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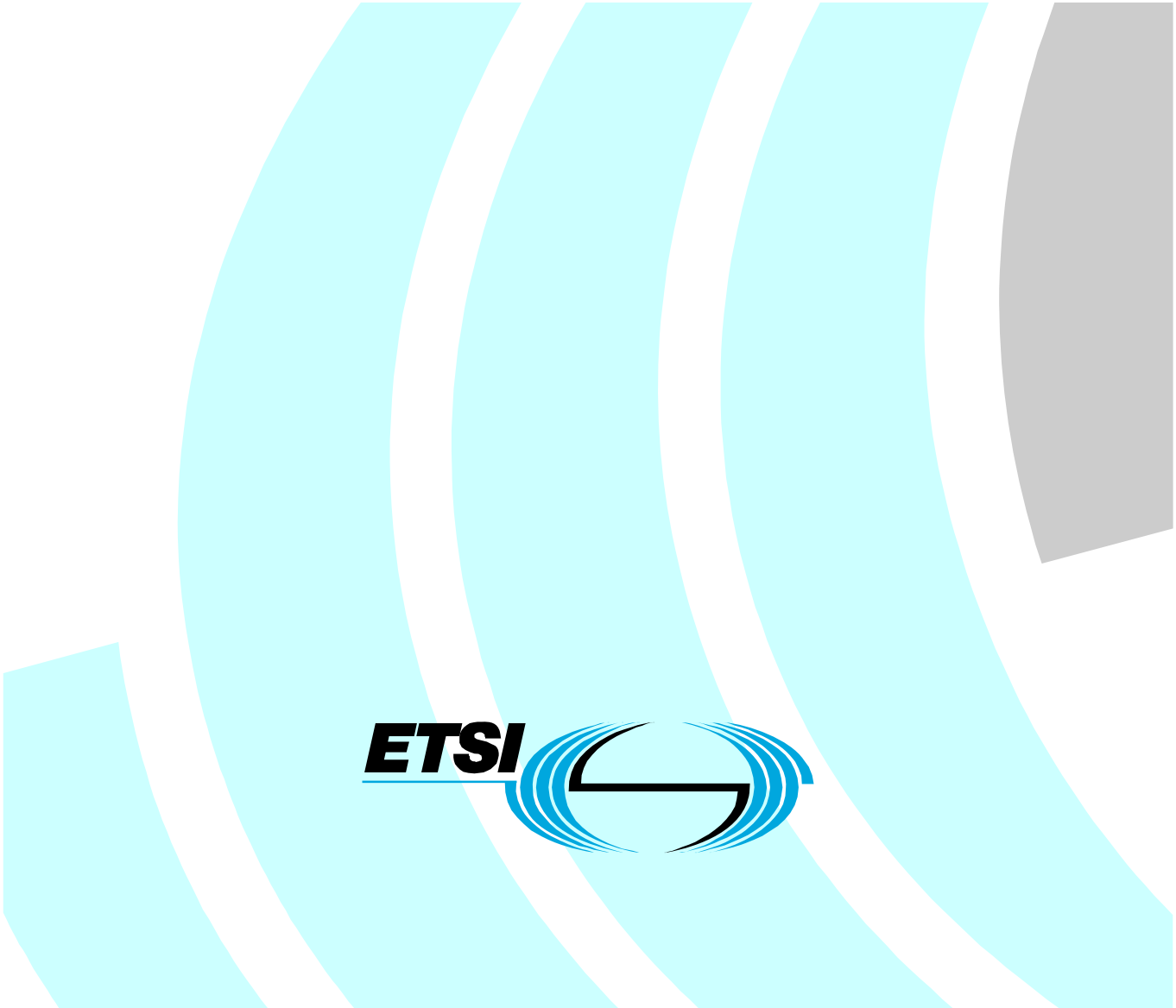
Special Report

**Electronic Communications Networks and Services;
Consequence on the NGN standardization activity
from the EU ECN&S regulatory view point**



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Contents

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Foreword

This Special Report (SR) has been produced by Advisory Committee Operational Co-ordination Group (OCG).

NOTE: The SR type of deliverable was chosen to publish the contents of the document because the information is not specifically technical and is an integration of information from many sources. The current version of the present document was published after endorsement by the ETSI Operational Co-ordination Group, which represents all technical bodies of ETSI.

Introduction

The application of Article 17 of the Framework Directive (2002/21/EC [i.1]) led to the production of studies like SR 002 211 [i.2] carried out by ETSI, and other European Standardization Organizations (ESOs). The development of NGN concepts and other future trends is impacting widely and deeply the future of the e-Communications Networks and Services, introducing major influence of other sectors, like IT, Broadcasting and other consumer's close products and services.

European authorities started a revision of the relevant regulatory documents. It is urgent that the appropriate TBs within ESOs are aware of the regulatory requirements and take them appropriately into account when developing standards for the NGN. The present document results from a number of fundamental presentations offered during the ECN&S meetings by the end of 2005 and beginning of 2006 and should evolve with contributions from ESO TBs and feed-back from CEU and European National Regulatory Authorities (NRAs).

The present document aims at identifying:

- the consequences of NGN standardization from the regulatory view point;
- standards which are produced to achieve public interest objectives;
- areas where further studies are needed.

1 Scope

The present document is intended for both regulators and technical groups. It looks at the NGN from the technical regulatory point of view. It assesses how the EU Regulatory Framework applies to the NGN as specified by ETSI TISPAN in collaboration with 3GPP (e.g. for IMS), TC LI and ITU-T. The present document refers to the Release 1 of NGN which does not include IPTV nor does it include content matters.

Regarding VoIP, the present document only looks at Voice over NGN. Only the NGN specific regulatory requirements are considered in the section. Outside the scope are requirements which apply to any networks (e.g. EMC).

2 References

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

- For a specific reference, subsequent revisions do not apply.
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  - for informative references.

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

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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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.

Not applicable.

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] Directive 2002/21/EC of the European Parliament and of the council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive).

[i.2] ETSI SR 002 211: "Electronic communications networks and services; Candidate list of standards and/or specifications in accordance with Article 17 of Directive 2002/21/EC".

[i.3] ETSI ES 282 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture".

[i.4] ETSI ES 282 007: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS); Functional architecture".

[i.5] ITU-T Recommendation Y.2001: "Next Generation Networks - Frameworks and functional architecture models; General overview of NGN".

[i.6] ITU-T Recommendation Y.2012: "Functional requirements and architecture of the NGN".

[i.7] ITU-T Recommendation Y.2011: "General principles and general reference model for Next Generation Networks".

[i.8] 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]".

[i.9] ETSI ES 282 004: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Functional Architecture; Network Attachment SubSystem (NASS)".

[i.10] ETSI TS 123 002: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Network architecture (3GPP TS 23.002 version 6.10.0 Release 6)".

[i.11] ITU-T Recommendation Y 2091: "Terms, Definitions and High-Level Terminological Framework for Next Generation Networks".

[i.12] ETSI TR 180 000: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Terminology".

[i.13] IETF RFC 3261: "SIP: Session Initiation Protocol".

[i.14] ETSI TR 180 001: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Release 1; Release definition".

[i.15] ETSI TS 181 005: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Service and Capability Requirements".

[i.16] ETSI TS 122 101: "3Universal Mobile Telecommunications System (UMTS); Service aspects; Service principles".

[i.17] ITU-T Recommendation M.3050.1: "Enhanced Telecommunications Operations Map - The Business Process Framework".

[i.18] ETSI TR 121 905: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Vocabulary for 3GPP Specifications (3GPP TR 21.905 version 7.4.0 Release 7)".

[i.19] ITU-T Recommendation Y.110: "Global Information Infrastructure principles and framework architecture".

[i.20] ETSI TR 101 878: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 5; Service Capability Definition; Service Capabilities for a Multi Media Call".

[i.21] ETSI TS 102 261: "Open Network Services and Architecture (ONSA); Abstract architecture and reference points definition; Mapping of functional architectures and requirements for NGN".

[i.22] ITU-T Recommendation X.115: "Definition of address translation capability in public data networks".

[i.23] Void.

[i.24] Void.

[i.25] IETF RFC 3966: "The tel URI for Telephone Numbers".

[i.26] ETSI TS 102 424: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Requirements of the NGN network to support Emergency Communication from Citizen to Authority".

[i.27] ETSI TS 182 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Subsystem (IMS); Stage 2 description (3GPP TS 23.228 v7.2.0, modified)".

[i.28] ETSI TS 123 228 (V7.2.0) modified: "IP Multimedia Subsystem (IMS); Stage 2 description".

[i.29] ETSI TS 133 203: "3G security; Access security for IP-based services".

[i.30] ETSI ES 282 010: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Charging management [Endorsement of 3GPP TS 32.240 Release 7, 3GPP TS 32.260 Release 7, 3GPP TS 32.297 Release 7, 3GPP TS 32.298 Release 7 and 3GPP TS 32.299 Release 7, modified]".

[i.31] ETSI TS 182 009: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Architecture to support emergency communication from citizen to authority [Endorsed document 3GPP TS 23.167, Release 7]".

[i.32] ETSI TS 183 021: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); NGN Release 1; Endorsement of 3GPP TS 29.162 Interworking between IM CN Sub-system and IP networks".

[i.33] ETSI TS 129 162: "Interworking between the IM CN subsystem and IP networks".

[i.34] ETSI TS 123 218: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); IP Multimedia (IM) session handling; IM call model; Stage 2 (3GPP TS 23.218)".

[i.35] Treaty of Maastricht (http://en.wikipedia.org/wiki/Three-pillars-of-the-European-Union).

[i.36] 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.37] ITU-T Recommendation Y.2205: "Next Generation Networks - emergency telecommunications - Technical considerations".

