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Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN), and is now submitted for the ETSI standards Membership Approval Procedure.

1 Scope

The present document describes the overall TISPAN NGN functional architecture, its subsystems and the relationships between them.

2 References

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

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2.1 Normative references

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

[1] ETSI TS 102 144: "Services and Protocols for Advanced Networks (SPAN); MTP/SCCP/SSCOP and SIGTRAN (Transport of SS7 over IP); Stream Control Transmission Protocol (SCTP) [Endorsement of RFC 2960 and RFC 3309, modified]".

[2] ITU-T Recommendation Y.2011: "General principles and general reference model for next generation networks".

[3] ETSI TS 123 002: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Network architecture (3GPP TS 23.002 version 7.3.1)".

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

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

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

[7] ETSI ES 282 007: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Core IMS architecture".

[8] ETSI ES 282 002: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Functional architecture for PSTN/ISDN Emulation".

[9] ETSI TS 182 012: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IMS-based PSTN/ISDN Emulation subsystem: Functional architecture".

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

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

[12] ETSI TS 185 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Customer Network Gateway architecture and interfaces ".

[13] ETSI TS 185 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); TISPAN Customer Devices architecture and interfaces".

[14] ETSI TS 181 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Direct Communication Service in NGN; Service Description [Endorsement of OMA-ERELD-PoC-V1]".

[15] ITU-T Recommendation G.8010: "MPLS layer network architecture".

3 Definitions and abbreviations

3.1 Definitions

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

access network: collection of network entities and interfaces that provide the underlying IP transport connectivity between end user devices and NGN entities

core network: portion of the delivery system composed of networks, systems equipment and infrastructures, connecting the service providers to the access network

functional entity: entity that comprises a specific set of functions at a given location

NOTE: Functional entities are logical concepts, grouping of functional entities are used to describe practical physical realizations.

user equipment: one or more devices allowing a user to access services delivered by TISPAN NGN networks

NOTE: This includes devices when under user control commonly referred to as IAD, ATA, RGW, TE, etc., UE does not include network controlled entities such as network terminations and access gateways.

3.2 Abbreviations

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

3GPP	Third Generation Project Partnership
A-MGF	Access Media Gateway Function
AN	Access Node
ARF	Access Relay Function
AS	Application Server
ASF	Application Server Function

ATA	Analogue Terminal Adaptor
AUC	AUthentication Centre
BGF	Border Gateway Function
BGW	Border GateWay
BNG	Broadband Network Gateway
BRAS	Broadband Remote Access Server
BTF	Basic Transport Function
C-BGF	Core Border Gateway Function
CND	Customer Network Device
CNG	Customer Network Gateway
CPN	Customer Premises Network
CSCF	Call Session Control Function
DHCP	Dynamic Host Configuration Protocol
DSLAM	Digital Subscriber Line Access Multiplexer
ENUM	tElephone NUmber Mapping
ECF	Elementary Control Function
EFF	Elementary Forwarding Function
HLR	Home Location Register
HSS	Home Subscriber Server
IAD	Integrated Access Device
IBCF	Interconnection Border Control Function
I-BGF	Interconnection-Border Gateway Function
I-CSCF	Interrogating-Call Session Control Function
IGMP	Internet Group Management Protocol
IMS	IP Multimedia Subsystem
IMS-MGW	IMS-Media Gateway
IP	Internet Protocol
ISDN	Integrated Services Digital Network
IVR	Interactive Voice Response
IWF	InterWorking Function
MGCF	Media Gateway Control Function
MGF	Media Gateway Function
MLD	Multicast Listener Discovery
MRFP	Multimedia Resource Function Processor
MTP	Message Transfer Part
NAPT	Network Address and Port Translation
NAPT-PT	NAPT and Protocol Translation
NASS	Network Attachment SubSystem
NGN	Next Generation Network
OSA	Open Service Access
PES	PSTN/ISDN Emulation Subsystem
PIM	Protocol Independent Multicast
PPP	Point-to-Point Protocol
PSTN	Public Switched Telephony Network
RACS	Resource and Admission Control Subsystem
RADIUS	Remote Access Dial In User Service
RCEF	Resource Control Enforcement Function
RGW	Residential GateWay
R-MGF	Residential Media Gateway Function
SCCP	Signalling Connection Control Part
SCTP	Stream Control Transmission Protocol
SGCF	Signalling Gateway Control Function
SGF	Signalling Gateway Function
SGW	Signalling GateWay
SLF	Subscription Locator Function
TDM	Time Division Multiplexing
TE	Terminal Equipment
TGCF	Trunking GateWay Function
TGW	Trunking GateWay
T-MGF	Trunking-Media Gateway Function
UE	User Equipment
UPSF	User Profile Server Function

4 Overall architecture

The NGN functional architecture described in the present document complies with the ITU-T general reference model for next generation networks [2] and is structured according to a service layer and an IP-based transport layer.

