profiles (i.e., they differ in terms of SIP extensions, SIP information elements and SDP lines that are supported). A transport-level profile, e.g., RTP, is also described. This is necessary just like the description of the media used in service-level signalling.

Detailed aspects of the NNI are specified in [ITU-T Q.3401].

9.1.3 ANI as per ITU-T Q.1741.6

[ITU-T Q.1741.6] endorsed the Third Generation Partnership Project (3GPP) specifications, which specified the SIP protocol used in this interface.

9.1.4 SNI as per IETF RFC 2616

The SNI interface will use HTTP as per [IETF RFC 2616].

9.2 Internal interfaces of NGN

Interfaces included in Figure 3 are listed in Table 9-1.

Table 9-1 – Internal interfaces of NGN

Interfaces	Interface description	Protocol passing through interface	Recommendation defining stage 3
Ia-s	Interface between ASS-PE and SC-PE	SIP	[ITU-T Q.1741.6] (Note)
Ia-c	Interface between ASS-PE and CD-PE	SIP	[ITU-T Q.1741.6] (Note)
Is-c	Interface between SC-PE and CD-PE	SIP	[ITU-T Q.1741.6] (Note)
Is-n	Interface between SC-PE and NAC-PE	Diameter	[ITU-T Q.3221]
Ic-t	Interface between CD-PE and T-PE	For further study	–
In-t	Interface between NAC-PE and T-PE	For further study	–
Rs	Interface between SC-PE and PD-PE	Diameter	[ITU-T Q.3301.1]
Rp	Between TRC-PE	RCIP	[ITU-T Q.3302.1]
Rw	Interface between PD-PE and PE-PE	Introduction	[ITU-T Q.3303.0]
		COPS-PR	[ITU-T Q.3303.1]
		ITU-T H.248	[ITU-T Q.3303.2]
		Diameter	[ITU-T Q.3303.3]
Rc	Interface between TRC-PE and T-PE	COPS-PR	[ITU-T Q.3304.1]
		SNMP	[ITU-T Q.3304.2]
Rt	Interface between PD-PE and TRC-PE	Diameter	[ITU-T Q.3305.1]
NOTE – [ITU-T Q.1741.6] endorsed the 3GPP specifications which specified the SIP protocol used in this interface.			

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