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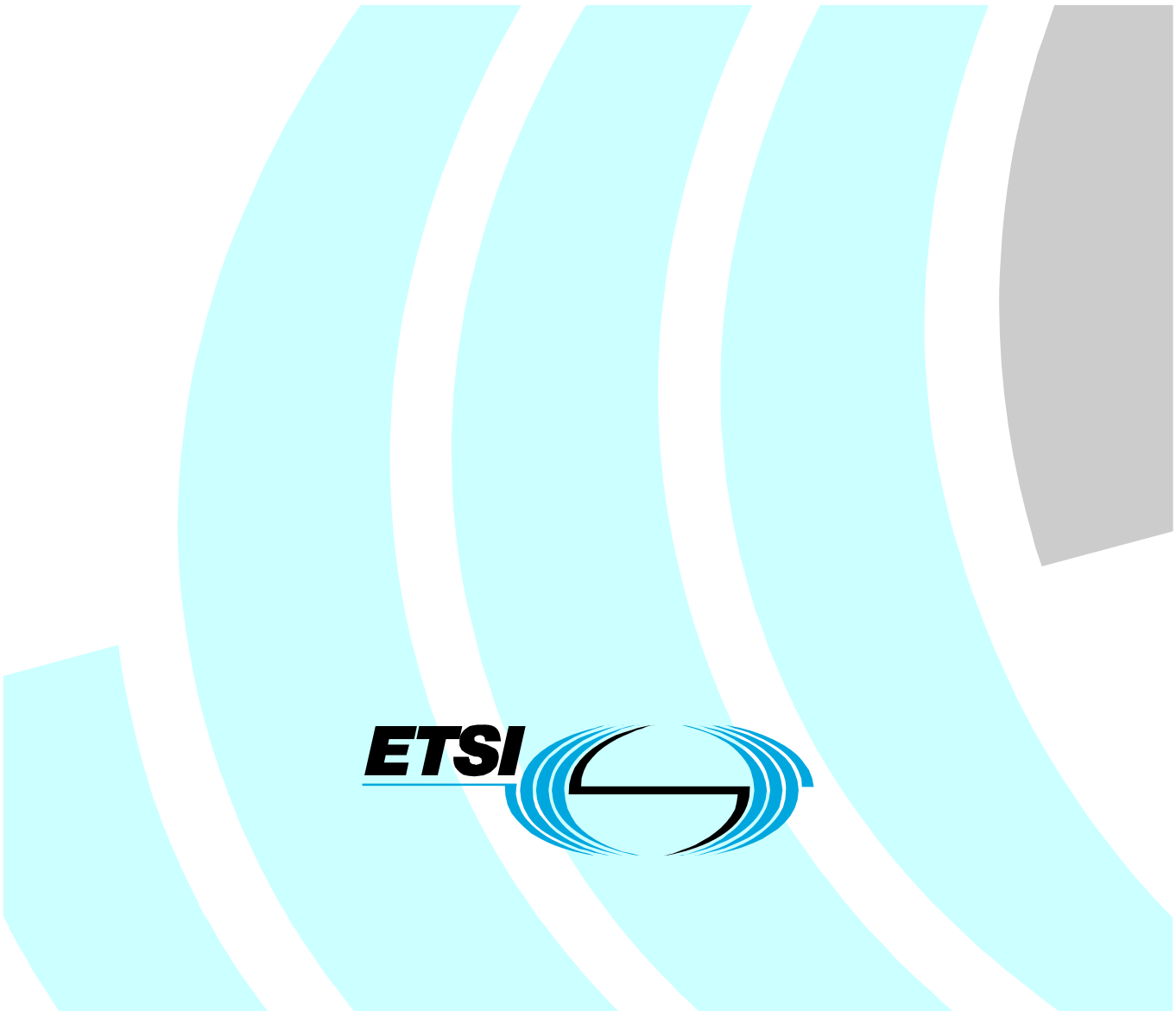
Technical Report

User Group;
End-to-end QoS management at the Network Interfaces;
Part 3: QoS informational structure



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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
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

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

The present document is part 3 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

The network and service QoS management is a multidimensional problem. In the methodology described in parts 1 [i.1] and 2 [i.2], five dimensions were identified through the analysis carried out: the **information dimension** which represents the entire system by the structured data; the **organizational dimension** which defines the management/control relationship between different entities; the **functional dimension** which defines a set of functions related to management/control activities, the **architectural dimension** which describes the structure of management entities and their related interfaces for information exchange, and **the protocol dimension** which defines the means for transmitting the management information. Among these five dimensions, the information dimension is the basic building block for the other dimensions of the End-to-End (E2E) QoS management and control. This structure of the information dimension provides a generic information image of the components in the user's system and a description of any ambient resource applied to any architecture and system technology for the QoS management. The present document focuses on the QoS informational structure.

1 Scope

The present document provides a description of QoS criteria related to the different visibility levels (Equipment, Network, Service) and related profiles involved in each step of the service lifecycle. A set of user preferences and an information structure are defined in the user-centric profile for personalisation purposes.