The service layer comprises the following components:

- the core IP Multimedia Subsystem (IMS);
- the PSTN/ISDN Emulation Subsystem (PES);
- other multimedia subsystems (e.g. IPTV Dedicated Subsystem) and applications;
- common components (i.e. used by several subsystems) such as those required for accessing applications, charging functions, user profile management, security management, routing data bases (e.g. ENUM), etc.

This subsystem-oriented architecture enables the addition of new subsystems over the time to cover new demands and service classes. It also provides the ability to import (and adapt) subsystems defined by other standardization bodies.

IP-connectivity is provided to NGN user equipment by the transport layer, under the control of the network attachment subsystem (NASS) and the resource and admission control subsystem (RACS). These subsystems hide the transport technology used in access and core networks below the IP layer.

The architecture described in the present document and related subsystems specifications is a functional architecture. Each subsystem is specified as a set of functional entities and related interfaces. As a result implementers may choose to combine functional entities where this makes sense in the context of the business models, services and capabilities being supported. Where functional entities are combined the interface between them is internal, is hidden and un-testable.

Figure 1 provides an overview of the NGN architecture. An example of realization of this functional architecture, with an xDSL-based access network is provided in annex A.

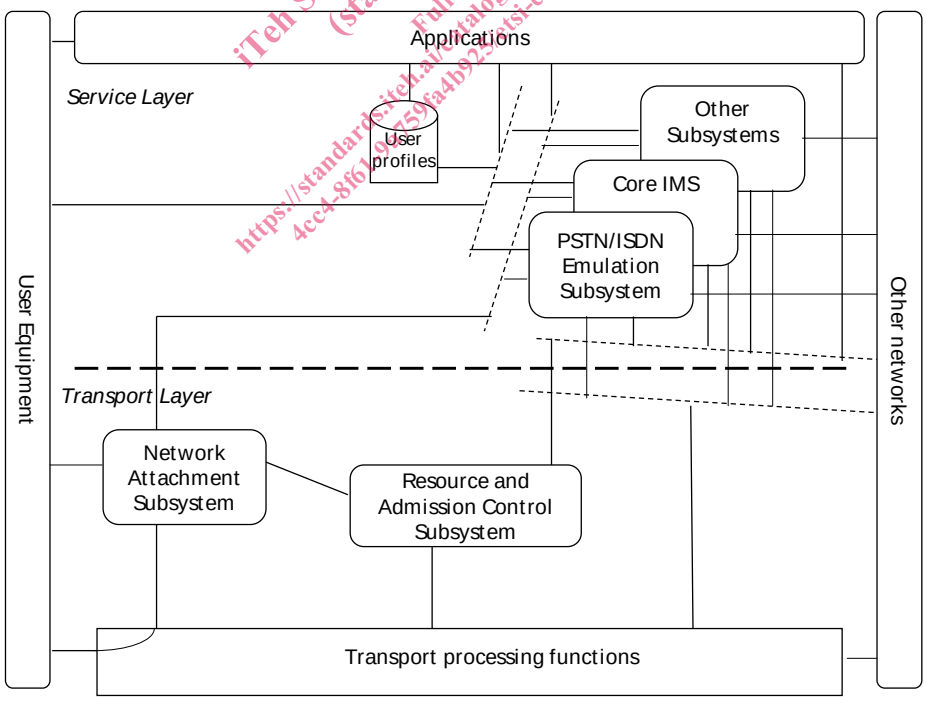

Figure 1: TISPAN NGN overall architecture

The functional entities that make up a subsystem may be distributed over network/service provider domains (see figure 2). The network attachment subsystem may be distributed between a visited and a home network. Service-layer subsystems that support nomadism may also be distributed between a visited and a home network.

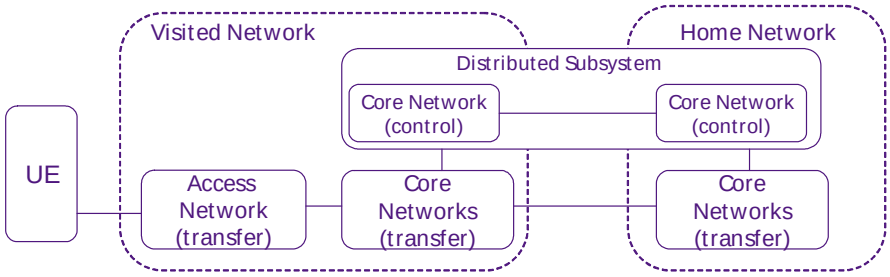

Figure 2: Distributed subsystems

This architecture supports the service capabilities and requirements identified in TS 181 006 [14].

An access network comprises an access segment and an aggregation segment (figure 2a). The access segment (also known as "last mile segment" stretches from the customer premises to the first network node (also known as the "access node"). The aggregation segment comprises the transport network elements enabling one or more access nodes to be connected to a core network through an IP Edge Router, at the Di reference point.

NOTE: In configurations where the access segment uses the DSL technology, the aggregation segment generally uses ATM or Giga Ethernet. The IP Edge is known as a Broadband Remote Access Server (BRAS) or Broadband Network Gateway (BNG).

