QoS Management for Multimedia Services in Future Internet: Reconfiguring User Sessions in Response to Session and Terminal Mobility

- extended abstract -

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***Abstract*—This work presents a Quality of Service (QoS) management approach for future Internet, which maintains and adapts QoS for multimedia services by means of session reconfiguration. The key components of the approach enfold around *mobility events* impacting QoS, which steer the reconfiguration, and basic procedures, called *reconfiguration primitives*, which are applied in response. Functional network architecture of the solution is depicted, along with an illustration of applying the solution in a future Internet.**

***Keywords*-Future Internet; multimedia services; Quality of Service management; mobility events; session reconfiguration**

I. Introduction

A future Internet is envisaged to provide *generalized mobility* [1], including two different aspects: *terminal mobility* and *session mobility*. Terminal mobility allows a user terminal to change its network attachment point, even between various access technologies (*vertical handoff*), while continuing established communication. Session mobility, on the other hand, enables communication continuity when changing terminals. In such a network, which offers diverse access options and a common IP transport, Quality of Service (QoS) management is an important issue [1] [2]. QoS provision is being tackled at the application, transport and network layers, with a special emphasis on coordination among them [3] [4]. Another relevant aspect of QoS support is adaptation to changing conditions induced by mobility [3].

This work presents a solution that supplements the recent research and introduces an application-layer approach that maintains and adapts QoS for multimedia services. Utilization of the application layer provides independence of a particular access technology or service scenario, and flexibility to make application-dependent decisions and to perform management operations selectively. The proposed approach relies on reconfiguring user sessions due to changes (called *events*) induced by session and terminal mobility, and on interacting with network resource control to reserve required resources. The key components of the solution enfold around: (1) mobility events impacting QoS, which steer the reconfiguration, and (2) basic procedures, called *reconfiguration primitives*, which are applied in response.

The remainder of the paper is organized as follows. In Section 2, we define mobility events and the reconfiguration primitives. Section 3 depicts functional network architecture of the solution, while Section 4 illustrates application of the solution in a future Internet. We summarize the proposed approach in Section 5.

II. Mobility events and session reconfiguration primitives

A *multimedia session* is an exchange of media flows within an association of participants and is created to establish a media service. A *media flow* is a stream of media data (e.g., audio or video), to which chosen format and encoding are associated, along with a QoS specification in terms of required network bandwidth, delay, jitter, and packet loss. A *session participant* refers to a user terminal in the session, or a server, which acts as a media source. The following mobility events are targeted by the reconfiguration:

(a) *Change in terminal* - denotes a change of the terminal due to *session mobility*;

(b) *Change in location* - represents a change in terminal's location (i.e. IP address) due to *terminal mobility*; and

(c) *Change in access network* - indicates a change of terminal's access network when *vertical handoff* occurs.

Session reconfiguration defines three primitives: (1) *start media flow*, (2) *stop media flow*, and (3) *modify media flow*. Starting a flow assumes agreement on QoS specification between the participants and reservation of network resources, while stopping it releases the resources. Modifying a flow alters its format/encoding or other media parameters. This modification may entail adjusting the resource reservation.

III. Functional network architecture

Functional network architecture of the solution (Figure 1) comprises generic entities of a control plane that handle session signaling and reservation of the data plane resources. *User Terminal Entity* (UTE) represents a *session participant* used for accessing multimedia services. The two most important functions that UTE encompasses are *Session control function* (SCF) and *Event analysis function* (EAF). EAF is responsible for processing *User inputs* and generating notifications of *Change in terminal*. When EAF forms a notification, SCF is invoked to convey it to *Session Configuration Management-Support Entity* (SCM-SE), which

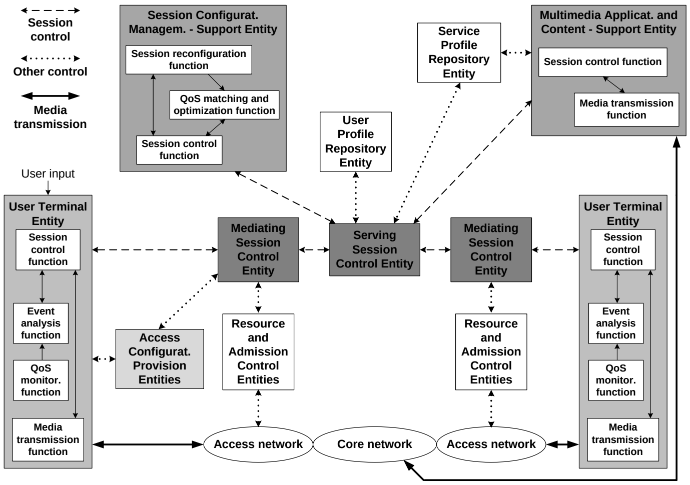

Figure 1. Functional network architecture for the QoS management

is responsible for deciding upon session reconfiguration. SCF also starts signaling needed for establishing multimedia sessions and agreeing upon the QoS specifications.

Mediating Session Control Entity (MSCE) represents the connection point for each UTE that wants to establish the sessions. It forwards session control messages between UTEs and the chosen *Serving Session Control Entity* (SSCE), as well as invokes the reservation of access network resources by interacting with *Resource and Admission Control Entities*. SSCE is the central point of the signaling path, which forwards the control messages between session participants. It is responsible for including SCM-SE in the signaling, thus invoking functions that SCM-SE provides.

SCM-SE is the key component, which integrates the QoS matching and optimization function (QMOF) and session reconfiguration function (SRF). QMOF was modeled by a group of authors in [5] - it produces QoS specifications based on capabilities of the terminals in a session, characteristics of used access networks and availability of their resources, as well as requirements and constraints of the requested multimedia services. A notification conveyed to SCM-SE is delivered to SRF, which analyzes the change and decides upon the reconfiguration primitive. *Multimedia Application and Content-Support Entity* (MAC-SE) also represents a *session participant*, i.e. a server which executes multimedia applications and hosts content that is delivered to the users.

Access Configuration Provision Entities provide information about access network a UTE is attached to, including a unique identifier of the network, and about location of the UTE, thus producing notifications for events (b) and (c).

IV. A USE CASE SCENARIO

A session involving audio and video flows is established between a UTE (UTE1) and a MAC-SE, when a user decides to transfer the flows from UTE1 to another UTE, UTE2, in order to get "greater" screen resolution and "better" sound quality. A *Change in terminal* notification is then sent by UTE1 to SCM-SE, specifying UTE2 as the targeted terminal. SCM-SE invokes SRF to decide upon the reconfiguration primitive, which, in this case, includes both *start media flow* and *stop media flow*. The *start media flow* primitive serves to establish audio/video exchange between UTE2 and MAC-SE, while *stop media flow* terminates the exchange between UTE1 and MAC-SE. This way, communication continuity is preserved. First, SRF executes QMOF to produce a QoS specification that considers capabilities of UTE2, and subsequently the corresponding MSCE is invoked to initiate reservation of network resources for UTE2, thus enabling QoS-guaranteed media delivery. Afterwards, UTE2 informs SRF of the transfer, which applies the second primitive and has UTE1 terminate its media exchange with the MAC-SE.

V. SUMMARY

This paper presents a QoS management approach for multimedia services by means of session reconfiguration. It introduces a set of generically defined changes (*events*) induced by mobility and the corresponding application-layer notifications, which invoke and steer the management. Utilization of the application layer provides independence of a particular access technology or service scenario. The approach also establishes basic reconfiguration procedures and new, or extensions to the existing, functional network entities for maintaining and adapting QoS, which supplements prevailing research focus on the lower layers.

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VITAE

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