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - 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.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

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] ETSI TR 102 805-1: "User Group; End-to-end QoS management at the Network Interfaces; Part 1: User's E2E QoS - Analysis of the NGN interfaces (user case)".

[i.2] Noëmie Simoni, Simon Znaty (1997): "Gestion de réseau et de service: similitude des concepts, spécificité des solutions".

[i.3] ETSI ES 202 746: "Human Factors (HF); Personalization and User Profile Management; User Profile Preferences and Information".

[i.4] IETF RFC 1633: "Integrated Services in the Internet Architecture: an Overview".

[i.5] IETF RFC 2474: "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".

[i.6] IETF RFC 2475: "Architecture for Differentiated Services".

[i.7] ETSI TR 102 805-2: "User Group; End-to-end QoS management at the Network Interfaces; Part 2: Control and management planes solution - QoS continuity".

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 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: 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.6]). At each DiffServ router, packets are subjected to a 'per-hop behaviour' (PHB), which is invoked by the DSCP (RFC 2474 [i.5]).

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

infoware: knowledge base that covers the different visibility levels and acts by inference

IntServ: the integrated services architecture RFC 1633 [i.4] defined a 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: 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.

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

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.

terminal mobility: use of a mobile device while moving across the same or different networks and 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 user's ambient contexts

3.2 Abbreviations

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

BA	Behaviour Aggregate
CPU	Central Processing Unit
DiffServ	Differentiated services (IETF)
DSCP	Differentiated Services CodePoint
E2E	End-to-End
ETSI	European Telecommunications Standards Institute

GGSN	Gateway GPRS Service Node
HSS	Home Subscriber Server
IETF	Internet Engineering Task Force
IntServ	Integrated Services (IETF)
LM	Local Machine
MIPS	Millions of Instructions Per Second
MMS	Multimedia Messaging Service
NGN	Next Generation Network
NLN	Node-Link-Network
QoS	Quality of Service
RS	Remote Server
SGSN	Serving GPRS Support Node
SLA	Service Level Agreement
SMS	Short Message Service
UMTS	Universal Mobile Telecommunications Systems
VPCN	Virtual Private Connectivity Network
VPEN	Virtual Private Equipment Network
VPSN	Virtual Private Service Network

4 QoS and profiles

In this clause, the instantiations of each visibility level (Equipment, Network and Service) are described according to the QoS criteria defined in [i.1] (clause 4.1). The different QoS information involved in each step of the service's lifecycle (Figure 1) are then presented: resource profile with QoS capability which is involved in the E2E conception phase (clause 4.2), resource usage profile which is involved in the deployment phase (clause 4.3) and finally the QoS values which are involved in the exploitation phase (clause 4.4).

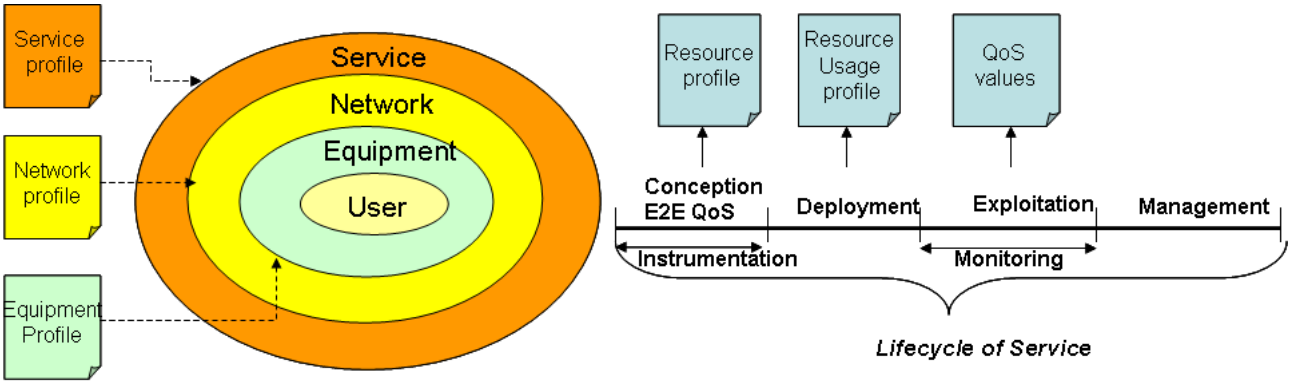

Figure 1: QoS and profiles

4.1 QoS criteria related to visibility levels

The QoS of the four actors (Equipment, Network, Service and User) participating in the E2E session determines the overall E2E session's QoS (Figure 2). Each actor has responsibilities in the achieved QoS [i.2].

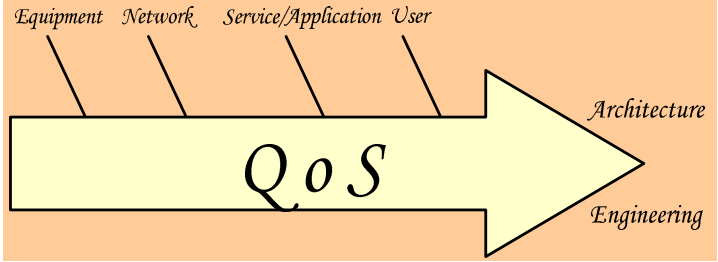

Figure 2: End-to-end QoS

In order to monitor the component behaviour in a heterogeneous environment, it is necessary that a homogeneous expression of its QoS be available to evaluate the E2E behaviour during the whole session.