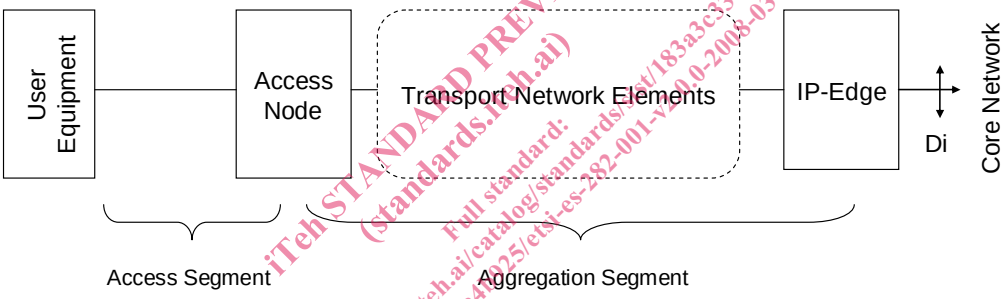

Figure 2a: Access and aggregation segments

5 Transport layer

The transport layer comprises a transport control sublayer on top of transport processing functions in the access and core networks. Equivalent functionality in the User Equipment is defined in clause 8.

The transport control sublayer is further divided in two subsystems:

- the Network Attachment Subsystem (NASS);
- the Resource and Admission Control Subsystem (RACS).

5.1 Transport control sublayer

5.1.1 Network Attachment Subsystem (NASS)

The Network Attachment Subsystem provides the following functionalities:

- dynamic provision of IP addresses and other terminal configuration parameters;
- authentication taking place at the IP layer, prior or during the address allocation procedure;

- authorization of network access based on user profiles;
- access network configuration based on user profiles;
- location management taking place at the IP layer.

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

NOTE: The user profiles mentioned above are related to the access subscription only.

The NASS interfaces with the following entities (see figure 2b):

- the user equipment at the e3 reference point for configuration purposes;
- transport processing entities acting as relays to/from the user equipment for address allocation, authentication and authorization purposes (a1 and a3 reference points);
- the Resource and Admission Control Subsystem at the e4 reference point for exporting subscriber access profile information;
- service-control subsystems and applications in the service layer at the e2 reference point for exporting information on access sessions and supporting notification services.

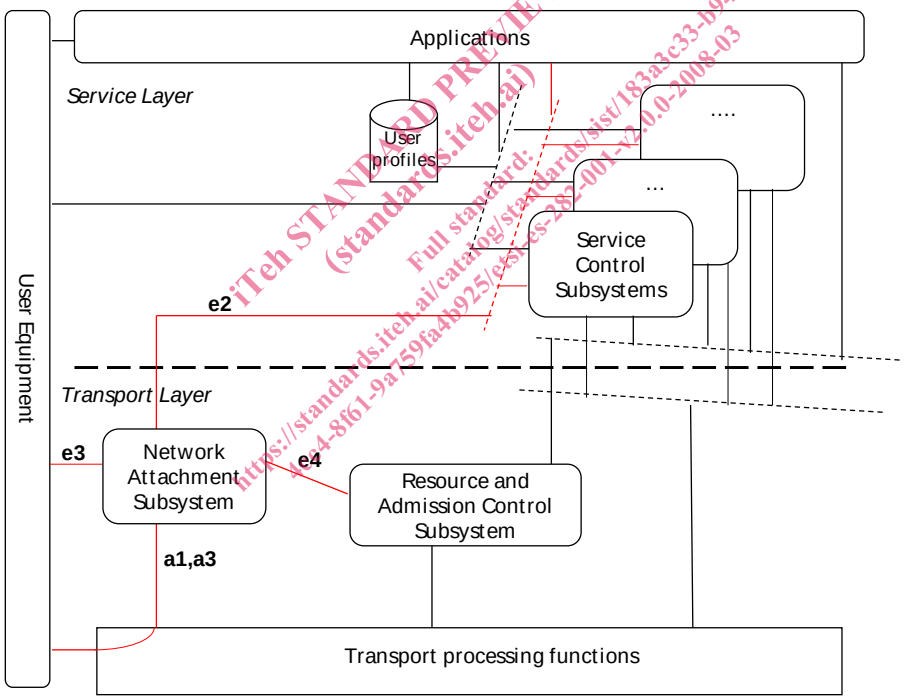

Figure 2b: NASS external reference points

Further details about the functionalities and architecture of the NASS can be found in ES 282 004 [5].

5.1.2 Resource and Admission Control Subsystem (RACS)

RACS is the TISPAN NGN subsystem responsible for the implementation of procedures and mechanisms handling policy-based resource reservation and admission control for both unicast and multicast traffic in access networks and core networks.

Besides acting as a resource control framework, RACS also includes support for controlling Network Address Translation (NAT) at the edge of networks and assisting in remote NAT traversal. Furthermore, RACS also covers aspects related to the setting and modification of traffic policies, end to end quality of service and transport-level charging.