3 Definitions and abbreviations

3.1 Definitions

Wherever possible, the present document refers to existing terminology from ETSI and ITU-T sources. The terms and definitions and a framework relevant to providing a general understanding of Next Generation Networks are provided in the ITU-T Recommendation Y.2091 [i.11] and in TR 180 000 [i.12].

access network: collection of network entities and interfaces that provides the underlying IP transport connectivity between the device and the NGN entities

administrative domain: collection of physical or functional entities under the control of a single administration

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

customer: the customer buys products and services from the Enterprise or receives free offers or services

domains: describes the infrastructure owned by single operators

domain (General): collection of physical or functional entities which are owned and operated by a player and can include entities from more than one role

identity: attributes by which an entity or person is described, recognized or known

networks: terms listed here describe the connectivity infrastructure surrounding an NGN

player: organization, or individual, which undertakes one or more roles

role: business activity which fits in a value chain

subscriber: person or organization responsible for concluding contracts for the services subscribed to and for paying for these services

service domain: collection of physical or functional entities offering IP based services under the control of an NGN Service Provider which share a consistent set of policies and common technologies

user, end user: the user is the actual user of the products or services offered by the Enterprise

User Equipment (UE): one or more devices allowing user access to network services delivered by NGN

user domain: collection of physical or functional entities under the control of an end user that share a consistent set of policies and common technologies

user profile: set of information necessary to provide a user with a consistent, personalized service environment, irrespective of the user's location or the terminal used (within the limitations of the terminal and the serving network)

3.2 Abbreviations

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

3GPP	Third Generation Partnership Project
ACR&CB	Anonymous Call Rejection & Call Barring
AF	Application Function
ALG	Application Level Gateway
AoC	Advice of Charge
ARF	Access Relay Function
AS	Application Server
ASF	Application Server Function
B2B	Business-to-Business
CDR	Call Detail Record
CLIP/OIP	Calling Line Identification Presentation / Originating Identification Presentation
CLIR/OIR	Calling Line Identification Restriction / Originating Identification Restriction
CoIX	Connectivity-oriented Interconnection
COLP/TIP	Called Line Identification Presentation / Terminating Identification Presentation
COLR/TIR	Called Line Identification presentation Restriction / Terminating Identification presentation Restriction
CS	Circuit Switched
DoS	Denial of Service
ECN	Electronic Communication Network
ECS	Electronic Communication Service
EMC	Electro Magnetic Compatibility
ENUM	Electronic Numbering
eTVRA	Threat, Vulnerability and Risk Assessment for eEurope
FBI	Fixed Broadband Access to IMS
FMC	Fixed Mobile Convergence
GPRS	General Packet Radio Service
HSPA+	HSPA Evolution
HSS	Home Subscriber Server
IBCF	Interconnection Border Control Function
I-BGF	Interconnect Border Gateway Function
I-CSCF	Interrogating Call Session Control Function
ICT	Information and Communication Technologies

IM CN	IP Multimedia Core Network
IMS	IP Multimedia Subsystem
IMS-MGW	IMS Media Gateway
IM-SSF	IP Multimedia Service Switching Function
IP	Internet Protocol
IP-CAN	IP Connectivity Access Network
IPTV	Internet Protocol TeleVision
ISDN	Integrated Service Digital Network
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
IWF	InterWorking Function
I-WLAN	Interworking WLAN
LI	Lawful Interception
LTE	Long Term Evolution
MCID	Malicious Call IDentification
MGCF	Media Gateway Control Function
MM	MultiMedia
MMS	Multimedia Messaging Service
MRFC	Media Resource Function Control
MRFP	Multimedia Resource Function Processor
NAPT	Network Address and Port Translator
NASS	Network Attachment SubSystem
NAT	Network Address Translation
NGN	Next Generation Network
OSA SCS	Open Services Architecture Service Capability Server
PBX	Private Branch Exchange
PCC	Policy and Charging Convergence
PCRF	Policy and Charging Rules Function
P-CSCF	Proxy Call Session Control Function
PDBF	Profile DataBase Function
PDF	Policy Decision Function
PES	PSTN/ISDN Emulation Subsystem
PS	Packet Switched
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RACS	Resource Admission Control Subsystem
RTSP	Real Time Streaming Protocol
SAE	System Architecture Evolution
SBLP	Service Based Local Policy
S-CSCF	Serving Call Session Control Function
SDP	Session Description Protocol
SGF	Signalling Gateway Function
SIP AS	SIP Application Server
SIP	Session Initiation Protocol
SLF	Subscription Locator Function
SMS	Short Message Service
SoIX	Service-oriented Interconnection
TDM	Time Division Multiplex
TISPAN	Telecoms and Internet converged Services and Protocols for Advanced Networking
TLS	Transport-Layer Security
T-MGF	Trunking Media Gateway Function
TV	TeleVision
UE	User Equipment
UPSF	User Profile Server Function
VCC	Voice Call Continuity
WAP	Wireless Access Protocol
WLAN	Wireless Local Area Network

4 Description of the NGN

NGN is a term widely used by telecommunication operators to represent a number of current and future structural changes in the telecommunication sector. The main difference between NGNs and today s PSTNs is a shift from circuit-switched networks that are traditionally used for voice service to packet-based networks providing a range of services including voice, video and data. These networks are applicable to various service characteristics. Traditional voice networks are based on circuit-switching and offer end-to-end quality of service.

The aim of the NGN is to offer more consistent speech quality service than may be achieved on the Internet when best effort service is used. Although, in many cases a quality of an Internet connection is good and the "self management" provides great resilience. NGN can be seen as a logical evolution from separate network infrastructures into a unified network for electronic communications based on IP. Participants from the telecommunication industry consider NGN as a progression of current technology leading to a multi-service, secure, packet-based global network, which will be able to offer quality of service and ease of access for end-users (see Bibliography).

The possible migration to Next Generation Networks (NGN) is nowadays becoming an important issue for the major telecommunication players. The eventual total switch-off of the traditional PSTN is expected to happen in the next ten years.

There are numerous views of what constitutes NGNs and different operators that have begun the process of migration or development refer to their networks differently. NGNs can be developed using a number of transmission technologies, including fibre, cable, fixed, mobile wireless, or further technology upgrades to the existing copper based networks. This represents the shift from a "one network-one service" approach, to a "one network-many services" one.

The transition to NGN driven by several forces, or enabling factors, is summarized as follows:

- structural changes on the ICT market;
- new users' needs and requirements;
- technology evolution;
- competition in the electronic communications market.

The transition to NGN also offers different opportunities at different levels of the telecommunication market:

For operators, NGN is considered essential for strategically positioning networks to compete in the increasingly converged world of services and content where voice is no longer the sole source of revenue.

At a market level, NGN is partially driven by the increased demand for ubiquitous, integrated data, voice and video, mobile and fixed broadband, alongside the increasing role of mobile services in the broadband domain. Operators and investors seek increased revenue and profitability, greater productivity and broader service offerings. These trends are facilitating the integration of separate and distinct mobile and fixed technologies (optimized for one service) to enable the seamless distribution of services over fixed and mobile broadband networks, i.e. transport services, and to create a unified IP-based multiservice network. In other words, NGN can be viewed as a "communication network that allows unfettered access to all communication products and services, irrespective of the service provider or network connection".

4.1 NGN Functional Architecture

The functional architecture of the ETSI TISPAN NGN Release 1 is provided in the ES 282 001 [i.3]. TISPAN IMS (IP Multimedia Subsystem) functional architecture is defined in ES 282 007 [i.4]. ITU-T NGN frameworks and functional architecture is provided in ITU-T Recommendation Y.2001 [i.5] and ITU-T Recommendation Y.2012 [i.6].

Both the ETSI as well as the ITU-T NGN architectures are in line with regards to the separation between transport and services defined in ITU-T Recommendation Y.2011 [i.7].

The separation of services from transport allows them to be offered separately and to evolve independently. The separation is represented by two distinct blocks called "strata of functionality" by ITU-T and "layers" by ETSI TISPAN. For the purpose of the present document the term "layers" will be used later in the text. The transport functions reside in the transport layer and the service functions related to applications reside in the service layer.

A set of transport functions are solely concerned with conveyance of digital information, of any kind, between any two geographically separate points. The transport functions provide connectivity.

A set of application functions is related to the service to be invoked. In this layer services may be, e.g. voice services (including telephone service), data services (including but not limited to Web-based services), or video services (including but not limited to movies and TV programmes), or some combination thereof (e.g. multimedia services such as video telephony and gaming).

The following section provides an overview of the NGN functional architecture based on the ES 282 001 [i.3].

The service layer comprises the following components:

- the core IP Multimedia Subsystem (IMS);
- the PSTN/ISDN Emulation Subsystem (PES);
- other multimedia subsystems (e.g. streaming subsystem, content broadcasting subsystem etc.); 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.

Each subsystem is specified as a set of functional entities and related interfaces. As a result implementers and operators may be tempted to combine functional entities where this makes sense in the context of their business models. Where functional entities are combined the interface between them is internal, is hidden and un-testable. It is a major task for regulation to ensure open interfaces so that fundamental principles, e.g. access for service providers to access functions or unrestricted access of users to various service offerings, of the NGN concept as defined in Y.2001 [i.5] can be met.

Figure 1 provides an overview of the NGN architecture.

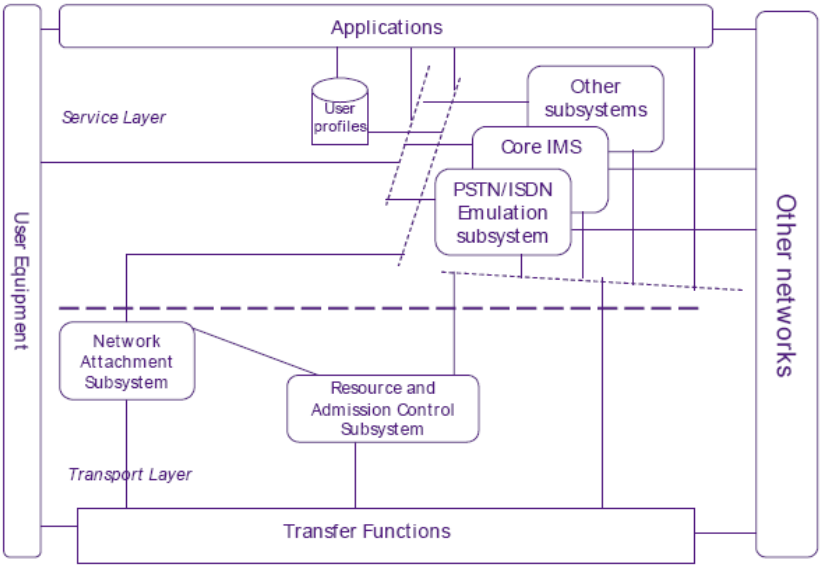


Figure 1: TISPAN NGN overall architecture

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.

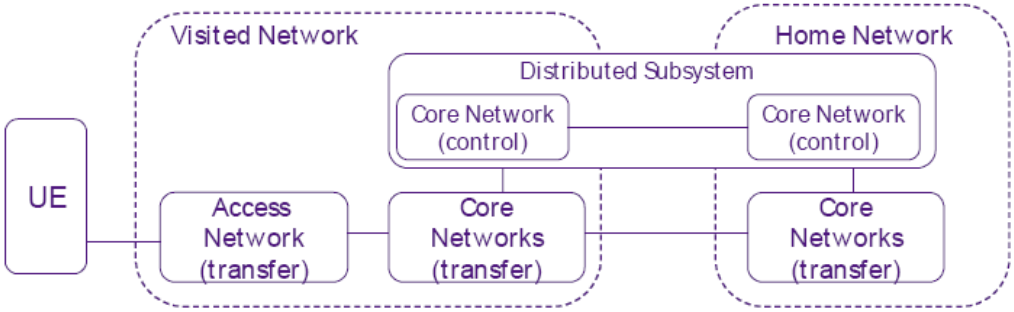


Figure 2: Distributed subsystems

This architecture supports the service capabilities and requirements identified in TS 181 006 [i.8].