Therefore, a unified QoS model (four criteria: ***availability, delay, fidelity*** and ***capability***) is applied to all components. These criteria can be applied to any QoS classification (Diffserv, Interserv, etc) and can also be measured easily according to specific parameters:

- Availability represents the aptitude of a service, network or equipment element to be accessed at a certain moment. The availability depends on the demands and the contractual conditions of the environment and time. It indicates the accessibility rate of the nodes and the logical links which have also been defined in the Meta model.
- Fidelity represents the aptitude of a service, network or equipment element to work without deteriorating the treated information with respect to the demands and the contractual conditions. It indicates the involuntary modification rate of the information concerning the nodes and the links during their treatment.
- Delay represents the aptitude of a service, network or equipment element to comply with the specific times requested in the demands and the contractual conditions. It indicates the treatment's duration of the nodes and the mean delay of the link transit.
- Capability represents the aptitude of a service, network or equipment element, which should have the necessary means to realize its task according to the demands and the contractual conditions. It indicates the maximum charge of the nodes and the usable bandwidth of the links.

The instantiations of the QoS model at each level are shown in the tables below. They demonstrate the feasibility of the measurement to evaluate the QoS in the performance assessment.

For the equipment visibility level, QoS parameters depend on the characteristics of hardware hosting the different software. Table 1 shows the instantiation of the QoS criteria at equipment visibility level.

Table 1: Instantiation of the QoS criteria at equipment level

QoS Criteria	Equipment		
	Node	Link	Network
Availability	Memory size	Linking (i.e. cable, fibre) availability	Availability resulting of the VPEN
Fidelity	Error rate in server/router/device	Error rate in link	Error rate of the VPEN
Delay	Handling time in server/router/device. Service time provided by the equipment depending on battery life	Propagation delay time	E2E delay time
Capability	MIPS of CPU	Standard bandwidth of link depending on technology	Standard bits per second
MIPS: Millions of instructions per second.			

For the network visibility level, the QoS parameters depend on the functional and procedural means for the data units' transit in the network link. Table 2 shows the instantiation of the QoS criteria at the network visibility level.

Table 2: Instantiation of the QoS criteria at network level

QoS Criteria	Network		
	Node	Link	Network
Availability	Accessibility rate of protocol process	Rejection rate	Accessibility rate of the VPCN
Fidelity	Packet error rate Duplication of packet	Packet error rate during routing	Error rate of the VPCN
Delay	Handling and information transit time of protocol machine	Delay for establishing the network connection + transit time	E2E transit time in network
Capability	Number of packet handled per second	Routed packet number handled per second	Delivered packet number handled per second

For the service visibility level, the QoS parameters depend on the functional and procedural means for establishing the service process through the associated link. Table 3 shows the instantiation of the QoS criteria at the service visibility level.

Table 3: Instantiation of the QoS criteria at service level

QoS Criteria	Service		
	Node	Link	Network
Availability	Accessibility rate of the Service Element (SE)	Association rupture rate	Accessibility rate of the VPSN
Fidelity	Error rate of the Service Element.	Error rate of message	Error rate of the VPSN
Delay	Handling and information transit time in the Service Element	Delay for establishing the association between the Service Elements	E2E Response time
Capability	Number of messages treated per second	Number of messages exchanged per second	Number of messages delivered per second

4.2 Resources profiles

Resource profiles are involved in the phase of the E2E conception. They are the basic profiles representing all the resources in a structured and uniform format. They contain the characteristics and definition of the resources at the visibility level of the service, network and terminal with the QoS capability. Resource profile is independent of any execution environment (anyway, in an optimization context) and is published by the resource provider.

The Equipment profile, Network profile and Service profile are instantiated from the resource profile. In the phase of E2E conception, in the service's lifecycle, each profile indicates the maximum QoS capabilities at its own level that a resource can provide with respect to the four criteria. For example, in Figure 3, a service profile is instantiated from the resource profile where the QoS capabilities are detailed according to the four QoS criteria.

```
<?xml version="1.0" encoding="UTF-8" ?>
- <ServiceProfile>
    <version>1.0.0.0</version>
  - <Identity>
      <ServiceName>VoD-SFR</ServiceName>
      <ServiceType>streaming</ServiceType>
    </Identity>
  - <QoSCapabilities>
      <Availability>0.998888</Availability>
      <Fidelity>0.998888</Fidelity>
      <Delay>3000ms</Delay>
      <Capability> 0.5M </Capability>
    </QoSCapabilities>
  </ServiceProfile>
```

Figure 3: Service resource profile

4.3 Resource usage profiles

Resource usage profiles are involved in the service deployment phase. Resource usage profiles (of equipment, network and service) provide a uniform and well structured format for each component's possibilities and constraints. Moreover, the QoS contract (Demanded QoS and Offered QoS with specific values) is integrated in each component (Figure 4), that allows selecting the components in a user centric context; i.e. the selected components will respond to the request and adapt the selection according to the user's context.

