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SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for the NGN – Signalling and control requirements and protocols to support attachment in NGN environments

Architectural framework for NACF signalling interface Recommendations

Recommendation ITU-T Q.3220

ITU-T

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Recommendation ITU-T Q.3220

Architectural framework for NACF signalling interface Recommendations

Summary

Recommendation ITU-T Q.3220 provides a framework by means of which the reader may understand the relationships between the Q.322x and Q.323x series of ITU-T Recommendations dedicated to the realization of NACF signalling interfaces. It defines the entities involved in the network attachment control signalling and the interfaces across which this signalling takes place.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Q.3220	2010-06-13	11

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

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/.

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Recommendation ITU-T Q.3220

Architectural framework for NACF signalling interface Recommendations

1 Scope

This Recommendation specifies a concrete realization of the functional architecture of the network attachment control functions (NACF), including the specification of the physical entities involved in network attachment control signalling, the interfaces across which signalling takes place, and the mapping between these entities and interfaces and the corresponding functional entities and reference points.

2 References

The following ITU-T Recommendations and other references contain provisions which, through references 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 Y.2014-2008] Recommendation ITU-T Y.2014 (2008), *Network attachment control functions in next generation networks*.

[ITU-T Y.2014-2010] Recommendation ITU-T Y.2014 (2010), *Network attachment control functions in next generation networks*.

[ITU-T Y.2018] Recommendation ITU-T Y.2018 (2009), *Mobility management and control framework and architecture within the NGN transport stratum*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 network attachment control entity (NACE): [b-ITU-T Q.3300].

3.1.2 policy decision physical entity (PD-PE): [b-ITU-T Q.3300].

3.1.3 policy enforcement physical entity (PE-PE): [b-ITU-T Q.3300].

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 access management physical entity (AM-PE): A device that implements the network access management functional entity (AM-FE) as defined in clause 7.2.2 of [ITU-T Y.2014-2010].

3.2.2 access relay physical entity (AR-PE): A device that implements the access relay functional entity (AR-FE) as defined in clause 7.2.7 of [ITU-T Y.2014-2010].

3.2.3 handover decision and control physical entity (HDC-PE): A device that implements the handover decision and control functional entity (HDC-FE) as defined in clause 6.4.2 of [ITU-T Y.2018].

3.2.4 home gateway configuration physical entity (HGWC-PE): A device that implements the home gateway configuration functional entity (HGWC-FE) as defined in clause 7.2.6 of [ITU-T Y.2014-2010].

3.2.5 mobile location management physical entity (MLM-PE): A device that implements the mobility location management functional entity (MLM-FE) as defined in clause 6.4.1 of [ITU-T Y.2018].

3.2.6 mobility management control entity (MMCE): A general term used to refer to a device exercising one of the mobility management and control functions (MMCF) as defined in clause 6.3.3 of [ITU-T Y.2018].

NOTE – These functions may be distributed over multiple devices, but identification of specific devices is unnecessary so long as the necessary information flows are supported over the M1, M2 and M13 interfaces.

3.2.7 network access configuration physical entity (NAC-PE): A device that implements the network access configuration functional entity (NAC-FE) as defined in clause 7.2.1 of [ITU-T Y.2014-2010].

3.2.8 network information distribution physical entity (NID-PE): A device that implements the network information distribution functional entity (NID-FE) as defined in clause 6.4.3 of [ITU-T Y.2018].

3.2.9 resource and administration control entity (RACE): A general term used to refer to a device exercising one of the resource and administration control functions (RACF) as defined in clause 7.1 of [ITU-T Y.2014-2010].

NOTE – These functions may be distributed over multiple devices, but identification of specific devices is unnecessary so long as the necessary information flows are supported over the Ru interface.

3.2.10 service control entity (SCE): A general term used to refer to a device exercising one of the service control functions (SCF) as defined in clause 7.1 of [ITU-T Y.2014-2010].

NOTE – These functions may be distributed over multiple devices, but identification of specific devices is unnecessary so long as the necessary information flows are supported over the S-TC1 interface.

3.2.11 transport authentication and authorization physical entity (TAA-PE): A device that implements the transport authentication and authorization functional entity (TAA-FE) as defined in clause 7.2.4 of [ITU-T Y.2014-2010].

3.2.12 transport location management physical entity (TLM-PE): A device that implements the transport location management functional entity (TLM-FE) as defined in clause 7.2.3 of [ITU-T Y.2014-2010].

