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Part 2: Control and management planes solution - QoS continuity

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Foreword

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

The present document is part 2 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.1].

1 Scope

The present document provides a study of exchange feasibility of the user-related QoS information aiming at E2E QoS continuity.

2 References

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[i.1] ETSI TR 102 805-1 (V1.1.1): "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] IETF RFC 3588: "Diameter Base Protocol".

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

capable QoS: level of QoS that the provider is able to provide

demanded QoS: assertion of the quality level requested by the user

desirable QoS: level of QoS required by user for his service

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

offered QoS: assertion of QoS level that the provider proposes to provide

perceived QoS: level of quality experienced by the user

provided QoS: level of quality that the provider has agreed to make available to the user

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

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

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:

3GPP	The 3rd Generation Partnership Project
AF	Application Function
AS	Application Server
AVP	Attribute-Value-Pairs
A-RACF	Access Resource and Admission Control Function
BGS	Border Gateway Services
CCR	Credit-Control Request
CPU	Central Processing Unit
DIAMETER	AAA protocol

NOTE: See RFC 3588 [i.2].

DIFFSERV	Differentiated services (IETF)
E2E	End-to-End
ETSI	European Telecommunications Standards Institute
GPRS	General Package Radio Service
HSS	Home Subscriber Server
IETF	Internet Engineering Task Force
IMS	IP based Multimedia Subsystem
INTSERV	Integrated Services (IETF)
IP-CAN	IP Connectivity Access Network
IPTV	Internet Protocol TeleVision
MBB	Make Before Break
MCF	Media Control Function
MDF	Media Delivery Function
NA(P)T	Network Address (and Port) Translation
NA(P)T-PT	Network Address Translation - Protocol Translation
NGN	Next Generation Network
NSIS	Next Steps In Signalling
NSLP	NSIS Signalling Layer Protocols
PAN	Personal area network
P-CSCF	Proxy CSCF
PCRF	Policy and Charging Rules Function

PDP	Packet Data Protocol
QoS	Quality of Service
QSPEC	QoS Specification
RACF	Resource and Admission Control Function
RACS	Resource and Admission Control Subsystem
RCEF	Resource Control Enforcement Function
S-CSCF	Server - Call Session Control Function
SDF	Service Discovery Function
SDF	Service Data Flow
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SPDF	Service Policy Decision Function
SSF	Service Selection Function
UE	User Equipment
UMTS	Universal Mobile Telecommunications Systems
UPSF	User Profile Server Function
VPSN	Virtual Personal Service Network
VSC	Virtual Service Community

4 User interaction: existing limitation and user oriented dynamic management

Nowadays, end users desire to access their services, without interruptions and in a continuous way. Moreover, it has to be taken into account dynamic adaptation of services and management of user-centric session according to user preferences and different types of mobility. In this clause, an analysis is carried out on insufficiencies of existing works that are mainly of informational order. In fact, a complete information is needed at the moment of subscription (clause 4.1). The signalling would be more efficient if it has the dynamic information (clause 4.2). And the management would be more flexible if the information IS coherent between the cross layers (clause 4.3). Finally, a user-centric oriented dynamic management (clause 4.4) is defined.

4.1 Information and subscription

User Profile Server Function (UPSF) defined in ETSI and HSS defined in 3GPP store subscribed user's profile information related to one or more service control subsystems and applications. But they do not contain complete profile information such as connectivity subscriptions and PAN (Personal area network) information. In order to offer services adapted to user preferences, the pertinent resource information and user's preference information are needed with the visibility of terminal device, network and service to choose the adequate component (terminal, network, service) to use in a user-centric session. Through interaction with such user system, the pertinent user's data can be reached and maintained.

4.2 Information and signalling

The QoS NSLP proposed by NSIS work group in IETF provides flexibility on patterns of signalling messages that are exchanged. Various QoS models can be used in the network, but these do not affect the specification of the QoS NSLP protocol. The QSPEC carries a collection of objects that can describe QoS specifications in a number of different ways, namely QoS Desired, QoS Available, QoS Reserved and Minimum QoS. A generic template contains object formats for the QoS description, which is designed to ensure interoperability when using the basic set of objects. NSIS has been focused on developing a protocol to manipulate QoS states of network resource along the data path in the network. Nevertheless their work on QoS description does not cover service layer with which user interacts more directly.