Meanwhile, the Resource Usage Profile is related to the execution environment of a resource. A component should be supported by the appropriate Demanded QoS from the lower level in order to offer an expected QoS to the upper layer (Figure 4). Demanded QoS will be compared with the Offered QoS in order to have a service provided with the right QoS. Therefore, the QoS cross-layer chaining will be transparent to the user.

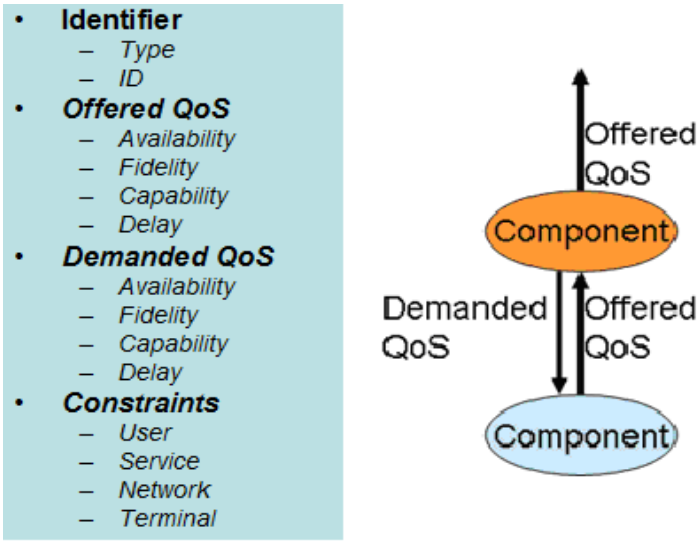

Figure 4: Resource usage profile structure

A Usage profile contains the following information:

Identifier: this field defines the resource type and allows identifying each resource without any addressing restriction by using a unique identifier.
Offered QoS: this field indicates the expected QoS of the described component resource.
Demanded QoS: this field represents the QoS needed in order to allow the described resource to work correctly.
Constraints: this field determines the restrictions of each level.

An example of service usage profile (end-to-end QoS vision) is shown in Figure 5.

```
<?xml version="1.0" encoding="UTF-8" ?>
- <ServiceUsageProfile>
    <version>1.0.0.0</version>
  - <Identity>
      <ServiceName>VoD-SFR</ServiceName>
      <ServiceType>streaming</ServiceType>
    </Identity>
  - <OfferedQoS>
      <Availability>0.998888</Availability>
      <Fidelity>0.998888</Fidelity>
      <Delay>3600ms</Delay>
    - <Capability>
        <UserMax>300</UserMax>
      </Capability>
    </OfferedQoS>
  - <DemandedQoS>
      <Availability>0.998888</Availability>
      <Fidelity>0.998888</Fidelity>
      <Delay>3000ms</Delay>
      <Capability>0.5M</Capability>
    </DemandedQoS>
- <Constraints>
  - <User>
      <Group>AnyBody</Group>
      <Langage>English</Langage>
      <AccessCost>"0.20/m"</AccessCost>
    </User>
  - <Service>
      <State />
      <Preference />
    </Service>
  - <Network>
      <ProtocolRelated>IPV6</ProtocolRelated>
      <ConnectionExtern>TRUE</ConnectionExtern>
    </Network>
  - <Equipement>
      <Processor>2.5GHz</Processor>
      <Memory>2Go</Memory>
      <Application>MediaPlayer</Application>
    </Equipement>
  </Constraints>
</ServiceUsageProfile>
```

Figure 5: Service usage profile

4.4 QoS values

The QoS criteria characterize the behaviour of the treatment in a resource node, of the link and of the overall service supported by the resource elements. Applying the proposed QoS model, three types of value are involved in the phase of exploitation under each of the four criteria**: conception value**, **current value** and **threshold value**.

The **conception value** is decided at the phase of service conception. It defines the maximum possibilities of the node's treatments and the link's interactions.

The **current value** is calculated during provisioning and exploitation to reflect the service's behaviour in real time.

The **minimum threshold value** and **maximum threshold value** define the range within which the node normally operates. An alert is provided when the current value is beyond the alert values thresholds.

5 User-centric profile

A user profile is used for personalization. A user-centric profile is an information model representing the end-user in the NGN context that denotes under which conditions (QoS, activities, role) and in which location a global service is available to the user according to his/her preferences. In this clause, the requirements of the user-centric profile including its relationship with the other profiles (clause 5.1) are presented first, and then the information structure of the user-centric profile is detailed (clause 5.2).

5.1 Requirements of user-centric profile and relationship

5.1.1 Requirements of user-centric profile:

- It represents the end-user in the NGN context (location, agenda and role).
- It can identify the end-user preferences.
- It contains all the subscribed services and owned components with associated SLA when possible.
- It interacts with the real-time profile.
- It can be associated with several subscription (Trans-organizational).

It is possible for a user to create, delete and modify his/her profile during the exploitation phase.