3.2.13 transport user profile physical entity (TUP-PE): A device that implements the transport user profile functional entity (TUP-FE) as defined in clause 7.2.5 of [ITU-T Y.2014-2010].

4 Abbreviations

This Recommendation uses the following abbreviations and acronyms:

AM-FE	Access Management Functional Entity
AM-PE	Access Management Physical Entity
AR-FE	Access Relay Functional Entity
AR-PE	Access Relay Physical Entity
CPE	Customer Premises Equipment
HDC-FE	Handover Decision and Control Functional Entity
HDC-PE	Handover Decision and Control Physical Entity

HGW	Home Gateway
HGWC-FE	Home Gateway Configuration Functional Entity
HGWC-PE	Home Gateway Configuration Physical Entity
HTTP	HyperText Transfer Protocol
IMS	IP Multimedia Subsystem
IP	Internet Protocol
MLM-FE	Mobile Location Management Functional Entity
MLM-FE(P)	An Instance of the MLM-FE performing the proxy mobile location management role
MLM-PE	Mobile Location Management Physical Entity
MLM-PE(P)	An Instance of the MLM-PE performing the proxy mobile location management role
MMCE	Mobility Management Control Entity
MMCF	Mobility Management and Control Functions
NACE	Network Attachment Control Entity
NACF	Network Attachment Control Functions
NAC-FE	Network Access Configuration Functional Entity
NAC-PE	Network Access Configuration Physical Entity
NGN	Next Generation Networks
NID-FE	Network Information Distribution Functional Entity
NID-PE	Network Information Distribution Physical Entity
P-CSCF	Proxy-Call Session Control Function
PD-FE	Policy Decision Functional Entity
PD-PE	Policy Decision Physical Entity
PE-FE	Policy Enforcement Functional Entity
RACE	Resource and Admission Control Entity
RACF	Resource and Admission Control Functions
SCE	Service Control Entity
SCF	Service Control Functions
TAA-FE	Transport Authentication and Authorization Functional Entity
TAA-PE	Transport Authentication and Authorization Physical Entity
TE	Terminal Equipment
TLM-FE	Transport Location Management Functional Entity
TLM-PE	Transport Location Management Physical Entity
TUP-FE	Transport User Profile Functional Entity
TUP-PE	Transport User Profile Physical Entity

5 Conventions

This Recommendation does not make use of specific conventions.

6 NACF architectural specification

6.1 NACF functional architecture

Figure 6-1 illustrates the NACF functional architecture in the first version of [ITU-T Y.2014] (2008).

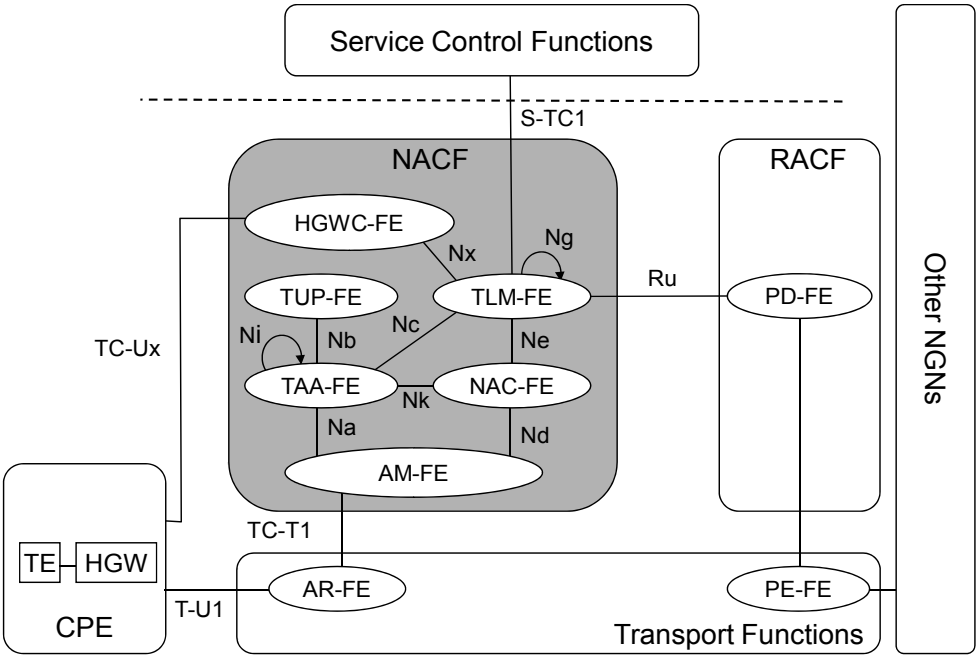

Figure 6-1 – NACF functional architecture

The NACF comprises the following functional entities:

- Network access configuration functional entity (NAC-FE).
- Access management functional entity (AM-FE).
- Transport location management functional entity (TLM-FE).
- Transport authentication and authorization functional entity (TAA-FE).
- Transport user profile functional entity (TUP-FE).
- Home gateway configuration functional entity (HGWC-FE).

The NACF has interaction with the following NGN components and entities:

- Service control functions (SCF) (e.g., such as those of the IMS service component) at the S-TC1 reference point for exporting information on access sessions.
- Resource and admission control functions (RACF) at the Ru reference point for exporting transport subscription profile information.
- Transport functions (i.e., access relay functional entity (AR-FE)) acting as relays to/from the CPE for address allocation, authentication and authorization purposes (TC-T1 and T-U1 reference points).

- The customer premises equipment (CPE) at the TC-Ux reference point for configuration purposes.

One or more functional entities may be mapped onto a single physical entity. If one functional entity is implemented by two physical entities, the interface between these physical entities is outside the scope of standardization.

Administrative domains are not represented in Figure 6-1. Functional entities in the NACF may be distributed over two administrative domains.

The NGN architecture does not require a single NACF instance to support multiple access networks. This does not prevent operators from deploying NACF functions that are common to multiple access networks (e.g., one user profile database common to different access networks).

6.2 Principles of mapping

The realization presented in this Recommendation accepts the considerations of scalability and domain independence that motivated the development of the functional architecture. As a result, it maps each functional entity of the functional architecture to a separate type of physical entity. Furthermore, each reference point is assumed to map to a separate interface. At a particular interface, one protocol, from a set of recommended protocols, may be used. Because the mapping between reference points and interfaces is one-to-one, each interface is named after the reference point to which it corresponds (e.g., Ru interface corresponding to the Ru reference point).

Depending on the technology involved, it may well be that some of the physical entities identified in this Recommendation are combined. In such a case, each combined entity will support the combined set of external interfaces of its component elements. Note that interfaces that would lie between the component elements if they were separate are absorbed into the interior of the combined entity.

6.3 Implementations of functional entities

Table 6-1 indicates the mapping from the functional entities to the physical entities implementing them.

Table 6-1 – Mapping from functional to physical entities concerned with network attachment control

Functional entity	Abbrev.	Physical entity	Abbrev.
Service control functions	SCF	Service control entity (e.g., implementation of P-CSCF)	SCE
Network attachment control functions	NACF	Network attachment control entity	NACE
Resource and administration control functions	RACF	Resource and administration control entity	RACE
Network access configuration functional entity	NAC-FE	Network access configuration physical entity	NAC-PE
Access management functional entity	AM-FE	Access management physical entity	AM-PE
Transport location management functional entity	TLM-FE	Transport location management physical entity	TLM-PE
Transport authentication and authorization functional entity	TAA-FE	Transport authentication and authorization physical entity	TAA-PE
Transport user profile functional entity	TUP-FE	Transport user profile physical entity	TUP-PE
Home gateway configuration	HGWC-FE	Home gateway configuration physical	HGWC-PE

Table 6-1 – Mapping from functional to physical entities concerned with network attachment control

Functional entity	Abbrev.	Physical entity	Abbrev.
functional entity		entity	
Policy decision functional entity	PD-FE	Policy decision physical entity	PD-PE
Policy enforcement functional entity	PE-FE	Policy enforcement physical entity	PE-PE
Access relay functional entity	AR-FE	Access relay physical entity	AR-PE

Figure 6-2 shows an example configuration of the physical entities identified in Table 6-1 and the interfaces between them. The actual configuration may vary according to the needs of the network operators concerned.