To circulate QoS information in a session, SIP has been designed in conformance with the Internet model in the control plane. As far as QoS is concerned, SIP uses SDP to describe the media in the session and negotiate QoS requested. Moreover, SIP can filter information according to the User Profile to implement application servers before establishment of a session. However, is it able to describe the behaviour of service component and communicate the QoS state information between the components in order to re-provisioning services during an active session in a mobility environment according to the user's preferences.

A *dynamic* management of resource information and user's preference information is needed to adapt component (terminal, network, service) during a user-centric session.

For the service continuity in an E2E session, the signalling should support broadening personalisation coverage with QoS through composition of service in service levels.

4.3 Information and management

In the management plane, protocol Diameter is used to carry the information of authorization, policy control and charging etc. The QoS related information can also be mapped to Diameter AVP.

Indeed, if the user wants always to have the dynamic selection of connection and accessibility by any of its identifiers, to have the most appropriate service components in the session with different terminals and different bearers according to different of SLAs, a mechanism is needed to ensure a coherent management of the user information including user's preference between each level (cross-layer). This mechanism could collaborate with E2E signalling.

4.4 User centric approach: dynamic management (convergence of control and management planes)

Generally, the lifecycle of QoS management consists of QoS conception, resource provisioning before the service delivery, transfer of the service data, and management. QoS conception consists of analysis of the system's QoS need and QoS context in order to make available the QoS-related structured information with its access interface. QoS provisioning performed before service delivery covers QoS negotiation which is responsible for issuing an agreement between the components to support the QoS involved in the service, admission control which is used to compare the required resource for the component with the available resource in the system, and resource reservation which arranges for the allocation of resources in response to the user requirements and the agreed QoS levels. When provisioning is achieved, management related functions begin with service delivery in a static way. They analyse the tracked QoS achieved actually and compare it to the initial requirements or agreements.

QoS management aims at satisfying user QoS expectation on the basis of a set of functions. Thus it is important to determine at what time should QoS management be considered and what actions to be performed in the different stages of the service lifetime. To allow user-centric oriented service to be carried out properly, QoS and user's expectation has to be considered for each component not only before but also during the service delivery. That includes the E2E QoS instrumentation in the service design phase and the E2E QoS management in the service operational phase. Furthermore, the management information should be taken into account in the process of re-negotiation.

To achieve the E2E QoS, the provisioning (control plane) and management (management plane) are integrated into the process of transfer the service data (User plane), as shown in Figure 1. During the real-time provisioning, the information management is taken into account during the phase of transfer. This is called dynamic management. Once the service is initiated and during its lifetime, dynamic QoS management is performed in order to ensure that the agreed levels of QoS will be maintained. When QoS degradation is signalled and there is no mean to adjust local resource, a re-negotiation process may be initiated. Dynamic QoS management should be done at every network interface (Home network, Access network, Core network and Service network). Meanwhile, in the phase conception, the instrumentation will be done on all the actors in the session chain, which are user's device, access network, core network, and service components.