5.1.2 Relationship

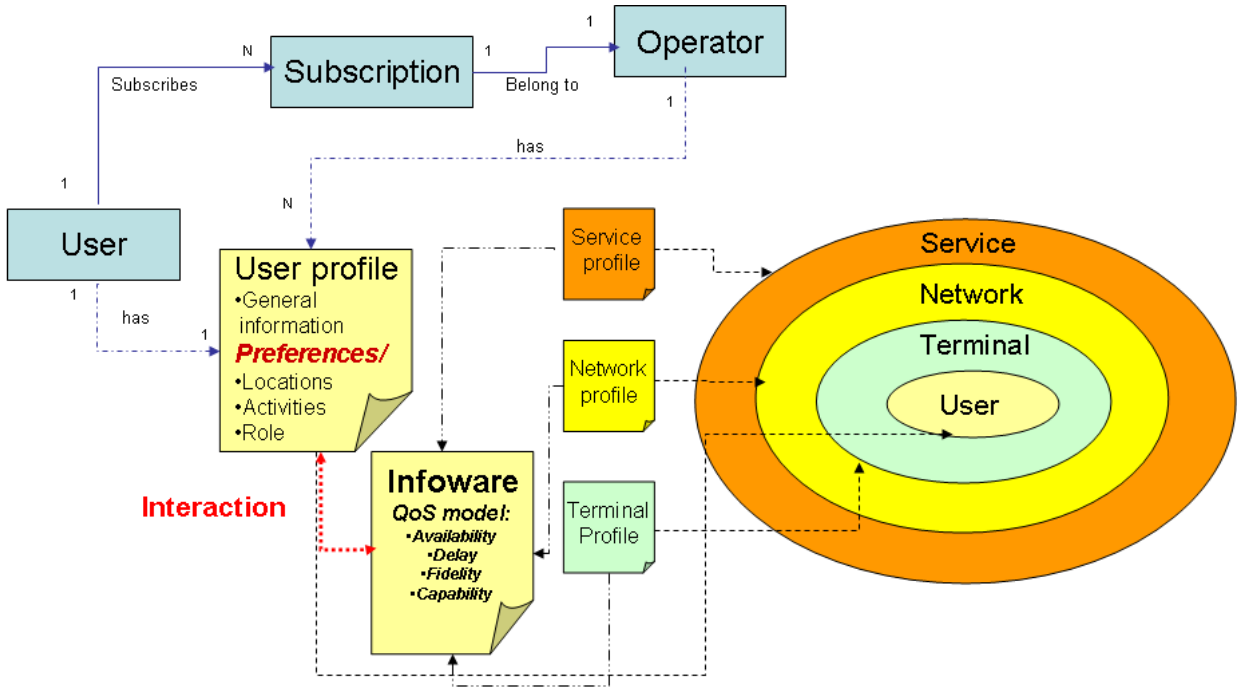

Figure 6: Relationship with other profiles and actors

A user can subscribe to different service providers. The user is represented by his user profile. This profile should provide appropriate representation of user preferences and QoS requirements (SLA).
Three sets of specific information describing the user's preferences are identified which depend on the user location (space/time), agenda (activity) and role (parents/children, employer/employee). Moreover, any change made by the user in the user profile will be taken into consideration in the provider Infoware (HSS) during the exploitation phase (Figure 6).

5.2 Information structure in User-centric profile

The user profile provides a common interface through which users can specify their preferences regarding terminals, networks and services. For each particular place, agenda and role, the user personalization (preferences) [i.3] can be translated as a priority of which terminals, networks and services a particular user wishes to use. Different locations, diverse activities, various roles represent the NGN context. The structure of the user profile is divided into four sub-parts: Personal information, Location, Agenda and Role.

5.2.1 Personal information sub-profile

The personal information sub-profile includes all the data directly associated to a user (Figure 7). An identifier associated with a password is used to authenticate the user and initialize his profile. This category includes other personal information, i.e. name, surname information, occupation, etc.