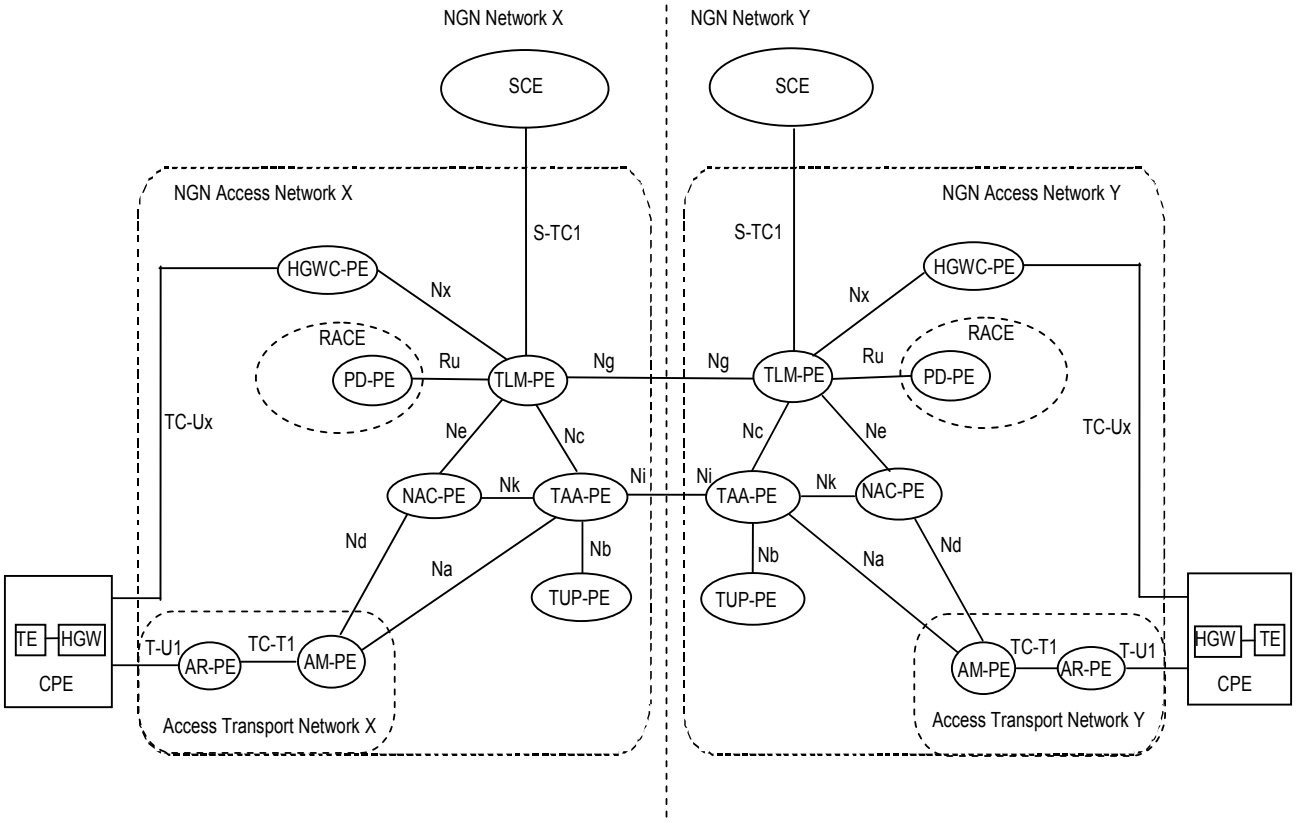

Figure 6-2 – Example physical realization of the NACF architecture

6.4 Interfaces and protocols

Appendix I provides a cross-reference between the interfaces defined in this Recommendation, the protocols used at those interfaces, and the Recommendations within which those protocols are documented.

7 NACF revision 1 architectural specification

7.1 NACF revision 1 functional architecture

Figure 7-1 illustrates the NACF functional architecture based on [ITU-T Y.2014-2010] and [ITU-T Y.2018], which is extended to address the issues related to multicast and mobility in support of IPTV service and mobility service, respectively.

