

User Group;
End-to-end QoS management at the Network Interfaces;
Part 1: User's E2E QoS -
Analysis of the NGN interfaces (user case)

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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Foreword

This Technical Report (TR) has been produced by ETSI User Group (USER).

The present document is part 1 of a multi-part deliverable covering the End-to-end QoS management at the Network Interfaces, as identified below:

Part 1: "User's E2E QoS - Analysis of the NGN interfaces (user case)";

Part 2: "Control and management planes solution - QoS continuity";

Part 3: "QoS informational structure".

Introduction

In all parts of this multi-part deliverable, the Quality of Service (QoS) should be seen from the end-user standpoint. This means that the QoS assessment should be performed with regards to the users' requirements. Telecommunication world evolves and is now **user centric** in opposition to system centric (behaviours are constrained by the system) and network centric (behaviours are constrained by the network).

User-centric requirements are expressed through user-related information, such as QoS parameters and end-user's preferences. The QoS commitments of the related providers should match that of the end-user's requirements and can be defined in his contract as unilateral commitments or with a Service Level Agreement negotiated with the customer (generally corporate end-user).

As networks are evolving towards NGN (Next Generation Network), the network environment is becoming more and more complex. Heterogeneity and mobility are two specific characteristics in NGN that take into account end-user terminals, access networks, core networks and services. Mobility allows end-users to communicate regardless of location, device used, access mode or network across multiple spatial domains.

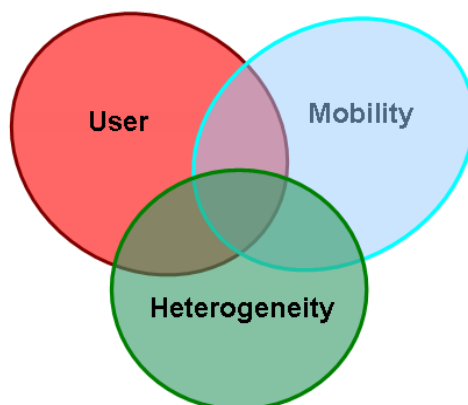


Figure 1: NGN context

The end-user wishes to choose any terminal or any access as a mean to use any service in a heterogeneous environment. Meanwhile, the end-user expects to have a continuous comprehensive service throughout the whole session while moving (terminal mobility) or changing terminal (user mobility). During this session, service connectivity is considered as a composition of elements in each layer (User, Terminal, Network and Service).

The solution today is located at the intersection of the three domains defined in [i.9]: User-centric, mobility and heterogeneity as shown in figure 1. As networks become more and more complex and new services emerge continuously, the requirement for an end-to-end (E2E) QoS for the end-user is growing.

Taking all the above into consideration, the goal is now to identify at which point end-users could and should enter their choices and preferences, etc. in the future network. These interactions have been taken into consideration in the user case. That is why in clause 4, all the scenarios representing and concerning the NGN context are identified as well as the QoS aspects from the end-user's viewpoint with a particular attention to the sensitivity to QoS criteria of the services used. In clause 5, the components, which play a key role in the interactions with the end-users, are delineated and identified. The functional procedures of the scenarios are described in order to define the interworking unit such as AF, RACS, PCRF, and GGSN. The transfer of the QoS information between networks, included in signalling or managing messages, is analyzed in clause 6. In clause 7, the conclusion introduces in TR 102 805-2 [i.3].

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1 Scope

The present document provides an analysis of the NGN interfaces by using a user case designed to show how the QoS could be handled in the NGN context to ensure end-to-end QoS from the end-user's viewpoint.

2 References

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

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2.1 Normative references

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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] ITU-T Recommendation G.1010 (11/2001): "End-user multimedia QoS categories".
- [i.2] ITU-T Recommendation Y.1541 (02/2006): "Network performance objectives for IP-based services".
- [i.3] ETSI TR 102 805-2 (V1.1.1): "User Group; End-to-end QoS management at the Network Interfaces; Part 2: Control and management planes solution - QoS continuity".
- [i.4] ETSI EG 202 009-1: "User Group; Quality of Telecom Services; Part 1: Methodology for identification of parameters relevant to the Users".
- [i.5] ETSI TS 102 464 (V1.1.1): "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM); Interworking with DiffServ QoS".
- [i.6] ETSI TS 123 107 (2009-01): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Quality of Service (QoS) concept and architecture (3GPP TS 23.107 version 8.0.0 Release 8)".