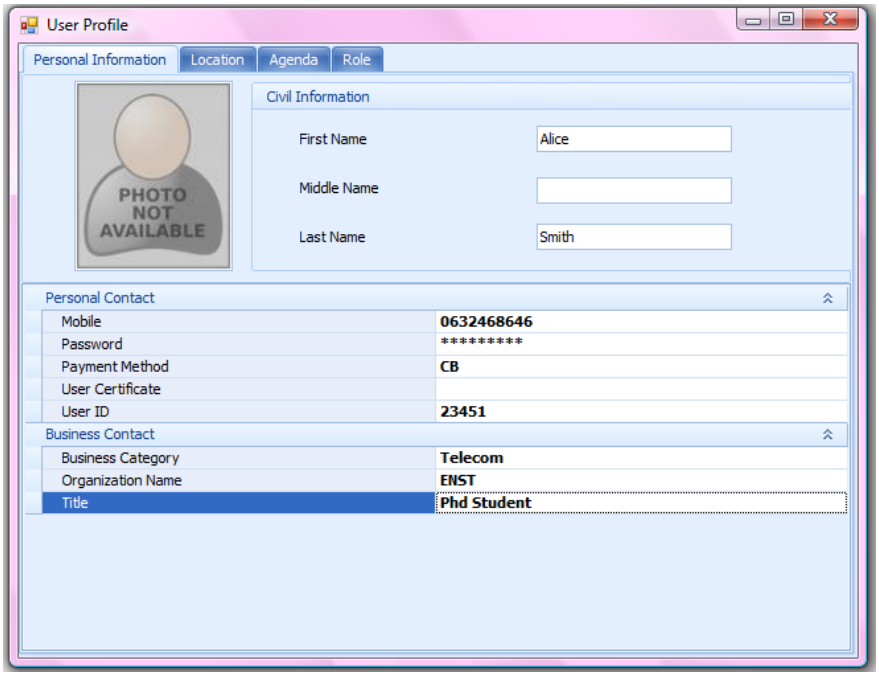

Figure 7: Personal information

5.2.2 Location sub-profile(s)

The location sub-profile(s) contains each user's registered location. The locations that a user visits frequently can be instantiated, for example home and office (Figure 8). The information for each location is exploited in order to initialize the environment of the user. The user can define preferences related to the choice of equipment (PCs, mobile phones, PDAs), network (Wifi, UMTS, cable, etc.) and service (Subtitle language, Browser, etc.) associated to a specific place.

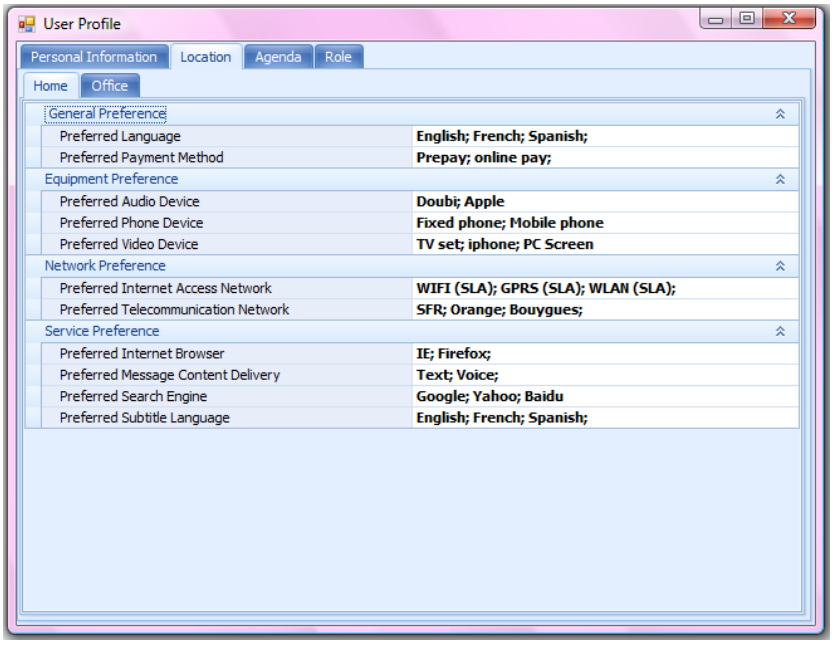

Figure 8: Location sub profile

5.2.3 Agenda sub-profile(s)

The agenda sub-profile(s) describes each activity according to the user's schedule (Figure 9). It contains the possible ambient resources (including the community's resources) according to a specific activity.