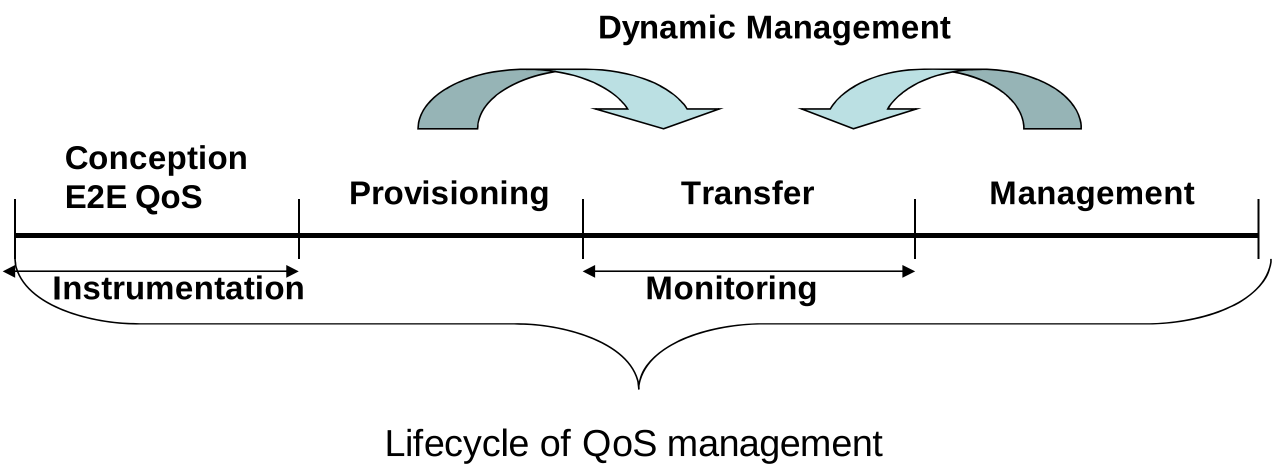

Figure 1: Dynamic management

Different solutions could be considered to achieve the E2E QoS dynamic management: a signalling based solution (such as SIP/SDP, NSIS/QSPEC) or a management based solution (such as DIAMETER or Policy Control) can be considered, but for a dynamic management as shown in the Figure 1, the convergence of these two solutions should be studied.

5 User-centric oriented QoS signalling

In order to fulfil the needs of QoS E2E negotiation in the user-centric session, a more flexible signalling in higher level to support delivery and negotiation of QoS and user's information between the service components for subscribers across any mobile or fixed network with any user's equipments is appreciated. Based on the VPSN architecture and a dynamic management concept, a "dynamic E2E QoS signalling" in the service level is described which covers the end-to-end session in order to achieve the provisioning for the services demanded and to conform to the SLA. This E2E QoS signalling is able to circulate the description of media as well as the capacity of service component. Moreover, it sends the monitoring QoS state (In/out contract) in the signalling control message during the phase of exploitation. In this clause, firstly the E2E QoS support (VPSN) is presented (clause 5.1), then the E2E QoS provisioning is detailed (clause 5.2). Finally the dynamic QoS signalling during the exploitation with state chart is analyzed (clause 5.3).

5.1 E2E QoS support: VPSN

An E2E user centric session is built by four levels of elements (terminal, access network, core network and service). In the service layer, the service component conception is applied, even the user's terminal running the applet can be considered as a kind of service component in the chain. These service components compose a Virtual Private Service Network (VPSN) to provide a personalized global service. This network is virtual because of the nature of the applicative resources and service components that are sharable as well as the provided abstraction feature. This network is private because it is the logic of linking the service components for the service requested by a particular customer having specific QoS needs. The aim of the VPSN is to satisfy the end-to-end contracted QoS. It means that, the VPSN nodes as well as the VPSN links should be aware of the QoS that they have to provide (local contracts) and the QoS that is currently being provided (current behaviour).

Meantime, the service components which have equivalent function and equivalent QoS compose the virtual communities of services (VSC). The VSC aims to dynamically fulfil QoS commitments by providing an alternative service component to replace the failed component when any QoS change occurs within the VPSN.

From the user's view, service can be accessed, changed and released directly by the end user; all the elements in access/core and service network should be transparent to the end user. The service network should involve all the visibilities of sub-network nodes under its coverage. As a result of such integration of service network and transport network, as the Figure 2 shows, when the service component changes to adapt to the user's demand or the mobility, the sub-networks can establish a corresponding path for this logic link between the service components. Therefore, QoS signalling applied in service layer with the users can be considered as E2E QoS provisioning. The services personalization depends on the user nomadic information like user localisation or the request moment in the QoS signalling.