- [i.7] ETSI TS 129 207 (2005-09): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Policy control over Go interface (3GPP TS 29.207 version 6.5.0 Release 6)".
- [i.8] ETSI TS 101 329-2 (V2.1.3): "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON systems; Part 2: Definition of speech Quality of Service (QoS) classes".
- [i.9] ETSI STF 360 report (January 2009): "Analysis of current E2E QoS standardization state".
- [i.10] IETF RFC 1633: "Integrated Services in the Internet Architecture: an Overview".
- [i.11] IETF RFC 2474: "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".
- [i.12] IETF RFC 2475: "Architecture for Differentiated Services".
- [i.13] ITU Study Group 19 - Contribution 25 (2007): "Considerations of horizontal handover and vertical handover".
- [i.14] 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.15] ETSI ES 283 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) Stage 3 [3GPP TS 24.229 [Release 7], modified]".
- [i.16] IETF RFC 854: "Telnet Protocol Specification".
- [i.17] ETSI TR 102 805-3: "User Group; End-to-end QoS management at the Network Interfaces; Part 3: QoS informational structure".

3 Definitions and abbreviations

3.1 Definitions

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

AmbientGrid: information inference (AmbientGrid) based on the profiles' matching, to structure with grid covering the needed end-user centric environment

class of service: way of traffic management in the network by grouping similar types of traffic and treating them as its own level of service priority

DiffServ networks: classify packets into one of a small number of aggregated flows or 'classes', based on the DiffServ codepoint (DSCP) in the packet's IP header

NOTE: This is known as behaviour aggregate (BA) classification (RFC 2475 [i.12]). At each DiffServ router, packets are subjected to a 'per-hop behaviour' (PHB), which is invoked by the DSCP (RFC 2474 [i.11]).

equipment: any material with its related OS, through its CPU and memory, which contributes to the end-to-end QoS

horizontal handover: handover within homogeneous access networks

NOTE 1: Generally it is referred to as the Intra-AN handover.

NOTE 2: ITU Study Group 19 - Contribution 25: Considerations of horizontal handover and vertical handover, 2007 [i.13].

infosphere: decisional knowledge base managing, in the real time, all the personalization and ambient environment information

IntServ (integrated services architecture): set of extensions to the traditional best effort model of the Internet with the goal of allowing end-to-end QoS to be provided to applications

NOTE 1: One of the key components of the architecture is a set of service; the current set of services consists of the controlled load and guaranteed services. The architecture assumes that some explicit setup mechanism is used to convey information to routers so that they can provide requested services to flows that require them. While RSVP is the most widely known example of such a setup mechanism, the IntServ architecture is designed to accommodate other mechanisms.

NOTE 2: See RFC 1633 [i.10].

multi-homing: end-user's services can be provided by more than one service or network provider

network mobility: network's ability, where a set of fixed or mobile nodes are networked to each other, to change, as a unit, its point of attachment to the corresponding network upon the network's movement itself

Per-Hop Behaviour (PHB): externally observable forwarding treatment applied at a differentiated services-compliant node to a behaviour aggregate

NOTE: See TS 102 464 [i.5].

policy control: adaptation and configuration of QoS according to particular goals dependent of user, network operator and service provider

QoS Classification: definition of class priority for QoS by describing traffic condition or performance parameters

QoS handover: ensures QoS state establishes when vertical/horizontal handover occurs

QoS Interworking: ensures the transfer of all different types of packet data with different QoS parameters in heterogeneous environment whenever the ANs and CNs are of different releases and types by mapping the QoS attributes

service mobility: ability to consistently provide services to the end-user, to maintain the expected QoS, at the system's initiative, regardless of the end-user's location, terminals, or networks.

NOTE: To maintain the service continuity, the session mobility is used.

session mobility: ability to keep the continuity of a service regardless the mobility of the terminal, of the access network, of the core network or of any service components as well as the Service Provider

terminal mobility: end-user uses his equipment to move across the same or different networks while having access to the same set of subscribed services

user mobility: ability for a subscriber to move to different physical locations and be able to use one or more devices connected to one or more access networks to gain access to their services without interruption

user-centric session: period of communication between one end-user and another or other end-users or servers characterized by a starting time and a termination time, including setting up the relation of the end-user equipment, access network, core network and services invoked during this period

userware: innovative user centric middleware (Userware) enhancing the seamless feasibility along with the location and activity, personalization and end-user's ambient contexts

vertical handover: handover across heterogeneous access networks. Generally, it is referred to as the Inter-AN handover

NOTE: ITU Study Group 19 - Contribution 25: Considerations of horizontal handover and vertical handover, 2007 [i.13].