The transport layer comprises a transport control sub layer on top of transfer functions. The transport control sub layer is further divided in two subsystems:

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

For the service layer, the TISPAN architecture uses a subsystem oriented approach. Each subsystem relies on its own architecture model and is specified independently from the others. This 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 such as the IMS.

The service layer comprises the following subsystems:

The "Core" IP Multimedia Subsystem (IMS)

The IP Multimedia Subsystem (IMS) core component of the NGN architecture (Core IMS) supports the provision of SIP-based multimedia services to NGN terminals. It also supports the provision of PSTN/ISDN simulation services.

The PSTN/ISDN Emulation subsystem (PES)

The PSTN/ISDN Emulation Subsystem supports the emulation of PSTN/ISDN services for legacy terminals connected to the NGN, through residential gateways or access gateways.

The Streaming Subsystem

The Streaming Subsystem supports the provision of RTSP - based streaming services to NGN terminals.

The Content Broadcasting Subsystem

The Content Broadcasting Subsystem supports the broadcasting of multimedia content (e.g. movies, TV channels, etc.) to groups of NGN terminals. The architecture of the content broadcasting subsystem is outside the scope of TISPAN NGN Release 1.

Common components

The NGN architecture includes a number of functional entities that can be accessed by more than one subsystem. These are:

- User Profile Server Function (UPSF);
- Subscription Locator Function (SLF);
- Application Server Function (ASF);
- Interworking Function (IWF);
- Interconnection Border Control Function (IBCF); and

- Charging and Data Collection Functions.

Figure 3 illustrates the position of the IMS in the overall NGN architecture.

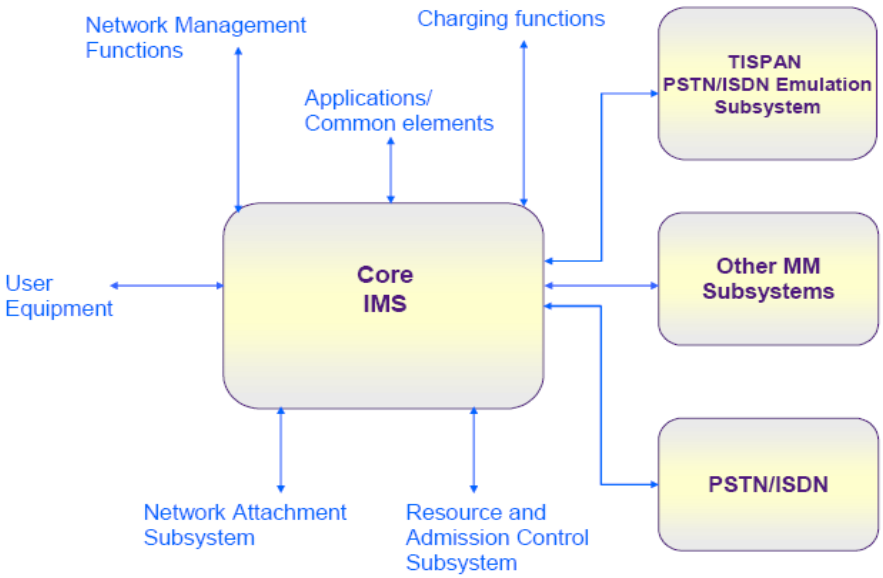


Figure 3: TISPAN IMS and its environment

Based on the NGN fundamental aspects specified in this clause and regulatory requirements as specified in clause 5, the interfaces between the Core IMS and other sub-systems and functions as provided in the annex A may require an analysis from the regulatory point of view.

4.2 New capabilities of NGN

This clause provides an overview of new NGN capabilities as being specified in ETSI TISPAN NGN (Release 2) and 3GPP (Release 7). The focus is on those capabilities that may be relevant from the regulatory point of view.

4.2.1 ETSI TISPAN NGN

The general objective of all ETSI TISPAN release-based standards is to provide a framework, that provides an extensible platform for future service and architecture development. The objectives for TISPAN NGN Release 1 were to provide such an extensible platform and architecture, and to demonstrate viability by specifying the details for two significant objectives:

- to enable delivery of the services supported in a 3GPP IMS to broadband fixed lines;
- to enable PSTN/ISDN replacement (in whole or in part).

A deployed Release 1 NGN may support either of the above objectives, or both using the same core network, transport, service and applications.

NGN Release 1 is designed to be extensible, allowing new services to be incorporated into the release 1 subsystems, and to enable other subsystems to be defined. Thus, NGN Release 2 covers:

- Completion of Release 1 topics;
- Release 2 enhancements extending the Release 1 capabilities.

Release 2 new services and capabilities that cover additions to Release 1 services and capabilities.

The following section highlights those of TISPAN NGN Release 2 work areas that may be relevant from the regulatory point of view, however it does not cover the exhaustive list of all work areas and topics.

IMS evolution

Enhancement of service requirements and network capabilities for Release 2. This includes the overall requirements, from the perspective of users, service providers, operators and content providers for TISPAN Release 2. Release 1 completion or enhancement of some PSTN/ISDN simulation services (MCID, ACR&CB, AoC).

Release 1 completion of Emergency services.

New topic on Business Communication and Business trunking cover requirements for connection of (IP-) PBX' to the NGN and the architecture and functionality required for business trunking.

Non-session based services

New topic on IPTV covers:

- IPTV impacts on the TISPAN NGN transport layer and specifies the network requirements as relates to the transport layer taking terminal capabilities into account.
- Service layer requirements to integrate IPTV service with NGN communication services, including broadcast TV, etc.
- Architecture and functions of an IPTV system that makes use of the NGN IMS architecture and its features.
- Architecture and functions of an IPTV system by incorporating IPTV functions within the NGN architecture.

Fixed mobile convergence (FMC)

New topic on fixed-mobile convergence scenarios in order to derive requirements and capabilities to support FMC capabilities and the impact of multimedia communication services.

User data

User identity issues in order to review the service requirements and architecture for NGN, identify the naming, Numbering, Addressing and Identification issues.

Corporate networks

Core and Enterprise NGN interaction scenarios and architectural requirements for enterprise network / NGN interconnection at all layers.

Hosted enterprise services describes the architecture and functionality required to support enterprise and corporate services as IMS applications hosted in the NGN operator's network on behalf of an enterprise.

Customer gateway and customer devices

Service requirements and capabilities for customer networks when customer devices are connected to TISPAN NGN via a Customer Network.

Interconnection issues

Service-oriented Interconnection approach (SoIX) for NGN interconnection instead of a pure Connectivity oriented Interconnection approach (CoIX), building on the ENUM initiative. NGN Interconnection may be grouped in:

- Service-oriented Interconnection (SoIX); and
- Connectivity-oriented Interconnection (CoIX).

A number of requirements for SoIx have been defined that may be relevant from the regulatory point of view, such as support of LI, support of appropriate privacy, support of authorization, support of authentication and access control, support of communications and data security (including integrity, confidentiality), support of DoS protection and security. Two interconnection scenarios are considered:

- SoIX interconnection between IMS platforms;
- SoIX interconnection between IMS and other IP platforms.

Accounting and charging

Release 1 completion of Online charging including charging for new services and coordination with RACS to provide RACS support of charging.

QoS and traffic engineering

New topic on QoS reporting identifies the capabilities (e.g. QoS reporting, resource monitoring, etc.) in order to guarantee an adequate QoS to the media flows and defines specific requirements for the NGN environment related to the identified capabilities.

Other topics

Enhancement of Release 1 Methods and Protocols for Security including Threat Analysis, Counter Measures and NGN Security Countermeasures Stage 2.

Lawful Interception addresses provision for lawful interception architecture for IP-based Multimedia Services and PSTN-Emulation Services.

eSecurity for Web-user - eTVRA database.

Media Security addresses key management/key distribution for user plane (/media) and the protection of the media data. It will also provide considerations on regulatory aspects such as lawful interception, and privacy.

4.2.2 3GPP

Service support

Earlier 3GPP releases already provide efficient support for the services including the most popular applications e.g. text messaging (SMS), Web and WAP access, multi-media messaging (MMS) and content downloads, e.g. ring tones, music and video clips, but also other services, with less penetration today but with high expectations for future growth, including mobile email access, mobile TV, mobile gaming and full track music downloads.

3GPP Release 7 focuses on providing improved support and performance for real-time conversational and interactive services such as Push-to-talk Over Cellular, picture and video sharing, and Voice and Video over IP. These services are becoming available as operators deploy IMS based on 3GPP Release 5.

3GPP Release 7 also includes definition of supplementary services using SIP.

Core Network and IMS features

3GPP Release 7 also provides new and enhanced Core Network and IMS features. IMS is extended to wireline subscribers to make it the common platform for both fixed and mobile networks going forward. IMS Multi-media Telephony defines a telephony service for Voice and Video over IP, allowing operators to provide telephony services in the packet switched (PS) domain that is consistent with the already existing services in the CS domain. Voice Call Continuity provides seamless mobility between the voice component of the IMS Multi-media Telephony and CS voice. CSI provides the means for a mobile station to combine a CS voice call with PS-based IMS services between the same two users, enabling picture and video sharing with CS voice calls in order to provide enriched voice services. Policy and Charging Convergence (PCC) allows operators to perform advanced dynamic QoS control and charging for packet data services.

Fixed Broadband Access to IMS (FBI)

Fixed Broadband Access provides a means of extending IMS services to wireline subscribers. The work on Fixed Broadband Access (FBI) will embed IMS as the framework for advanced services for many types of operators. IMS is extended to act as a common core and services platform for fixed and mobile networks.

Under the Fixed Broadband Access (FBI) work, 3GPP is considering requirements from a number of different communities of operators including those based on DSL and cable technology. A number of features have been introduced primarily in order to extend the IMS towards providing services for fixed broadband access:

- NAT traversal.
- Optional use of SIP preconditions for wireline access.

- PSTN bridging - the use of IMS as a transit network with PSTN round the edge.

Policy and Charging Convergence (PCC)

PCC provides enhanced and future-proof tools to allow operators to perform advanced dynamic QoS control and charging for IP data bearers. PCC develops the capabilities provided in Release 5 Service Based Local Policy (SBLP) and Release 6 Flow Base Charging for IP bearers.

PCC will combine the policy control and charging functions into a single architecture which provides consistent signalling and which can support multiple access types.

PCC will enable operators to adjust the QoS being provided to users based on a range of factors including application requirements and user subscription level (gold, silver and bronze). PCC will also provide tools useful to manage the impact of "bandwidth hogging" applications such as peer-to-peer file sharing.