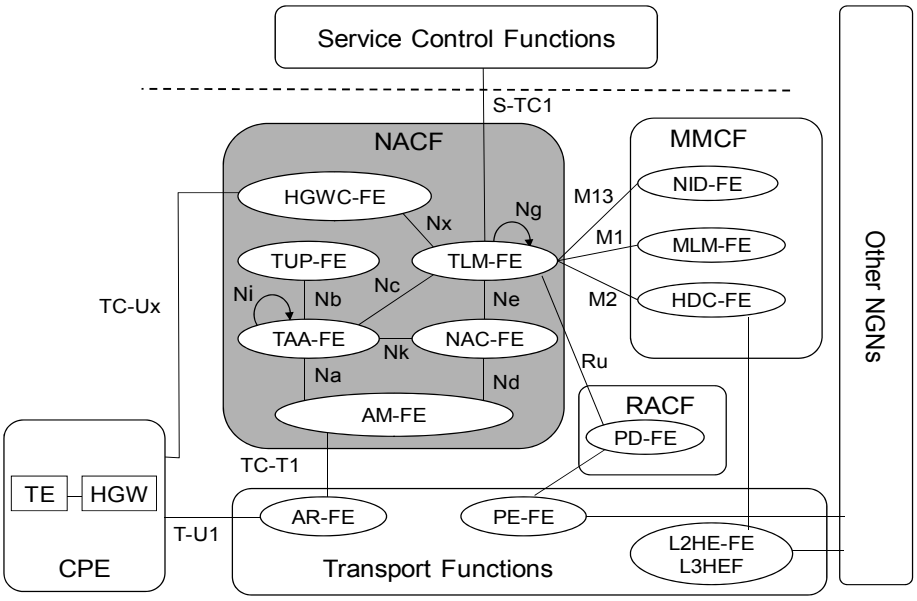

Figure 7-1 – NACF revision 1 functional architecture

The NACF comprises the following functional entities:

- Network access configuration functional entity (NAC-FE).
- Access management functional entity (AM-FE).
- Transport location management functional entity (TLM-FE).
- Transport authentication and authorization functional entity (TAA-FE).
- Transport user profile functional entity (TUP-FE).
- Home gateway configuration functional entity (HGWC-FE).

The NACF has interaction with the following NGN components and entities:

- Service control functions (SCF) (e.g., such as those of the IMS service component) at the S-TC1 reference point for exporting information on access sessions.
- Resource and admission control functions (RACF) at the Ru reference point for exporting transport subscription profile information.
- Mobility management control functions (MMCF) at the M1, M2 and M13 reference points for exporting several types of information on mobility management.
- Transport functions (i.e., access relay functional entity (AR-FE)) acting as relays to/from the CPE for address allocation, authentication and authorization purposes (TC-T1 and T-U1 reference points).
- The customer premises equipment (CPE) at the TC-Ux reference point for configuration purposes.

One or more functional entities may be mapped onto a single physical entity. If one functional entity is implemented by two physical entities, the interface between these physical entities is outside the scope of standardization.

Administrative domains are not represented in Figure 7-1. Functional entities in the NACF may be distributed over two administrative domains.

The NGN architecture does not require a single NACF instance to support multiple access networks. This does not prevent operators from deploying NACF functions that are common to multiple access networks (e.g., one user profile database common to different access networks).

7.2 Principles of mapping

The realization presented in this Recommendation accepts the considerations of scalability and domain independence that motivated the development of the functional architecture. As a result, it maps each functional entity of the functional architecture to a separate type of physical entity. Furthermore, each reference point is assumed to map to a separate interface. At a particular interface, one protocol, from a set of recommended protocols, may be used. Because the mapping between reference points and interfaces is one-to-one, each interface is named after the reference point to which it corresponds (e.g., Ru interface corresponding to the Ru reference point).

Depending on the technology involved, it may well be that some of the physical entities identified in this Recommendation are combined. In such a case, each combined entity will support the combined set of external interfaces of its component elements. Note that interfaces that would lie between the component elements if they were separate are absorbed into the interior of the combined entity.

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Functional entity	Abbrev.	Physical entity	Abbrev.
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Network attachment control functions	NACF	Network attachment control entity	NACE
Resource and administration control functions	RACF	Resource and administration control entity	RACE
Mobility management control functions	MMCF	Mobility management control entity	MMCE
Network access configuration functional entity	NAC-FE	Network access configuration physical entity	NAC-PE
Access management functional entity	AM-FE	Access management physical entity	AM-PE
Transport location management functional entity	TLM-FE	Transport location management physical entity	TLM-PE
Transport authentication and authorization functional entity	TAA-FE	Transport authentication and authorization physical entity	TAA-PE
Transport user profile functional entity	TUP-FE	Transport user profile physical entity	TUP-PE
Home gateway configuration functional entity	HGWC-FE	Home gateway configuration physical entity	HGWC-PE
Policy decision functional entity	PD-FE	Policy decision physical entity	PD-PE
Policy enforcement functional entity	PE-FE	Policy enforcement physical entity	PE-PE