3.2 Abbreviations

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

3GPP	The 3rd Generation Partnership Project
AA	Authentication & Authorization

AAA	Authentication, Authorization, and Accounting
AAR	AA-Request
ABG	Access Border Gateway
ACK	Acknowledgement
AF	Application Function
AMF	Access Management Function
AN	Access Network
A-RACF	Access Resource and Admission Control Function
AS	Application Server
CAC	Connection Admission Control
CCA	Credit Control Answer
C-BGF	Core Border Gateway Function
CLF	Connectivity session and repository Location Function
CNG	Customer Network Gateway
CODEC	COder / DECode
CPE	Customer Premises Equipment
CSCF	Call Session Control Function
DHCP	Dynamic Host Configuration Protocol
DSCP	Differentiated Service Code Point
DiffServ	Differentiated services (IETF)
E2E QoS	End-to-End QoS
ETSI	European Telecommunications Standards Institute
FIFO	First In First Out (queue)
GGSN	Gateway GPRS Service Node
GPRS	General Packet Radio Service
GTP	GPRS Tunnelling Protocol
GW	Gateway
HSS	Home Subscriber Server
I-BGF	Interconnection Border Gateway Function
I/CBG	Interconnection/Core Border Gateway
IETF	Internet Engineering Task Force
IMEI	International Mobile Equipment Identifier
IMEISV	IMEI Software Version
IMPI	IP Multimedia Private Identity
IMPU	IP Multimedia Public identity
IMS	IP based Multimedia Subsystem
INTRADIFF	INTRANET-DIFFSERV (an INRIA project)
IntServ	Integrated Services (IETF)
IP-CAN	IP Connectivity Access Network
IPDV	IP packet Delay Variation
IPER	IP packet Error Ratio
IPLR	IP packet Loss Ratio
IPRR	IP Packet Reordering Ratio
IPTD	IP packet Transfer Delay
ITU-T	International Telecommunication Union - Telecommunication standardization sector
IWU	InterWorking Unit
MS	GSM Mobile Station
NACF	Network Access Configuration Function
NASS	Network Attachment Subsystem
NAT	Network Address Translation
NGN	Next Generation Network
PC	Personal Computer
PCEF	Policy Enforcement Point
PCRF	Policy and Charging Rule Function
P-CSCF	Proxy CSCF
PDA	Personal Digital Assistant
PDP	Pack Data Protocol
PHB	Per Hop Behaviour
PPP	Point of Presence Protocol
QoS	Quality of Service
RACS	Resource and Admission Control Subsystem
RCEF	Resource Control Enforcement Function

RSVP	Resource ReserVation Protocol
SAA	Server Assignment Answer
SAR	Server Assignment Request
SD	Service Data
SDL	Session Description Language
SDP	Session Description Protocol
SGSN	Serving GPRS Support Node
SIP	Session Initiation Protocol
SP	Service Provider
SPDF	Service Policy Decision Function
TCP	Transmission Control Protocol
TISPAN	Telecommunications and Internet converged Services and Protocols for Advanced Networking
UAAF	User Access Authorization Function
UE	User Equipment
UMTS	Universal Mobile Telecommunications Systems
UPSF	User Profile Server Function

4 User QoS requirements information

In this clause, based on a user case (clause 4.1) highlighting the specificities of the NGN context, the QoS information (clause 4.2) which are relevant to the end-user will be identified.

4.1 User case description

The user case described below is that of an end-user which needs to stay connected both at home and while going and getting at work. This user case clearly highlights the specificities of the NGN context. It shows how the end-user goes from end-user mobility to terminal mobility changing services on heterogeneous networks. Such scenarios details are described below figure 2.