Voice Call Continuity (VCC)

VCC is a home IMS application, which enables seamless continuity of voice services between CS domain and IMS. VCC subscribers" calls are anchored in home IMS when roaming across CS domain and IMS.

VCC provides functions for call originations, terminations and call continuity across CS domain and IMS. The VCC Application is inserted in the control signalling path of VCC subscriber's CS and IMS sessions for employment of a third party call control function controlling these sessions. Calls established over CS domain are redirected to IMS for insertion of VCC Application in the call control signalling path using standard CS domain techniques available for redirecting calls at call establishment; these calls are then processed according to standard IMS procedures. This allows for voice service continuity across CS domain and IMS.

Signalling for Emergency Calls

Mobile terminals may well have simultaneous access to both the CS domain and the IMS for making emergency calls. Terminals making emergency calls need to decide which one to use (CS domain by default). While Releases 5 and 6 IMS direct the terminal to make the emergency call on the CS domain, emergency calling on IMS is being introduced in Release 7.

Protocol impact from providing IMS services via fixed broadband.

The work provides for possible enhancements of protocols used in the IMS in order to support a NGN based on IMS in ETSI TISPAN Release 1. Guided by a 3GPP system perspective 3GPP is developing the functional models, flows and protocol details for the IP Multimedia Core Network (IM CN) subsystem behaviour when providing IMS services based on the Session Initiation Protocol (SIP), the Session Description Protocol (SDP), other protocols, the Gq interface and the Cx interface via fixed broadband access.

Security

In Release 7, the security features and mechanisms for secure access to the IM subsystem (IMS) for the 3G mobile telecommunication system have been also adapted to the fixed broadband networks. They include the issues like how the SIP signalling is protected between the subscriber and the IMS, how the subscriber is authenticated and how the subscriber authenticates the IMS.

Security for the Presence Service

Release 7 is covering security requirements, security architecture, security features and security mechanisms for the Presence Service.

TLS (Transport layer Security) support

TLS provides transport-layer security over connection-oriented protocols deploying TLS. TLS is mandatorily supported by SIP proxies. and operators may use it to provide confidentiality and integrity inside their networks instead of or on top of IPsec. TLS may also be used between IMS networks on top of IPsec. TLS has also been specified for inter-operator communications between IMS and non-IMS networks.

Quality of Service

IP Multimedia Subsystem (IMS) networks promise complex user scenarios where one can access multiple applications in a single session from any location and across different access technologies. The policy function is the key to making this functionality possible and is directly responsible for the QoS perceived by the consumer. The policy function has been evolving along with the network architecture.

Previous Releases have separately specified the following features:

- Enhanced policy control to allow the operator to perform service based QoS policy control for GPRS access for their session-based PS applications;
- IP Flow-based charging to allow for more granularity for end-user charging, accounting and online credit control.

While some level of convergence between these functions has already been achieved in previous Releases, a full harmonization and merger of these functions for different IP-CANs (e.g. GPRS, I-WLAN, Fixed Broadband, etc.) is specified in Release 7 to allow for optimizing real-time interactions in the PS network.

A new term in - PCRF - has been introduced in 3GPP Release 7. PCRF is variably referred to as Policy Control and Charging Rules Function, Policy and Charging Rules Function or simply Policy Charging Rules Function.

Evolution Beyond Rel-7

To ensure the competitiveness of the 3GPP systems in a time frame of the next ten years and beyond, a long term evolution of the 3GPP access technology is specified in 3GPP.

To enhance the capability of the 3GPP system to cope with the rapid growth in IP data traffic, the packet-switched technology utilized within 3G mobile networks requires further enhancement.

Additionally, it is expected that IP-based 3GPP services will be provided through various access technologies. This can certainly lead to higher competition in the access. A mechanism to support seamless mobility between heterogeneous access networks is needed for future network evolution.

In order to achieve this, an evolution or migration of the network architecture, as well as an evolution of the radio interface is studied in the System Architecture Evolution (SAE), Long Term Evolution (LTE) and HSPA Evolution (HSPA+) Study Items in 3GPP. From a network deployment point of view it is likely that HSPA enhancements will be introduced first, followed by the evolved packet core (SAE) and then the evolved radio interface (LTE).

5 Regulatory Requirements for NGN

The list of items has been chosen from the outcome of OCG ECN&S work prepared by STF 254 [i.2], interpretation of the directive, based on the 2002 Regulatory Framework.

Only the NGN specific regulatory requirement are considered in the section. Outside the scope are requirements which apply to any networks (e.g. carrier selection, portability, unbundling, etc.).

5.1 Decoupling of service from transport

NGN involves separation or independence between services and underlying transport technologies or platforms, enabling unfettered access for users, service providers and devices to networks and to competing authorized service providers and/or services of their choice. This includes separation of control functions among bearer capabilities, call/session and application/service as well as decoupling of service provision from network, and provision of open interfaces. It should be noted that the degree of interoperability between transport layer and service layer will define the role of service providers. Even though service control (service-related functions) and routing/switching (transport) in NGN is provided by different network elements, fierce control of transport resources is done by service logic within individual networks. It means that the interconnection of transport and service layer between networks is still necessary for a global service area. Unlike legacy circuit switched networks, however, in the NGN environment there are many services & applications that need to be interconnected.

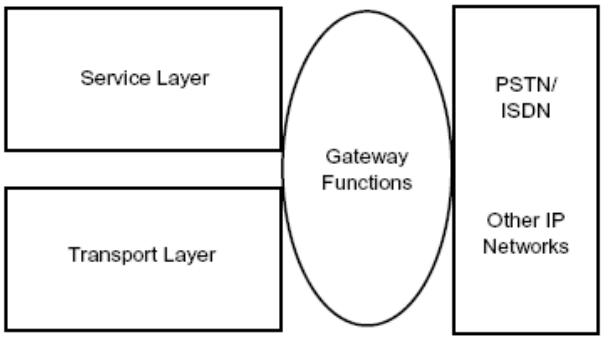


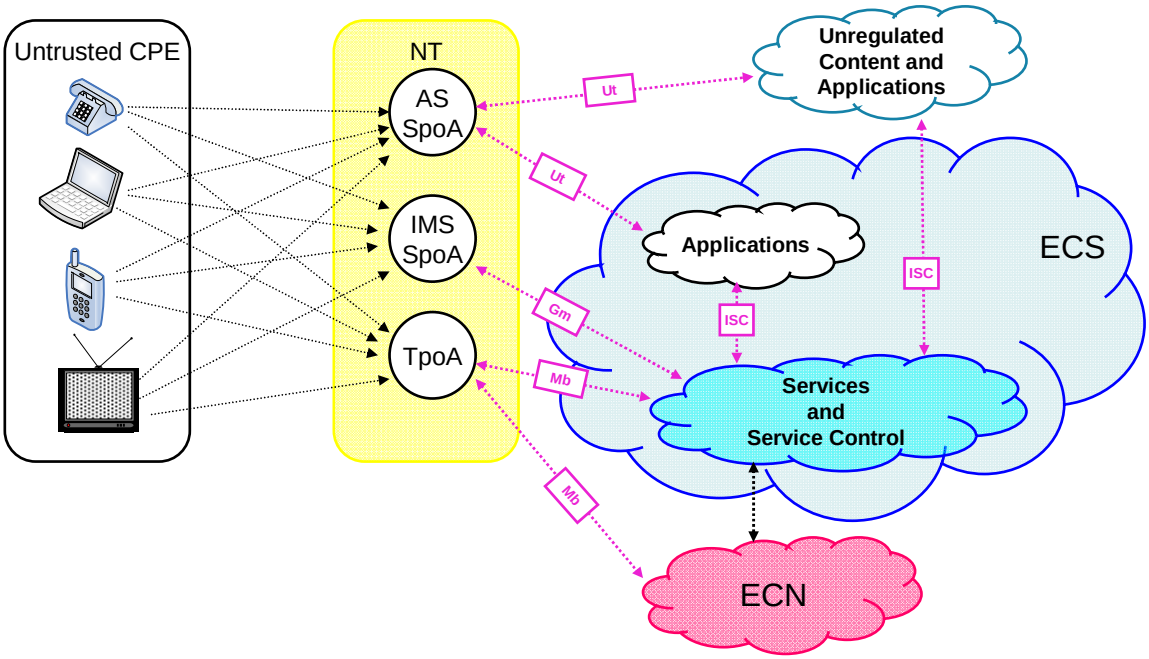
Figure 4: NGN decoupling of service and transport layers

Decoupling in this sense means that the transport (connectivity) portion of the network is separated from the services that run on top of that transport (see figure 4). By separating transport and service layers, a provider can enable a new service by defining it directly at the service layer without considering the transport layer - that is, service and transport layers are to some extent independent, which has, ultimately, implications for competition and pricing.

ETSI TISPAN NGN supports the delivery of end-user services through application servers, rather than directly embedding services as capabilities in the control protocols as described in TR 180 001 [i.14]. For real-time conversational services (SIP based session control), the application server controls the communication session by modifying the behaviour of the generic session control (e.g. using triggers). Third-party service providers and applications are supported through suitable control interfaces, and operators and providers are required to provide access to the relevant reference points.

5.2 NGN mapped to ECN&S

For the purpose of the present document, the NGN is mapped to the ECN&S framework as shown in figure 6 (where the root model is given in figure 5).



CPE Customer Premises Equipment
NT Network Termination
SpoA Service point of Attachment
TpoA Transport (IP) point of Attachment

Figure 5: Basic ECN&S model

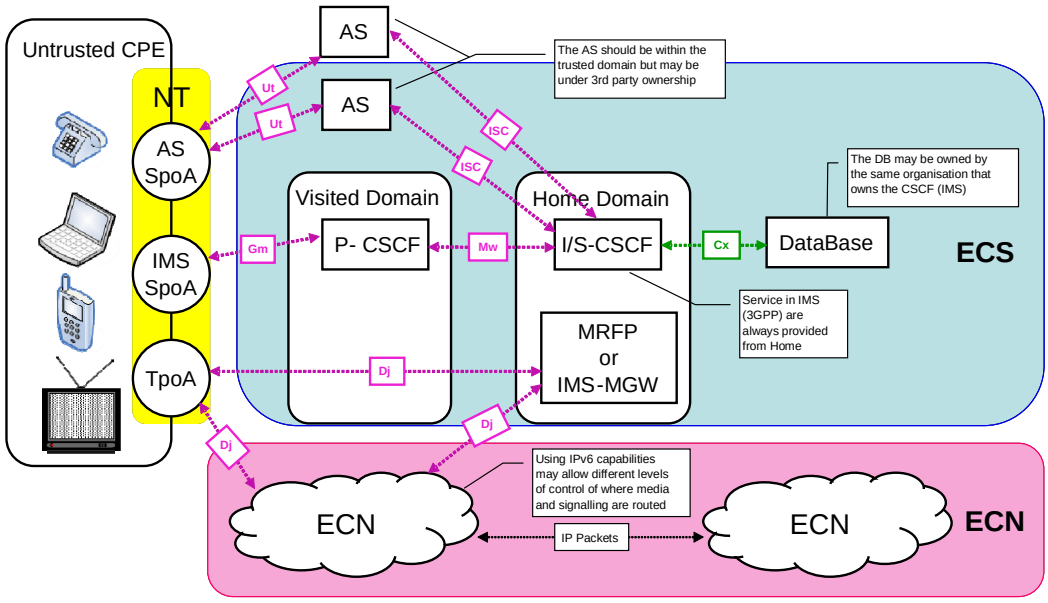


Figure 6: ECN&S model mapped to IMS based NGN

The services provided by the NGN Release 1 include the following:

- PSTN/ISDN Simulation and Emulation;
- Presence; and
- Messaging services.