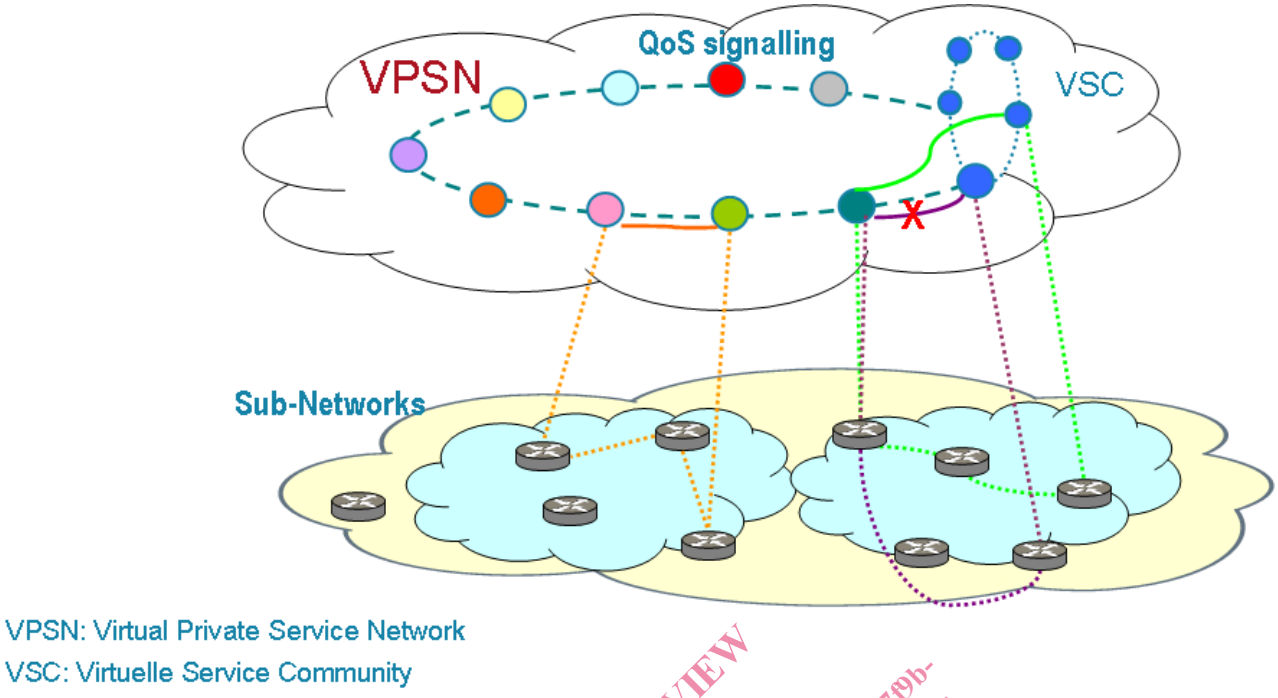

Figure 2: End-to-end QoS

5.2 E2E QoS Provisioning

In each node of VPSN/VSC, is a QoS agent which stores a contracted QoS according to the SLA. The model of expression was refined to distinguish the different values in different views as the Figure 3 shows.

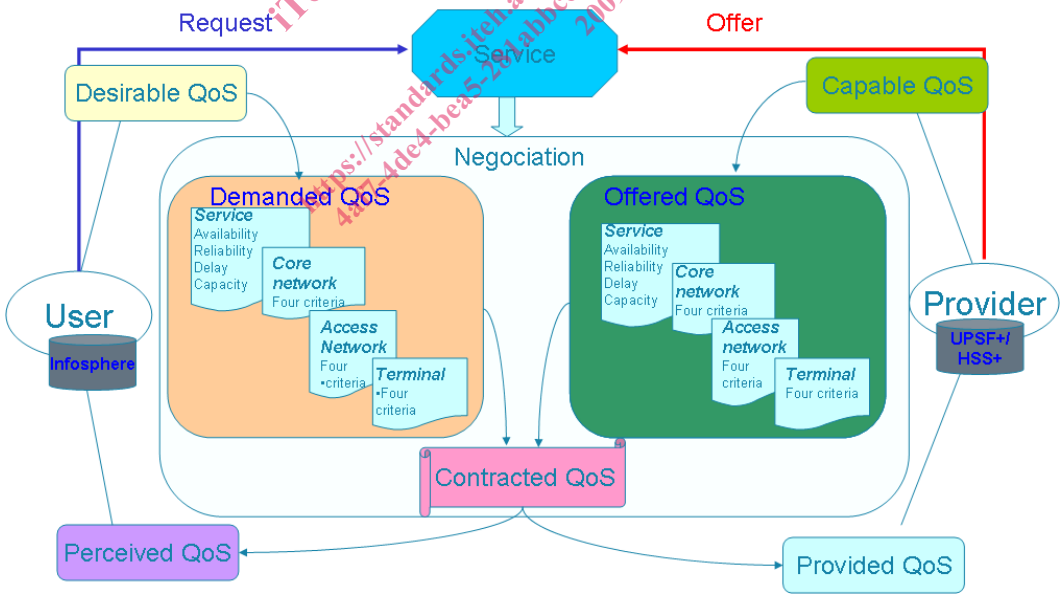

Figure 3: Model of expression for QoS

The Capable QoS is the level of QoS that the provider is able to provide. The Desirable QoS is the level of QoS required by user for his service. The Offered QoS is an assertion of QoS level that the provider proposes to provide. The Demanded QoS is an assertion of the quality level requested by the user. The Provided QoS is the level of quality that the provider has agreed to make available to the user. The Perceived QoS is the level of quality experienced by the user.