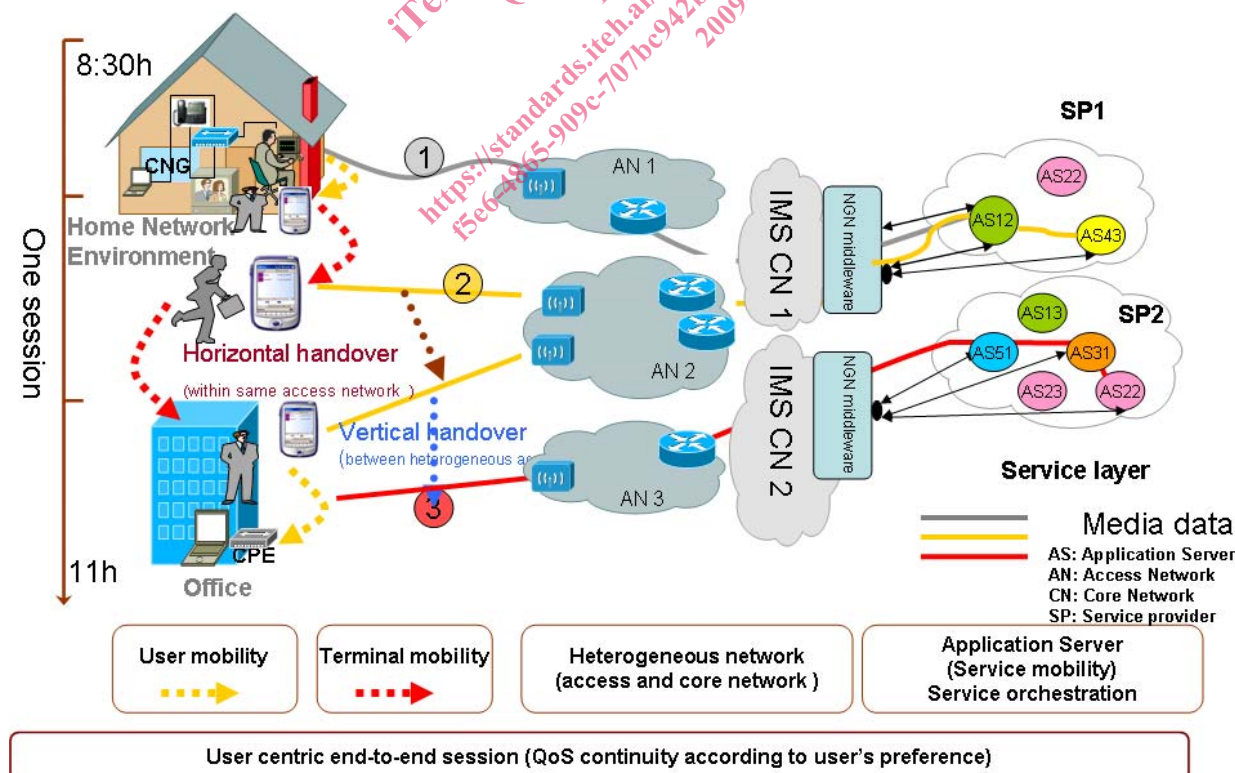


Figure 2: User case

The Services used by the end-user in the user case are:

- AS12: Video Conference.
- AS31: Telephony Service.
- AS51: Web Services.
- AS22: Video Broadcast Service.
- AS43: Text to Voice Service.

Description of the user case:

While still at home the end-user Tom starts his PC (QoS1) at 8h30 in the morning and engages in a Video Conference service AS12 (Service 1 for a QoS2) provided by the service provider SP1. Tom uses his home network environment and accesses to the service through an Access Network AN1, which is a mobile GPRS access.

Before leaving his home, Tom switches terminals (User Mobility), leaving his PC for his PDA (QoS2), keeping both the same home network environment and Access Network AN1. Tom can still access his services through the same opened session, while keeping his predefined preferences.

On his way to work (Terminal Mobility), Tom starts another Video Conference service AS12 provided by the same Service Provider SP1 than before, but using another Access Network AN2 (Vertical Handover).

At this point, Tom, as a pedestrian, prefers to receive his message in vocal mode rather than in text mode, by accessing the Text to Voice AS43 (Service 4 for a QoS3) provided by the same Service Provider SP1 through the same Access Network AN2.

When arriving at work, Tom's PDA is still attached to the same Access Network AN2 but has changed his Access Point (Horizontal Handover). Tom decides to end both his Video Conference and listening to his messages.

At work, Tom changes his terminal for another one (User Mobility), switching from his PDA to his laptop.

The laptop is connected to another Access Network AN3 than the one previously used for the PDA, through which Tom is now able to access different services provided by another Service Provider SP2 (Service mobility): web service AS51 (Service 5 for a QoS1), Telephony Service AS31 (Service 3 for a QoS1) and Video broadcast Service AS22 (Service 2 for a QoS2).

- At 11AM, Tom closes the session, which he opened at home at 8h30AM.