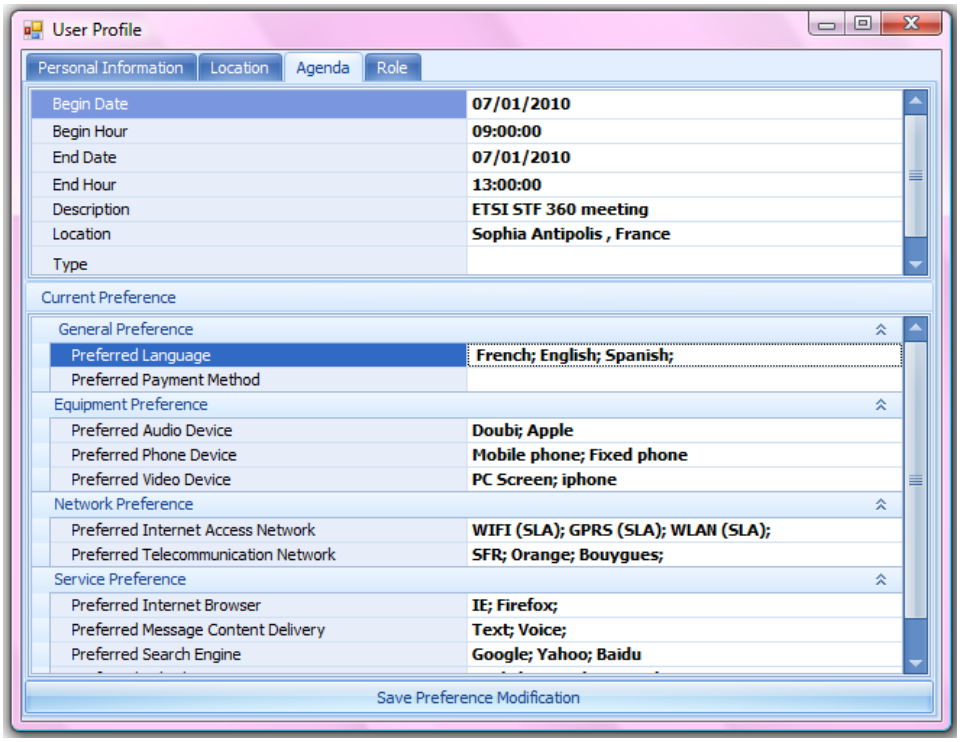

Figure 9: Agenda sub profile

5.2.4 Role sub-profile(s)

The role sub-profile(s) depicts each role played by a user. User plays different roles in different situation, for example at home, a user could be the parent of different children while, in his office, a user could be the employer of different employees. Thus, for his different roles, a user may have different responsibilities and different preferences.

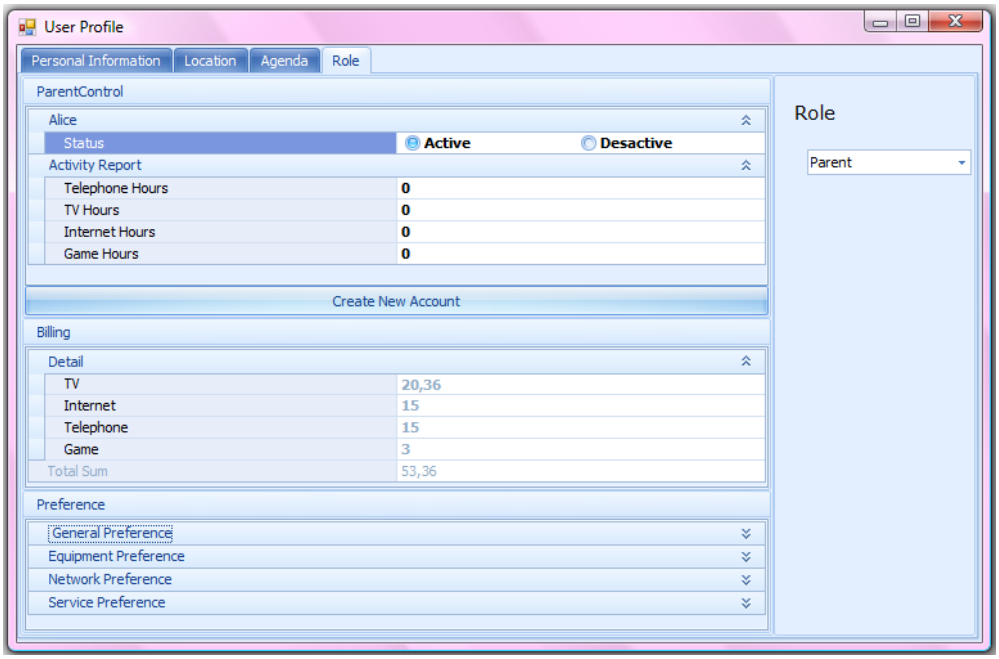

Figure 10: Role sub profile

6 Conclusion

The proposal described in the present document is to include the QoS user requirements in the user profile and to link it to the session. Hence the user QoS requirements are conveyed across the terminals/networks/service elements of the various providers involved during the use of the service.

These QoS requirements are based on the criteria defined in of TR 102 805-1 [i.1] (clause 4.1) and have an impact on networks as well as on every service element.

The user profile includes four sub-profiles (Personal information, Location, Agenda and Role) and is expected to interact with the QoS model including his preferences.

The implementation of such a proposal should lead to an increased user satisfaction as his QoS requirements are expected to be fulfilled and if this is not possible, a warning will be provided to the user so that he can seek for alternative solutions.

From the provider's perspective, this proposal should help managing the QoS of the various service components possibly provided by different providers so that the overall QoS is kept compliant to the main provider commitments.

Annex A:
QoS of Service delivery (Following Annex A of TR 102 805-1 V1.1.1: Media delivery)

In Annex A of TR 102 805-1 [i.1], Table A.2 defines the key criteria to ensure a proper management of the media delivery at the network level.

In this context, a service consists of several components (VPSN at the service layer), each of them having often different QoS requirements and treatment. For the end-to-end QoS, besides the QoS in each network segment, it is also essential to clearly identify the treatment by each end-actor (including the different kinds they belong to: server to person, person to person, one server, server to server) in the chain and to evaluate its impact precisely.

The QoS of the service delivered is impacted by both end-actors: User's terminal (LM: Local Machine) and Server (RS: Remote Server). The proposed segmentation of the services with the identification of the actors involved in each service is summarized in Table A.1. End-Actor 1 and End-Actor 2 are respectively the actors at each end of the service. Intermediate systems represent the media delivery at the network level according to the QoS classification presented in Table A.2 of TR 102 805-1 [i.1].