5.3 EC Regulatory targets and technical standardization

While the traditional PSTN-based regulatory model has approached intensively technical as well as economical regulatory aspects, the packet-based Internet is generally less subject to regulatory intervention. The two have evolved differently, by regulators. In some cases, the simple extension of current regulatory practices has been sufficient, such as mandating the right of Voice over Internet Protocol (VoIP) operators to interconnect with other operators. However, NGN combines characteristics of the traditional telecommunication model and the new Internet model at a technical level, thus, its regulation will require planning and foresight by regulators - and policy-makers. This will ensure that regulatory frameworks will continue to promote namely NGN development and deployment.

NGN migration presents an opportunity for regulators and policy-makers to analyze what impact their current regulatory framework has on their goals of innovation, investment and affordable access NGN migration thus presents another opportunity to redefine regulatory ground rules in advance and to audit and review approaches to regulation and policy to ensure that they promote competition, investment and widespread end-user access.

To highlight the main concerns that regulators and policy-makers should begin to address when dealing with NGN, it is necessary to explain different NGN aspects with a special focus on those ones that may be of concern for regulators and policy-makers.

5.4 Freedom of choice for users

The user is not only the consumer, but the end user of the NGN.

The end user should have the choice of the operator and content/service providers he would like to contract with, or to change to. The objective is to favor competition and increase alternative solutions for the end user.

To ensure service continuity and a transparent user experience, NGN requires interworking with legacy networks encompassing both mobile and fixed networks and their evolutions. Interworking is required for a seamless transition between legacy networks and NGN in order to maintain service capabilities provided by both.

NGN standards have been developed to cover such possibilities, by:

- ensuring that the technical standards allow end to end connectivity within the scope of any single service;
- ensuring that the appropriate interfaces needed to allow access to services provided by third parties are properly defined.

The goal is to ensure that any measure approved by a regulator on the area of interoperability may be effectively implemented in the networks.

5.4.1 Access to ECS providers

One of the most important aspects of NGN is the deliberate separation of the access from the service. It means that the access provider (the provider that provides a customer with access to the NGN) may be different than the service provider that provides a customer with various services, such as voice and video communication, e-mail, or other services. However, the access provider and service provider might be the same company. For example, as a subscriber to cable services, a customer may elect to purchase voice (telephone) services from his/her cable company. In that case, his/her access provider and voice service providers are the same.

Users may have one or many access providers providing access in a variety of ways, including cable, DSL, WLAN, WiMAX, fiber, etc. into the NGN. It is clear that the incumbents would prefer to further control both the access and the services, blocking competitors from being able to come into the market and offer competitive services.

The ETSI TISPAN NGN supports business agreements between the access network operator and the network operator providing NGN IMS services (NGN IMS operator). The NGN IMS can offer services to users that are attached to access networks owned by another operator. The service offering may be restricted by the capabilities of the access network and the business agreement between all the parties involved in the service provision, e.g. access network operator , core network operator and ECS provider.

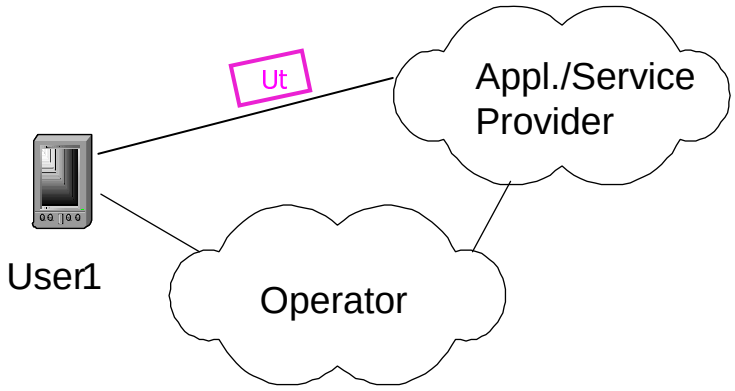


Figure 7: Access to an indirect ECS service provider

This concerns the Ut interface which is standardized, which relates to NGN and which is expected to be subject to regulation.

5.4.2 Interconnection

End to end connectivity

End to end connectivity applies both to end to end connectivity communications between "peer" ordinary users, and between a user client and a "host" service provider (e.g. content providers).

Access to Third Party applications and services

The open interface Isc is the interface between AS and S-CSCF. While this interface is clearly defined, operators may have specific implementations. This area should be of interest to regulation because it has influence on the Third Party Application provider market.

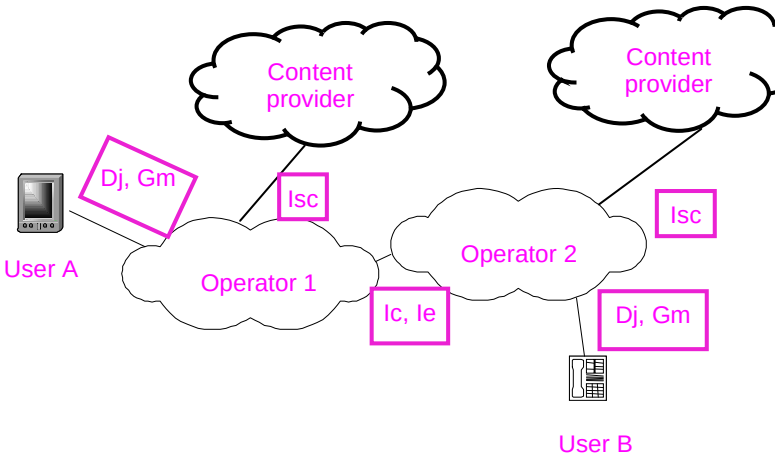


Figure 8: End to end connectivity

Different interconnections are possible, depending if the operator has or not chosen IMS for his network architecture.

Interworking with legacy networks via open interfaces

To ensure service continuity and a transparent user experience, NGN requires interworking with legacy networks encompassing both mobile and fixed networks and their evolutions. Interworking is required for a seamless transition between legacy networks and NGN in order to maintain service capabilities provided by both.

NGN interworking with legacy networks is provided via open interfaces. These open interfaces are realized by gateway functions. It should be noted that gateways can be run by service providers for their own subscribers or can be run independently as a "service" to other service providers (i.e. there could be a few gateway providers in each country who would serve many service providers all around the world for connections with the PSTN in that country).

Interworking with legacy networks is supported in TISPAN NGN Release 1. NGN Release 1 supports the interworking with legacy PSTN/ISDN networks via gateways. The NGN IMS provides the support for the interoperability of PSTN/ISDN like services with PSTN/ISDN Services and vice versa including Supplementary Services. The scope of this interworking may result in a limited service capability. Additionally, NGN Release 1 also supports interconnection to other networks such as 3GPP IMS, and IPCablecom based cable networks.

Support of multiple last mile technologies

The last mile is the final leg of delivering communications connectivity to a customer. NGN supports diverse last mile technologies and capabilities. This includes wireline (e.g. xDSL, optical access, cable networks or other wireline access network connectivity types, e.g. Gigabit Ethernet link to a corporate network) as well as wireless technologies (e.g. wireless LAN networks, 3GPP or 3GPP2 IP-CAN, e.g. GPRS core network with GERAN and/or UTRAN or other wireless access network connectivity types). All NGN access types are required to offer IP connectivity. Control over the last mile provides a significant strategic advantage to the provider who controls it.

NGN provides support to a wide range of services, applications and mechanisms based on service building blocks (including real time/ streaming/ non-real time and multi-media services).

NGN provides the infrastructure that will enable the advanced new services that mobile and fixed network operators have started to offer, while continuing to support existing services. It will also support fixed, mobile and nomadic users and have the ability to carry voice, data and multimedia - real time interactive services. Built on open modular elements, standard protocols, and open interfaces, the NGN caters to the specific needs of all users - enterprises, remote offices, telecommuters, and small office/home office (SOHO) customers. Key expectation in NGN include flexible service creation, and innovation. Certainly, existing services should be re-used when possible, e.g. PSTN/ISDN emulation. However, for new service creation, focus will be on standard "service capabilities (building blocks) " as toolkit of service enablers. Using building blocks to create new services and applications will facilitate flexible service and application design, creation and development. It will also facilitate promotion of innovative and evolving services as well as third-party services development and support. On the other hand, the new challenges of NGN for regulation will appear, including the shift of NGN competition from lower layers to services and application layers, appearance of new sources of possible market power as well as bottlenecks.

The focus of ETSI TISPAN NGN Release 1 is on two objectives:

- to enable delivery of the services supported in a 3GPP IMS to broadband fixed lines;
- to enable PSTN/ISDN replacement (in whole or in part).

Service building blocks in ETSI TISPAN NGN are defined as "service capabilities" as indicated in TR 180 000 [i.12]. Service capability is a specified function (or group of functions) that is used either alone or in combination with other service capabilities to realize a complete service. These are within networks and under network control. Service capabilities may be provided either by the network operator or by 3rd parties via appropriate interfaces.

ETSI TISPAN NGN supports conversational real and non-real time services and streaming. Services can take advantage of the multimedia capabilities of the NGN network. Additionally, NGN defines PSTN/ISDN "emulation" in support of transparent PSTN/ISDN service between legacy PSTN/ISDN terminal equipment and "PSTN/ISDN Simulation" in support of PSTN/ISDN-like services on NGN terminals. For conversational services NGN uses an enhanced 3GPP IMS (Release 6) as its core.

Standardization of service capabilities rather than the complete sets of services in ETSI TISPAN is in line with the 3GPP work as mentioned in TS 122 101: Service Aspects; Service principles (Release 7) [i.16]. 3GPP preferentially standardizes service capabilities. In circumstances where the service is meant to be used across different operators' networks, hence a common specification set is of paramount importance, the service should be standardized to a level of detail sufficient to ensure interoperability and interworking across different operators' networks. Service capabilities consist of bearers associated with specific QoS and the mechanisms needed to realize services. These mechanisms include the functionality provided by various network elements, the communication between them and the storage of associated data.

