Chapter 23

Third Party Multimedia Streaming Control with Guaranteed Quality of Service in Evolved Packet System

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ABSTRACT

This paper studies implementation issues of Parlay X "Multimedia Streaming Control" and "Application-driven Quality of Service" web services in the Evolved Packet System (EPS). EPS is defined as evolution of mobile communication networks with broadband radio interface and Internet Protocol (IP) based core. The main signalling protocols in EPS used for multimedia session management and quality of service control are respectively Session Initiation Protocol (SIP) and Diameter. The functional architecture for third party multimedia streaming control with guaranteed quality of service considers deployment of an application server which exposes web service interfaces toward applications and control protocols toward the network. In a role of mediation functionality, this application server is responsible for the translation between web services interface operations and control protocol messages. In addition, it needs to maintain synchronized state models that reflect both third party application view and protocol view. An approach to automated functional verification of such type of application server providing "Multimedia Streaming Control" and "Application-driven Quality of Service" web service interfaces is suggested. Use cases that illustrate the approach applicability are described.

1. INTRODUCTION

The Evolved Packet System (EPS) is defined as a 3rd Generation Partnership Project (3GPP) standard which features ubiquitous access to multimedia services from any device. The main prerequisite is Internet Protocol (IP) connectivity that may be achieved through any access network both fixed and mobile, narrowband and broadband. EPS is aimed to provide full integration of voice and data services with the requisite quality of service (QoS), which increases productivity and overall effectiveness (Ekstron, 2009). The development of innovative applications is stimulated by open-

ing the network interfaces for third party, which allows third party providers from an IT domain to create applications that use network connections, streaming, messaging and multimedia (Lam, 2012; Petry, 2009).

The increasing requirements to multimedia streaming applications provided on IP based infrastructure impose challenging requirements to signalling protocols in the network. The traditional approach relies on Real Time Streaming Protocol (RTSP) (Shibeshi, 2010; Marungwana, 2009; Khan, 2007), while more advanced solutions study the usage of Session Initiation Protocol (SIP) for multimedia session management (Zheng, 2012; Pleshkova, 2010; Gabin, 2010). From the content provider point of view, the deployment scenario for multimedia streaming applications needs to provide means for control on the streaming content e.g. to start media stream, to control media stream, to receive notification about media stream status etc. Such type of control may be provided by Parlay X "Multimedia Streaming Control" web service (3GPP TS 29.199-19, 2009).

EPS allows both service and subscriber differentiation based on efficient QoS solution ensuring that user experience of each service is acceptable. This solution applies a mechanism for authorization and usage control of bearer resources intended for multimedia traffic and it is called Policy and Charging Control (PCC) (Balbas, 2009; Quellette, 2011). PCC is based on Diameter protocol signaling. Third party application may request a session with required QoS. For example, the open access to QoS management allows provisioning of multimedia content with quarantined QoS (Tugara, 2006). The "Application-driven Quality of Service" (ADQ) is a Parlay X web service that allows applications to dynamically control the QoS available on user connection(s) (3GPP TS 29.199-17, 2009). Configurable service attributes are upstream rate, downstream rate and other QoS properties specified by the service provider and may be applied temporary for defined period of time, or by default.

Opening the network interfaces for third party application control through web services requires deployment of a special type of application server called Parlay X gateway. The Parlay X gateway provides web service interfaces toward third party applications and specific control protocols facing the network. Some publications concerning gateway implementation focus on aspects related to web services interfaces (Walker, 2009; Yang, 2008), while other authors discuss evaluation of conformance of the session control mechanisms in the network out of the application context (Chlamtac, 2008; Menday, 2006).

This paper studies the implementation issues related to deployment of "Multimedia streaming control" and "Application-driven quality of service" web services in EPS. An approach to formal verification of functional behaviour of Parlay X gateway supporting web services interfaces is proposed.

The paper is structured as follows. In Section 2, functional architecture for third party control on multimedia streaming and provisioned QoS is considered. Section 3 presents the suggested mapping of web services interfaces onto EPS protocols. In Section 4, session state models as seen by third party application and by network control protocols are suggested. Section 5 describes the formal approach used to prove the synchronized behaviour of both types of models in the gateway, which may be applied in generation of automatic test sequences. Section 6 provides use cases that illustrate the approach applicability.

2. FUNCTIONAL ARCHITECTURE FOR THIRD PARTY CONTROL IN EPS

2.1. Deployment of Multimedia Streaming Control

The functional architecture for deployment of Parlay X Multimedia Streaming Control web

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