Table A.1: Segmentation of services

Service	Medium	End-Actor 1	Intermediate System	End-Actor 2
Fax	Data	LM	To	LM
Newsgroups (Usenet)	Data	LM	To	LM
Electronic mail SMTP to POP server transfer	Data	LM	To	LM
Audio Broadcast	Audio	Requester (via LM) to RS	To	Request (via LM)
Video Broadcast	Video	Requester (via LM) to RS	To	Request (via LM)
MMS (Multimedia Message Service)	Video	Person (Via LM)	LM to RS to LM	LM to Person
SMS (Short Message Service)	Data	Person to LM	LM to RS to LM	LM to Person
Voice messaging (Recording)	Audio	Person (via Microphone	To	RS
Voice messaging (Playback)	Audio	RS	To	Person
High priority transaction services e.g. e-Commerce, ATM	Data	Person (Via LM)	LM to RS to LM	Person (Via LM)
Electronic mail SMTP/POP server access	Data	Requester to LM	LM to RS to LM	Person (Via LM)
Web Browsing	Data	Requester to LM	LM to RS	RS to Requester (Via LM)
Telephony (Conversional voice)	Audio	Person (Via LM)	To	Person (Via LM)
Video TeleConferencing service (VTC):	Video	Person (Via LM)	To	Person (Via LM)
Telnet (remote access)	Data	Requester (Via LM)	LM to RS to LM	Requester (Via LM)
IPTV	Video	Person (Via LM)	LM to RS to LM	LM to Person
Interactive game	Data	Player (Via LM)	LM to RS	RS to Player (Via LM)
NOTE: Intermediate: unidirectional and bidirectional networks with units and equipment interoperability. RS: Remote Server. LM: Local Machine.				

The Multimedia Messaging Service (MMS) is a standardized messaging service that allows for the sending, reception and presentation of multimedia content. The MMS service is taken as an example to outline the treatment in sender/receiver terminals and in the service platform.

The diagram below (Figure A.1) shows the procedure of a MMS transmission and reception between two users within a particular test platform:

- The sender's end sends the Multimedia Message to the MMS platform through the transport network (send time: 39,2 s).
- The MMS server treats the message and sends a SMS (Short Message Service) notification to the receiver; the receiver analyzes the notification and initiates the launch of a PDP context (SMS notification sent time + treatment time in terminal and MMS server: 26 s).
- The MMS platform sends the MMS to the receiver (send time: 30,5 s).

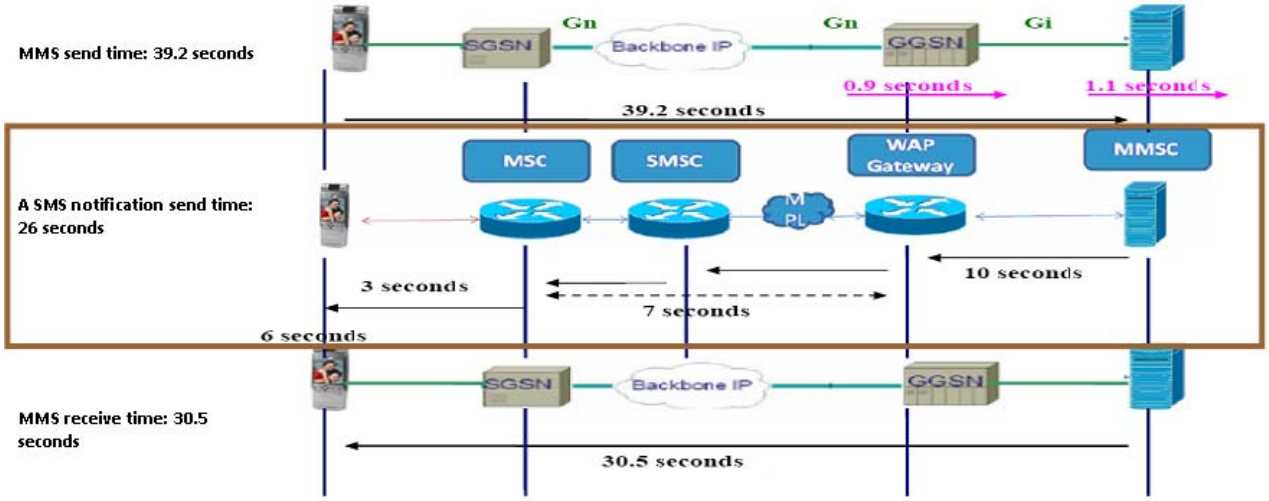

Figure A.1: Procedure of MMS Service delivery and delay in each step

In this procedure, a SMS notification is sent from the MMS platform to the terminal before sending the MMS to the receiver. For an end-to-end service flow measurement, the treatment and performance at both ends (User's terminal and Server) will be taken into account. Therefore, the characterization of the nodes and links
(NLN model: Node-Link-Network) should be measured as shown below:

- **End-to-end flow** should be measured in both directions: User's terminal to Server and Server to User Terminal.
- **Network flow** (Link in the NLN model) should be measured at each interface of the transport network: Gi, Gn, Gb shown in Figure A.1.
- **Equipment performance** (Node in the NLN model): SGSN, GGSN, terminal, Server should be measured on the service platform.

Annex B: Bibliography

- ETSI TR 102 806: "User Group; Analysis of current End-to-End QoS standardization state".
- IETF RFC 854: "Telnet Protocol Specification".

History

Document history		
V1.1.1	April 2010	Publication