Converged services between Fixed/Mobile networks

Fixed/Mobile network convergence provides seamless connectivity for services across fixed and mobile networks. On one hand, convergence may bring greater complexity for consumers. On the other hand, as the bundling of wide and varying ranges of services becomes the norm – which may be of concern to regulators -, comparing products to make informed buying decisions may become harder. Offering different services over different networks simultaneously and seamlessly is not a trivial task, even if suppliers are willing to co-operate. This may reduce the positive effects of competition.

Converged networks can provide subscribers with a seamless fixed/wireless environment that delivers the services they require no matter what end-user device they are using.

Converged services between Fixed/Mobile are supported in ETSI TISPAN NGN Release 1. NGN is based on the IMS defined in a number of 3GPP Release 6 specifications. NGN Release 1 provides modifications or adaptations to these specifications in order to support the same services on terminals utilizing access networks other than the 3GPP IP-CAN.

5.5 Mobility

While roaming that has been introduced by mobile networks is a facility that enables a subscriber to use the infrastructure of another operator when he/she is located beyond the coverage of his/her home network, NGN and the provisioning of associated services (such as seamless service provision) introduces new challenges: the ability of roaming between networks based on different technologies (inter-technology roaming) and the ability of maintaining a session while roaming between two networks (mobility support). Mobility support solutions could actually also solve inter-technology roaming issues depending on how they are specified. The major issues in roaming and mobility lie in the definition of a commercial model, the setting-up of service level agreements and billing processes. A major feature of NGN will be generalized mobility, which will allow a consistent provision of services to a user (i.e. the user will be regarded as a unique entity when utilizing different access technologies, regardless of their types). This capability also provides challenges including different service configurations and possible bridging between the different services.

In TISPAN NGN Release 1, support is provided for nomadism and personal mobility. NGN assumes that service mobility may be supported and that such service mobility may employ session continuity. The session continuity achieved may in some circumstances be close to that of a "hand-over" however NGN R1 gives no guarantee that this will be the case. Terminal mobility is supported to the extent that devices that may be moved between access networks support the relevant technologies employed in that access network. Seamless hand-over is supported only in 3GPP UTRAN access networks.

ETSI TISPAN NGN Release 1 defines mobility requirements for the IP Multimedia Services as well as for PSTN/ISDN Emulation Service: TS 181 005 [i.15].

For the IP Multimedia Services, the NGN supports:

- Terminal portability as defined in TR 180 000 [i.12];
- Nomadism, as defined in TR 180 000 [i.12], and described in TS 181 005 [i.15];
- Capability for a user to change to a different device or devices connected to one or more access networks to gain access to their services;
- Capability of the user to change network access point whilst moving.

The NGN home network and visited network support the capability of providing services from the NGN home network to a user connected to the visited network. Services should be able to be reconfigured so as to be suitable for the target network and target device. The service has to be reconfigured at the time the user first accesses the service from a new location. For particular services, mobility does not interfere with the provision of all information required by the service (e.g. geographic location information).

There is no requirement to support mobility or a nomadic capability for PSTN/ISDN Emulation. There are no additional mobility requirements. This does not prevent the existence of user nomadism where it is implicit in the chosen business model nor does it require that nomadism be actively prevented.

The service portability is related to QoS being clearly defined to the end user, who should have the freedom of choice of the device and price for a service he has subscribed to.

5.6 QoS and Network Performance

The deployment of NGN adds a new dimension and increased complexity to the consumer purchasing decision and satisfaction levels, namely choice of services available and the differential QoS they may experience. Some consumers may demand a higher quality of service than they currently experience, which could be provided, for example, through wide-band speech, or expect the same level of service from a different technology, for example Video. Consumer may be prepared to pay more for faster Internet speeds and access to new content and applications. In turn, this may lead to a more transparent QoS-related pricing mechanisms, provided consumers demand the relevant QoS information needed to differentiate between the products and services on offer.

NGN needs to ensure that the network will work reliably all the time. In a NGN environment where many different networks will be connected with each other and different types of services delivered, limitations in the interoperability between different vendor equipments can deteriorate end-to-end quality. Therefore, it is important to reach agreement among different systems on end-to-end QoS suited for each different type of data stream, and to set the parameters with upper layer protocol to control the lower layer, transport and access level QoS mechanisms. In addition, the information at end-user interfaces has to be sufficient enough to enable them to select among connections with different qualities. The quality of the access for the end-users has also to be sufficient to support satisfactorily the full range of applications. High-speed broadband access and other capabilities of NGN will help address this. NGN users can access the network through different access resources at the access layer. These access resources might belong to operators other than the service provider who cannot directly control the access resources of other operators. The NGN QoS is a very complex issue because it is influenced e.g. by performances of the service layer and the transport layer and terminal capabilities.

ETSI TISPAN NGN supports interfaces to a variety of different broadband Access Networks providing IP connectivity, such as xDSL, cable and 3GPP UTRAN as defined in TR 180 001 [i.14]. NGN recognizes that there may be a customer network beyond the access network. In support of end to end QoS, NGN includes a policy control framework based on admission control between the access and core networks. Resource reservation mechanisms may be deployed in the access network however Release 1 does not mandate the use of resource reservation in the core network. In the case of a Corporate Network connected via an access network, provision of admission control by the TISPAN NGN policy framework is not required. Besides, resource reservation may be provided within that customer network.

Whereas traditional PSTN basic terminals are normally line powered, NGN services are dependent on main power for their terminal equipment.

To allow comparison, a common understanding of the QoS criteria, point of measurement and method of measuring should be dealt with.

The ability to offer different levels of QoS has been seen as a key factor differentiating IP-based NGNs from the public Internet.

Tighter limits on network delay, and on variability of delay, would enable IP-based networks to deliver real-time bidirectional voice and video services more predictably and maybe more reliably than the current best-efforts arrangements. For instance, different resource management mechanisms exist to control the QoS such as traffic segregation in the access and in core network (prioritization or control of call set up, the later one being the modelling of PSTN).

While regulation should not impose QoS values onto the ECS or ECN providers, end users should be able to choose between different providers, based on identical parameters.

NGN provides new interfaces and there should be a global agreement regarding: where to measure, what to measure and how to monitor afterwards.

QoS does not only lie in the network, but also in the terminal which may have different Codecs to compensate network quality.

5.7 Customer Protection

Privacy handling requires close cooperation among operators, technology and contents providers.

Till now, operators were billing minutes of use, source, destination, jurisdiction, and sometimes mileage considerations. In the NGN marketplace, the billing relationship and access to customer information is viewed by some as a control point which could potentially require regulatory attention.

NGN will allow new business models, as a combination of local and long distance wireline services together with wireless services, all or some of which may be "advanced" services involving messaging, faxing, music downloads, video clips, digital pictures, stock quotes, etc.

The interfaces between Service Provider and the Network Access Provider are often based on B2B technologies and are usually developed in national regulatory activities but subject to International and European standards.

When considering the protection of personal information, the starting point for most analyses lies with rights to privacy.

Personal data can be collected lawfully for specific and limited purposes only, and can be stored only for as long as necessary to fulfil the purpose. Data should be accurate and adequate for the intended purposes, and individuals have a right of access to and correction of their personal data.

As consumers have been rapidly adopting new digital devices, ranging from mobile phones and PDAs, to GPS and DVRs (Digital Video Recorders), devices need no longer be self-contained:

- those devices can physically reside in one location;
- their associated data reside in another location; and
- their controls can reside in a third location.

5.7.1 Privacy

This chapter covers presentation and restriction of calling, called and connected identifications, Malicious call Id.

5.7.1.1 Identification information

Both originated and restricted ID are dealt with: CLIP/OIP, CLIR/OIR, COLP/TIP and COLR/TIR and it is not specific to NGN.

Protection of identification information (CLIR, Malicious Call Id) which may be overridden in case of emergency calling.

Regarding Anonymous Communications Rejection service requirements (ACR), the service capability is inherited from existing PSTN/ISDN specifications and no new requirements are identified.

As for Malicious Communication Identity service requirements (MCID), the service is required for all speech calls irrespective of which network originated the call. It is normally provided following a request from the customer concerned and may be subject to authorization.

5.7.1.2 Location information

Service providers can locate devices and provide global positioning services to business users, among others. Since locating the device locates the user, it becomes possible to develop services that add value to mobile communications.

The provision of location information has severe impacts of privacy but benefits in case of emergency calling.

5.7.2 Control of expenditure (Accounting and charging)

Under the competition pressure, some providers may be tempted to inform the user of their costs in less transparent manners. This is nevertheless likely to be one area where competition and consumer protection authorities will use appropriate laws, not necessarily specific to the communications sector.

When voice was only the service which was invoiced, the items which one could charge upon were: call duration, time of the call, and distance. With the introduction of data and packet switched, volume is something which is of importance. We are moving from a network centric billing model to the delivery of multimedia services running across multiple network systems from multiple service providers in addition to the network access provider that can be multiple if the user is roaming.

In the IMS architecture, services can be multidimensional, with service logic distributed across a variety of network elements. There will be a greater need to track call events/sessions as information is exchanged among users and various service providers. Metering and Billing aims to enhance end-user confidence in the accuracy of charges from Communications Providers, by the testing and certification of the systems and processes involved in creating those charges and generating bills and prepay debits.

Standards should provide information as to where, what and how the information is collected, stored, and processed, using which granularity. To allow service comparison and control, it is necessary to have the related parameters, measure at the same location in the network, using the same methodology of processing and control.

The importance of customer ownership and control through billing in NGN remains clear, Although billing in NGN could be provided by each single player providing a service, some players or even third-parties could provide billing services on behalf of other players.

NGN should enable all possible types of billing arrangements, as well as accounting (between providers). This includes also e-commerce arrangements. Billing, charging and accounting in NGN will be based on the collection of information from any appropriate entities in the form of Charging Data Records (CDRs). NGN release 1 will specify the format and content of these CDRs, reusing where possible appropriate specifications from 3GPP. This reuse may include entities outside the IMS. NGN Release 1 does not specify the functionality of billing, charging and accounting systems, or how CDRs are collected.

5.7.3 Subscription Management

Subscription management is about configuring the information held in the UPSF, PDBF and other functions of the TISPAN NGN Architecture. These are broadly equivalent to the information held in the 3GPP Home Subscription Server (HSS). Service providers should be able to provision their NGN network entities for delivering services for a specific subscriber. Subscribers should then be allowed to configure their services when they have these capacities.

NGN Architecture allows for the provision of the network access to be from a different provider to that providing the services e.g. IMS based. Subscription Management therefore configures subscription information in both the Network Access Provider and the Service Provider.

In view of the freedom of choice for the user and in order to promote competition between service providers it is necessary at the operational level that subscriptions can easily be initiated, modified (up-/down-graded), cancelled and moved from one provider to another. Nevertheless, security procedures must be in place to ensure that the competition for subscriptions does not put the user's decision for a subscription with a certain provider at risk.