Table 7-1 – Mapping from functional to physical entities concerned with network attachment control

Functional entity	Abbrev.	Physical entity	Abbrev.
Mobile location management functional entity	MLM-FE	Mobile location management physical entity	MLM-PE
Handover decision and control functional entity	HDC-FE	Handover decision and control physical entity	HDC-PE
Network information distribution functional entity	NID-FE	Network information distribution physical entity	NID-PE
Access relay functional entity	AR-FE	Access relay physical entity	AR-PE

Figure 7-2 shows an example configuration of the physical entities identified in Table 7-1 and the interfaces between them. The actual configuration may vary according to the needs of the network operators concerned.

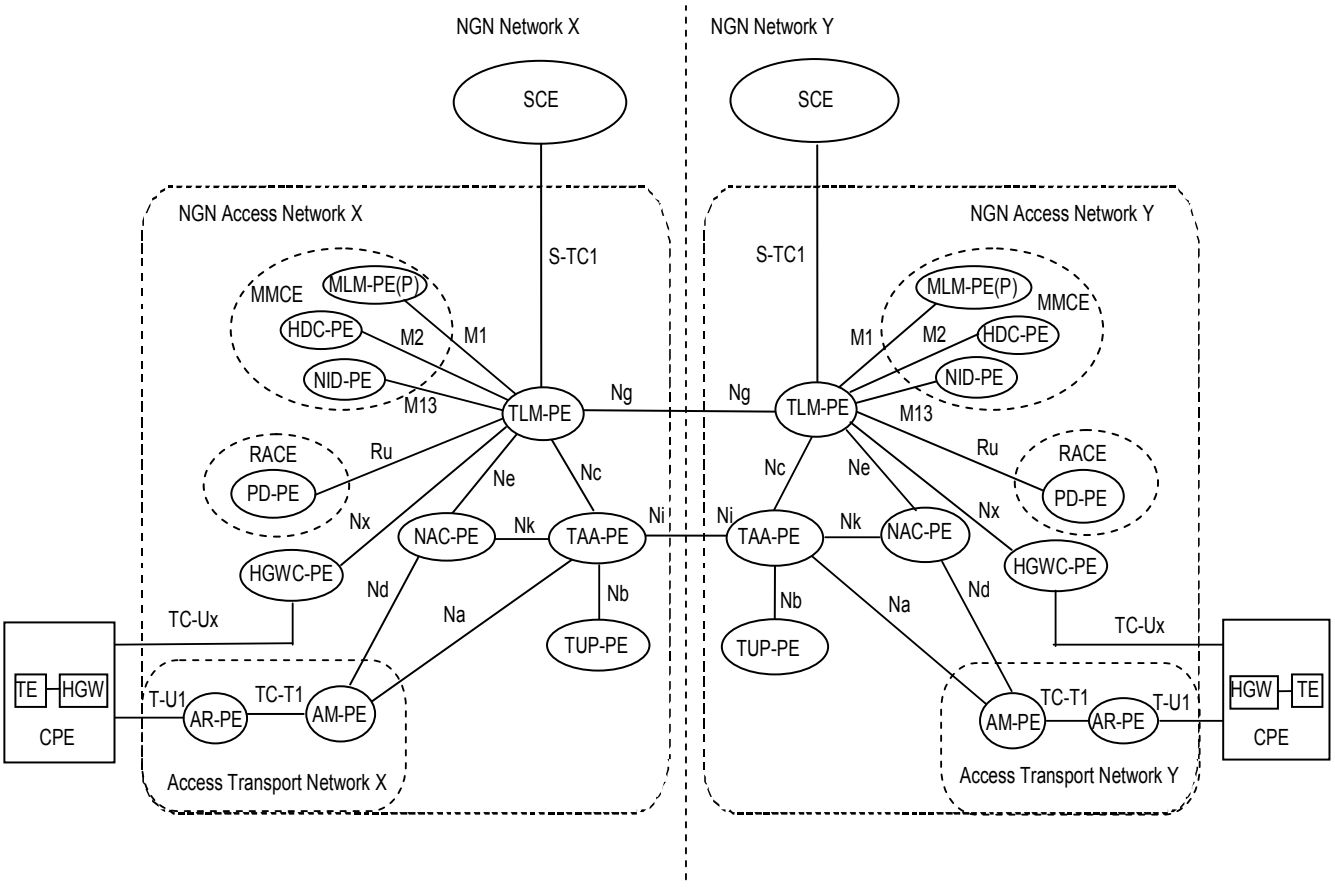

Figure 7-2 – Example physical realization of the NACF revision 1 architecture

7.4 Interfaces and protocols

Appendix II provides a cross-reference between the interfaces defined in this Recommendation, the protocols used at those interfaces, and the Recommendations within which those protocols are documented.