5.8 Security

NGN is able to guarantee secure communications and to block unwanted traffic. It has introduced new security technics not currently available on Internet and brought improvement on authentification and authorization, as well as a secured transport layer.

The NGN is defined in that manner to provide sufficient security services and mechanisms to meet the IP Multimedia Service requirements as specified in TS 181 005 [i.15].

The NGN IMS subsystem provides services, including connectivity, to a user entitled to use the resources of the NGN and the IMS subsystem. The Access Network provides access connectivity to a user entitled to use the resources of the Access Network. The NGN supports independent verification by IMS and Access Network of the previous two requirements. However, to facilitate the early deployment of NGN, two special legacy scenarios, permit the verification to be linked. These two special deployment scenarios are:

IMS authentication is linked to access line authentication (no nomadism).

IMS authentication is linked to access authentication for IP Connectivity (limited nomadism can be provided).

A PSTN/ISDN Emulation meets the security requirements placed on a national PSTN/ISDN network. Where appropriate, requirements and mechanisms may vary to take account of the underlying NGN and IP technology.

Lawful Interception

In terms of regulation LI obligations are largely found under Pillar 3 of the EU ("Police and Judicial Co-operation in Criminal Matters" (PJCC) pillar concerns co-operation in the fight against crime) whereas the Framework directive is a consequence of Pillar 1 ("Community" pillar concerns economic, social and environmental policies) [i.34].

Integrity of the network

To protect the integrity of the network, operators need to take account of potential security threats at every level of their network infrastructure as well as at the customer level e.g. laptops, personal digital assistants and mobile phones.

Identification/Authentication/Authorization

The mutual identification and authentication between user and service provider is an important capability which is essential for any commercial real time and non-real time services.

5.9 Emergency communications

By emergency communications we mean emergency calls, early warning to the public and disaster relief. Those involve both the end user (priority handling and location) and the network (network quality to be maintained). The emergency telecommunication can be divided into the following categories:

Emergency calls. Access to Emergency services is extremely important for citizens, irrespective of how a voice service may be classified for legal and regulatory purposes. From a public policy point of view it is desirable that access to emergency services is available from as wide a range of electronic communications services as possible. When communicating to the emergency services, sender location information should be provided to the extent technically feasible as well the class of priority, described in TS 182 009 [i.31].

Early Warning. This is an alert distribution system allowing an authority to inform some or many individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response.

Telecommunications for Disaster Relief. This provides for preferential call handling and connection setup for organizations involved in the coordination of relief operations in case of a disaster [i.36].

Whilst Early Warning and Telecommunications for Disaster Relief may not need to enjoy immediate attention when developing the NGN for European countries Emergency Calling enhanced with the provision of caller location information is to be taken care of from the very beginning because of its frequent use and high expectations by all stakeholders with regard to availability, reliability and quality [i.36].

[the paper presented for comments contained a paragraph on Emergency Calling and merely enumerated EW and TDR. For cosmetic reasons the enumeration was expanded a little bit requiring a final paragraph to put the three items into perspective]

Emergency traffic may be directed:

- from citizen to authority;
- from authority to citizen;
- from authority to authority.

5.10 Numbering and Addressing

Services can only be interoperable if there is an agreed method of identification of the parties and entities involved.

It is urgent to establish a long term numbering policy. The routing names and addresses required have to be managed and allocated in a fair and non-discriminatory way but has no impact on the standard.

NGN has introduced a new element of architecture: the ECS plane.

The introduction of new services, of which Voice over NGN, will require new numbering, naming and/or addressing schemes which will have to encompass legacy, transitional and NGN services.

The numbering plans should be technologically neutral, based on the service descriptions and the same number ranges should in principle be available for both traditional voice and VoIP services.

Services can only be interoperable if there is an agreed method of identification of the parties and entities involved and if the service provided can cope with the user's terminal characteristics. The lack of adequate names and addresses may become an extremely serious difficulty if incompatible and privately managed resources are used by different providers. This problem is avoided if established public identifiers are used and allocated by regulators or independent third parties such as registries.

Early identification of naming and addressing needs is highly recommended in areas where interoperability might be required. Regulators should have the power to guarantee the availability of naming and addressing resources when the lack of such identifiers may become a barrier for interoperability.

ETSI TISPAN NGN Release 1 defines numbering, naming and addressing requirements for the IP Multimedia Services as well as for PSTN/ISDN Emulation Service described in TS 181 005 [i.15].

For IP Multimedia Services, the NGN is defined in that manner to provide the capability to uniquely identify each user. This Identity Information has to include at least the asserted public identity. This identity information is verified. Both telecom and Internet numbering and addressing schemes have to be supported as public identities. IP multimedia communication establishment (both originating and terminating) depending on originator has to be able to be based on E.164/tel URI (see RFC 3966 [i.25]) or SIP URI (see RFC 3261 [i.13]). It is necessary to guarantee the possibility to assign several public identities for one subscription. Public identities have to be administered by the network operator and cannot be changeable by the user. The network operator will guarantee the authenticity of a public identity presented for an incoming session to a user where the communication is wholly across trusted network. This is equivalent to the situation for CLIP with today's telephony networks. Interworking and interoperability require exact mappings and rules for conversion.

The users of PSTN/ISDN Emulation will be allocated numbers (or number ranges) in the appropriate E.164 number space allocated by the national numbering authority. The nature of this E.164 number will vary from operator to operator and from country to country. The design permits the use of both geographical and non-geographical E.164 numbers. There is no requirement to support the use of non-E.164 names within PSTN/ISDN Emulation but the use of non-E.164 names is not precluded. PSTN/ISDN emulation does not introduce any new requirement to support number portability.

Regulatory service requirements for the PSTN/ISDN Emulation Service include:

- Lawful Intercept service requirements: All implementations of PSTN/ISDN Emulation have to provide the ability to provide Lawful Interception in accordance with national requirements. Where possible the packet interception handover interfaces should be made available to authorities to avoid the ability of targets to maintain covert channels not monitored by TDM handover interfaces. Packet handover is most important for derived service where the packet stream is not under direct control of the provider of the Electronic Communication Network. The capabilities to support Lawful Intercept for Emulation are described in TS 187 005.

- Emergency service requirements: The capabilities to support the Emergency Service are described in TS 102 424 [i.26].

The associated directory services will need to be developed. Indeed, E.164 numbers will not be enough and will be complemented by another numbering, naming and/or addressing scheme.

5.11 e-Accessibility

There are no specific requirements for persons with disabilities, older people, or anybody in specific environmental or social situations. However NGN brings many new services accessible through different means and terminals which they could benefit from.

e-Accessibility is one of the focuses of e-Inclusion and includes special measures for disabled users:

- User friendliness.

- Disabled and elderly people.

- There is nothing specific in the Speech to text.

6 Recommendations for future work

Based on results of the study, it is recommended that ECN&S in cooperation with TISPAN and other relevant groups closely monitor and when needed give guidelines to the ongoing standardization of NGN in order to ensure that the aims of technical regulatory requirements will be taken into account as follows.

6.1 Enhancement of provision of new services and freedom of choice for users

NGN is a platform for new narrow and broadband multimedia (including audio and video) services including services with different QoS requirements, customization of services, services offered by third parties and converged fixed/mobile services.

The transport (connectivity) layer of the NGN network is separated from the services that run on top of that transport. By separating transport and service layers, a provider can enable a new service by defining it directly at the service layer with limited considerations to the performance of the transport layer - that is, service and transport layers are highly independent.

The access network should be separated from the service control and core network. It means that the access provider (the provider that provides a customer with access to the NGN) may be different than the service provider that provides a customer with various services, such as voice and video communication, e-mail, or other services. cable, DSL, WLAN, WiMAX, fiber.

The nomadism and personal mobility is provided. The NGN home network and visited network will have to support the capability of providing services from the NGN home network to a user connected to the visited network. Services should be able to be reconfigured so as to be suitable for the target network and target device.

6.2 Quality of Service and Network performance

A customer should be able to compare pricing with respect to quality and to compare between services, based on the parameters and monitoring afterwards.

A special attention should be focused on the capabilities of the RACS and QoS signalling.

6.3 Privacy

Privacy protection e.g. protection of personal data (identification/location/presence) needs be properly standardized. Users should be provided with the capability to prevent the presentation of their identity and location information. Additionally, in emergency and in other cases, the withholding of presentation should be able to be overridden by public authorities.

Personal data require to be collected lawfully for specific and limited purposes only, and should be stored only for as long as necessary to fulfil the purpose. Data have to be accurate and adequate for the intended purposes, and individuals have a right of access to and correction of their personal data.

Privacy requirements should be taken into account in preparation of standards for Subscriber management.

Monitoring tools should be provided to ensure that billing, charging and accounting are accurate. Billing in NGN could be provided by each provider and by third-parties.

6.4 Security

NGN is able to guarantee secure communications and to block unwanted traffic or access to a terminal.

The identification, authentication, authorization of a user and other entities of the NGN are essential for security and any commercial real time and non-real time services. A special attention should be focused on the capabilities of the NASS and other functionality dealing with the identification.

NGN network integrity has to be ensured taking account of potential security threats (e.g. anti-spam) at every level of their network infrastructure.

6.5 Emergency Communication

Access to emergency services is important from the public interest point of view. It is desirable that access to emergency services is available from as wide a range of NGN services as possible. Furthermore it is necessary to provide trustable identification and location information to relevant authorities.

6.6 Numbering/addressing/naming and Identity management

Several forms of addresses should be possible to be used e.g. SIP URIs or E.164 numbers. E.164 numbers are needed to receive calls from traditional telephony networks.

Nomadism is an essential feature of user mobility having impacts on identification. A special attention should be focused on the Identity management.

6.7 e-Accessibility

The "design for all" principle should be followed in the standardization process and special measures for disabled and elderly users provided when so needed.

Annex A:
NGN IMS overview

Figure A.1 provides an overview of the functional entities that compose the NGN IMS, the reference points between them and with components outside the IMS.

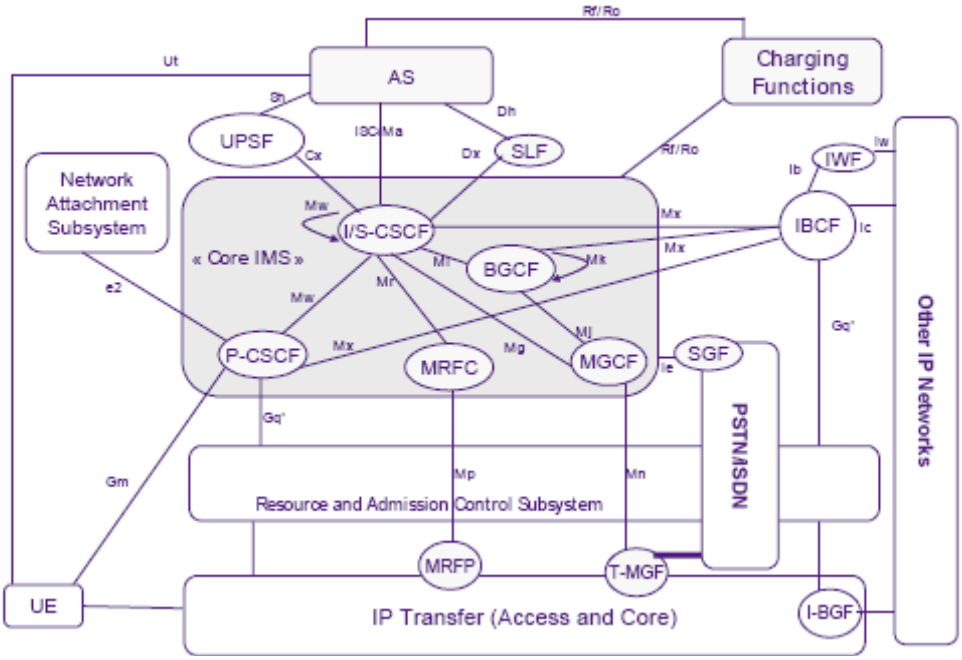


Figure A.1: NGN IMS overview

Based on the NGN fundamental aspects specified in clause 4.1. and regulatory requirements specified in clause 5, the following interfaces between the Core IMS and other sub-systems and functions may require an analysis from the regulatory point of view:

User Equipment - Core IMS

This interface is provided in the Gm reference point between UE and P-CSCF. The Gm reference point supports the communication between UE and the IMS, e.g. related to registration and session control. Among the functions provided by P-CSCF at the Gm interface as specified in TS 182 006 [i.27]: Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN);

IP Multimedia Subsystem (IMS); Stage 2 description (TS 123 228 [i.28]), the following may be of the regulatory interest:

- Emergency services: P-CSCF detects and handles an emergency session establishment request as per error handling procedures defined by stage-3.
- Security: If required for certain users, P-CSCF maintains a Security Association between itself and each UE, as defined in TS 133 203 [i.29].
- Numbering, naming and addressing: P-CSCF act as an Application Level Gateway (ALG) by changing the appropriate SIP/SDP parameters in order to translate addresses into same or different IP version addresses.
- End-to-end QoS: In TISPAN Release 1, the Application Function (AF) interacts with the transport subsystem to request transport-layer control services for QoS provisioning to services. The AF converts QoS information from the application layer to QoS information which is suitable for the RACS subsystem. This function is implemented in some functional entities from the service layer, such as the Application Server Function (ASF) and the P-CSCF of the Core IMS. At this interface, the AF is provided by the P-CSCF.

User Equipment - PSTN/ISDN Emulation subsystem

Interworking with legacy networks via open interfaces: Access to the services of the PSTN/ISDN Emulation subsystem is provided to legacy terminals through a gateway function, which may reside in customer premises or in the operator's domain.

User Equipment - Applications

Authentication/Identification/Authorization: Interactions with SIP Application Servers take place through the Ut interface. This interface enables the user to manage information related to his services, such as creation and assignment of Public Service Identities, management of authorization policies that are used e.g. by Presence service, conference policy management, etc. Support of interactions with other types of Application Server Functions is outside the scope of TISPAN NGN Release 1.

Two levels of network identification/authentication are available in the NGN architecture, namely at the level of the network attachment (between UE and NASS) and at the service layer level (NGN Service control subsystems and applications). At the NGN service layer, application level user authentication is applied. This type of authentication is performed between the UE and the NGN service subsystems / applications and has to be based on the user identity that is relevant at the level of these subsystems/applications. An example of this type of authentication is the user authentication performed by the IMS.

End-to-end QoS: In TISPAN Release 1, the Application Function (AF) interacts with the transport subsystem to request transport-layer control services for QoS provisioning to services. The AF converts QoS information from the application layer to QoS information which is suitable for the RACS subsystem. This function is implemented in some functional entities from the service layer, such as the ASF (Application Server Function) and the P-CSCF of the Core IMS. At this interface, the AF is provided by the ASF.

User Equipment - NASS

Authentication/Identification/Authorization: These interfaces enable the user equipment to attach to the network and receive configuration information. Signalling between the UE and the NASS may be relayed via the ARF in the transfer sub-layer. These interfaces are further defined in the NASS specification ES 282 004 [i.9]. The Network Attachment Subsystem (NASS) provides registration at access level and initialization of User Equipment (UE) for accessing to the TISPAN NGN services. The NASS provides network level identification and authentication, manages the IP address space of the Access Network and authenticates access sessions. The NASS also announces the contact point of the TISPAN NGN Service/Applications Subsystems to the UE. Network attachment through NASS is based on implicit or explicit user identity and authentication credentials stored in the NASS. The NASS controls the access to the access network.

Mobility: Mobility management functions provided by the NASS in the TISPAN NGN Release 1 are limited to the ability of a terminal to be moved to different access points and access networks (which may be owned by a different access network provider) and a user to utilize different terminal, access points and access networks to retrieve their TISPAN NGN services (even from another network operator). The TISPAN NGN Release 1 does not require the support of handover and session continuity between access networks without excluding autonomous mobility capabilities provided within the access networks.

User Equipment - RACS

This interface is outside the scope of TISPAN NGN Release 1.

Core IMS - Applications/Common elements

Decoupling of service provision from network, and provision of open interfaces: Three types of Application Server Functions (ASF) can be accessed by the IMS through the ISC or Ma reference point (see figure A.2). Further details are provided in TS 123 218 [i.34].

- SIP Application Servers (SIP AS);
- IM-SSF Application Server;
- the OSA SCS Application Server.

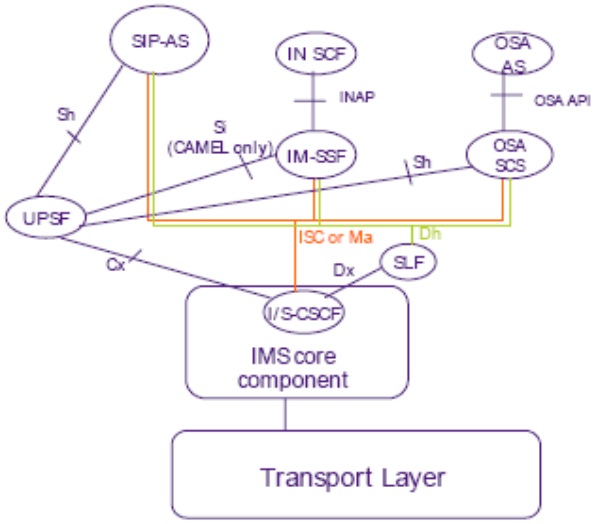


Figure A.2: Value Added Services architecture

The Service-CSCF (S-CSCF) to AS interface is used to forward SIP requests, based on filter criteria associated with the originating or end user.

The Interrogating-CSCF to (I-CSCF) AS interface is used to forward SIP requests destined to a Public Service Identity hosted by the AS directly to that AS.

It should be noted that ISC/Ma reference points also comply with the following NGN fundamental aspects:

Independence of service-related functions from underlying transport technologies.

Support for a wide range of services, applications and mechanisms.

Unrestricted access by users to different service providers.

Core IMS - Charging functions

Broadband capabilities with end-to-end QoS and transparency and Billing, charging and accounting: The following functional entities in the Core IMS may act as charging trigger points:

- AS;
- BGCF;
- (I-/P-/S-) CSCF;
- MGCF;
- MRFC.

For off-line charging the Rf interface is used. For on-line charging the Ro interface is used. Details are described in ES 282 010 [i.30].

It should be noted that the IBCF to which the Core IMS is connected may also act as a charging trigger point. For NGN Release 1, offline charging derived from the IMS and application servers has been specified only.

Core IMS - Resource and Admission Control Subsystem

Broadband capabilities with end-to-end QoS and transparency: The NGN IMS interacts with the Resource and Admission Control Subsystem (RACS) at the Gq' reference point for the following purposes:

- authorization of QoS resources;
- resource reservation;
- gate control (including NAPT binding information relay).

With regard to the RACS architecture; the P-CSCF plays the role of an Application Function (AF). Details are described in TS 182 006 [i.27]. This interface is not required when the user equipment is connected to a 3GPP IP-CAN. In such configurations, the P-CSCF interacts the 3GPP Policy Decision Function as described in TS 123 002 [i.10].

As mentioned in [i.10], in case of network interconnection, interactions with the resource control subsystem may also take place at the edge of the IMS, at the IBCF level for the following purposes:

- gate control (including NAPT binding information relay).

With regard to the RACS architecture; the IBCF plays the role of an Application Function (AF).

Details are described in TS 183 021 [i.32].

Endorsement of TS 129 162 [i.33] Interworking between IM CN Sub-system and IP networks.

Core IMS - other networks/domains

Interconnection between Core IMS and other networks/domains takes place at different levels.

Interconnection at the transfer level takes place either with TDM-based networks through T-MGF and SGF entities or with IP-based networks through an I-BGF entity (see figure A.1). Interconnection with SS7-based networks only applies to the IMS and PSTN/ISDN Emulation subsystems. In such cases, the service layer controls the T-MGF entity behaviour. Interconnection with IP-based networks depends on the subsystems involved. The I-BGF may behave autonomously or under the control of the service layer, through the RACS, for services that involves the IMS core component or the PSTN/ISDN Emulation subsystem. Future releases of the TISPAN specifications will address the control of the I-BGF in other configurations.

Interconnection at the NASS level is required for supporting nomadism and is further described in the NASS specification ES 282 004 [i.9].

Interconnection between RACS subsystems is outside the scope of TISPAN NGN Release 1.

Interconnection at the service layer can take place either with SS7-based networks or IP-based networks. Interconnection with SS7-based networks only applies to the IMS and PSTN/ISDN Emulation subsystems, both of which include appropriate functionality to interact with the T-MGF and the SGF. Interconnection with IP-based networks depends on the subsystems involved. IP-based interconnection to/from the IMS core component or the PSTN/ISDN Emulation subsystem is performed using the IBCF entity and possibly the IWF entity. Direct interconnection between other types of subsystems or applications is outside the scope of TISPAN R1. IP-based interconnection with external networks supporting a TISPAN-compatible version of SIP is performed at the Ic reference point, via the IBCF. Interconnection with external networks supporting H.323 or a non-compatible version of SIP is performed at the Iw reference point, via the IWF. The IBCF and the IWF communicate via the Ib reference point.

From the regulatory point of view, these interfaces may have an impact on:

- Interworking with legacy networks via open interfaces
- Broadband capabilities with end-to-end QoS and transparency.

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History

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