Appendix I

Tabulation of NACF Recommendations

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

Table I.1 lists the protocol Recommendations applicable to each network attachment control interface specified in the body of this Recommendation.

Table I.1 – NACF Recommendations

Interface	Supporting entities	Protocol base (Note)	Rec. No.
Nd	AM-PE, NAC-PE	Interface is for further study	TBD
Ne	NAC-PE, TLM-PE	Interface is for further study	TBD
Na	AM-PE, TAA-PE	Interface is for further study	TBD
Nc	TAA-PE, TLM-PE	Interface is for further study	TBD
Nk	NAC-PE, TAA-PE	Interface is for further study	TBD
Ni	Between TAA-PE	Interface is for further study	TBD
Nx	HGWC-PE, TLM-PE	Interface is for further study	TBD
Ng	Between TLM-PE	Diameter	[b-ITU-T Q.3222]
Nb	TUP-PE, TAA-PE	Interface is for further study	TBD
Ru	TLM-PE, PD-PE	Diameter	[b-ITU-T Q.3223]
S-TC1	TLM-PE, SCE	Diameter	[b-ITU-T Q.3221]
T-U1	AR-PE, CPE	Interface is for further study	TBD
TC-T1	AM-PE, AR-PE	Interface is for further study	TBD
TC-Ux	HGWC-PE, CPE	Interface is for further study	TBD
NOTE – Diameter: [b-IETF RFC 3588].			

Appendix II

Tabulation of NACF revision 1 Recommendations

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

Table II.1 lists the protocol Recommendations applicable to each network attachment control interface specified in the body of this Recommendation.

Table II.1 – NACF revision 1 Recommendations

Interface	Supporting entities	Protocol base (Note)	Rec. No.
M1	TLM-PE, MLM-PE(P)	Interface is for further study	TBD
M2	TLM-PE, HDC-PE	Interface is for further study	TBD
M13	TLM-PE, NID-PE	Interface is for further study	TBD
Nd	AM-PE, NAC-PE	Interface is for further study	TBD
Ne	NAC-PE, TLM-PE	Interface is for further study	TBD
Na	AM-PE, TAA-PE	Interface is for further study	TBD
Nc	TAA-PE, TLM-PE	Interface is for further study	TBD
Nk	NAC-PE, TAA-PE	Interface is for further study	TBD
Ni	Between TAA-PE	Interface is for further study	TBD
Nx	HGWC-PE, TLM-PE	Interface is for further study	TBD
Ng	Between TLM-PE	Diameter	TBD
Nb	TUP-PE, TAA-PE	Interface is for further study	TBD
Ru	TLM-PE, PD-PE	Diameter	TBD
S-TC1	TLM-PE, SCE	Diameter	TBD
T-U1	AR-PE, CPE	Interface is for further study	TBD
TC-T1	AM-PE, AR-PE	Interface is for further study	TBD
TC-Ux	HGWC-PE, CPE	Interface is for further study	TBD
NOTE – Diameter: [b-IETF RFC 3588].			

Bibliography

[b-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)*.

[b-ITU-T Q.3222] Recommendation ITU-T Q.3222 (2010), *Requirements and protocol at the interface between transport location management physical entities (Ng interface)*.

[b-ITU-T Q.3223] Recommendation ITU-T Q.3223 (2009), *Requirements and protocol for the interface between a transport location management physical entity and a policy decision physical entity (Ru Interface)*.

[b-ITU-T Q.3300] Recommendation ITU-T Q.3300 (2008), *Architectural framework for the Q.33xx series of Recommendations*.

[b-IETF RFC 3588] IETF RFC 3588 (2003), *Diameter Base Protocol,* <http://www.ietf.org/rfc/rfc3588.txt?number=3588>.

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