QoS Control in Service Delivery in IMS

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Abstract- As the next generation networks promise to provide network convergence with services for both static and mobile networks, the recent research focus is converging in the direction of standardizing common infrastructure based on all-IP networks. IMS is a recent initiative, designed by 3GPP and TISPAN partnership, which outlines a service delivery platform (SDP) framework. A flexible and robust QoS management system for IMS is essential to encertain the achievability of service quality on these converged networks. As Triple Play and Quadruple Play services are becoming the most celebrated services in the near future, the necessity of on demand QoS and dynamic Service Level Agreement are becoming eminent as the need of the hour. This paper discusses the issues, design and analysis related to on demand dynamic QoS Control in these next generation networks

Keywords: IMS, SDP, QoS, dynamic QoS, SLA

1. Introduction

IMS was defined by 3GPP [1] as an standard architecture which provides a horizontal, cross-functional layer of intelligence on top of IP, enabling the creation, control and execution of new and rich user-to-user services (video streaming), user-to-server offerings (IPTV) and multi-user media services (game-playing on the move and at home via PC).

To enable this, IMS architecture must be made compatible with existing service delivery environment such as Service Delivery Platform (SDP). A typical SDP+IMS [2] solution is depicted in Figure 1.

As IMS must provide a cost effective solution to the companies. Therefore, the services provided by the IMS environment should be delivered according to Service Level Agreements and ensure Quality of Service. As the traffic can be generated from anywhere at anytime, it is desirable that QoS management is dynamically adaptable to the users' requirements. Hence, a flexible and robust QoS management system for IMS is essential to encertain the achievability of service quality on these networks. The next generation solutions are designed to provide converged services such as Triple Play [3] and Quadruple Play [4] services, which are becoming the most celebrated services in the near future. This challenges a need of an on demand QoS and dynamic Service Level Agreement.
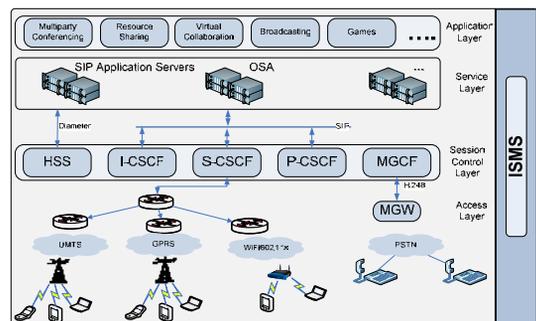

Fig. 1. Simplified view of IMS/ SDP architecture with management server (ISMS) as a vertical layer.

This paper discusses the issues, design and analysis related to on demand dynamic QoS control in these next generation networks. Section 2 describes the background work in SLA and QoS provisioning in IP networks. Section 3 discusses the issues of dynamic QoS control and Service Level Agreement. Section 4 discusses the feasibility of dynamic QoS control in IMS network. Finally, section 5 concludes our study.

2. Background

Most of the traffics in service delivery scenarios are audio and video communication. The most important characteristic of this traffic is the existence of constraints on the delay in the data delivery. For handling such constraints, the system must monitor the network parameters and guarantee network resources for the traffic flows. This is achieved using a comprehensive QoS management scheme.

The Internet Engineering Task Force (IETF) has defined two QoS architectures for IP networks: Integrated Services (IntServ) [6] and Differentiated Services [7] (DiffServ). Several attempts to provide scalable dynamic QoS have been made to combine IntServ with another QoS model [5]. On the other hand, Differentiated Service (DiffServ) [7] is known to be scalable. Rather than providing per flow QoS, DiffServ provides coarse grained QoS for traffic aggregates or classes and applies different per-hop services to different classes.

3. Dynamic QoS & SLA

3.1. Service Level Agreement

A service-level agreement is a key component of a service-level contract (SLC). The SLC specifies connectivity and performance agreements for an end-user service from a provider of service.

SLAs can serve as catalyst for implementing policy-based networking, which helps streamline network operations and provides for scalability. At the same time, ensuring prioritization of network application traffic via policy is another important aspect of managing service-levels.

3.2. Dynamic QoS

IETF has defined the Policy-based Network Management (PBNM) architecture to configure network services [8]. Currently most efforts are focused on Differentiated Services (DiffServ) in the Internet. The goal of the policy-based network management is to enable network control and management on a high abstraction level by defining configuration rules called policies. Policies specify how a network node must be configured in vendor-independent, interoperable and scalable manner. For example the *Policing Rule = drop out-of profile* packets can be applied to all the packets which are out of profile regardless of whether the network is capable or not to transmit this packet.

The traffic in the network is profiled and policed at all time by the edge routers with in the network. These routers can dynamically decide what actions must be applied to out-of-profile packets. These actions also vary according to the network state such as network link load and traffic behavior.

4. Dynamic QoS & SLA in IMS/SDP

In IMS architecture, we have applied a single centralized server, ISMS (IMS-SDP Management Server) which works as a vertical layer to .the horizontal layers of IMS/SDP [9], as shows in figure 1. This centralized server, gathers the network parameters using SNMP agents, managed objects and Service managed objects (SMO) [9] to provide network and service management. It uses SIP signaling for session management. For QoS management, Policy enforcement is done using the well known architecture of COPS protocol [10].

When a network element is started, its local PEP requests the PDP for all policies concerning DiffServ traffic marking using COPS (Common Open Policy Service) [10]. The policies sent by the PDP to the PEP, may concern entire node's QoS configuration or a portion of it, as an updating of a DiffServ marking filter. The PDP may proactively provision the PEP reacting to external events generated by some monitors such as a bandwidth monitor.

The ISMS manages the SLA for each customer and ensure the delivery of service is according to the SLAs. ISMS works as the PDP, while the

network and IMS nodes such as gateways works as PEPs [10]. These PEPs enables the applied policies according to the SLAs are enforced. For example, a gateway would manage that the certain amount of resource such as bandwidth is provided to a certain flow (as stated by the SLA). So it has to guarantee that amount of bandwidth. Moreover, it also limits and checks if more than resources are not being provided to a certain flow. In conclusion, these PEPs guarantee that each flow gets its rightful share.

But sometimes, due to a change in network parameters such as degradation of performance, a certain resource may not be able to be provided to each flow according to its SLA. Many solutions
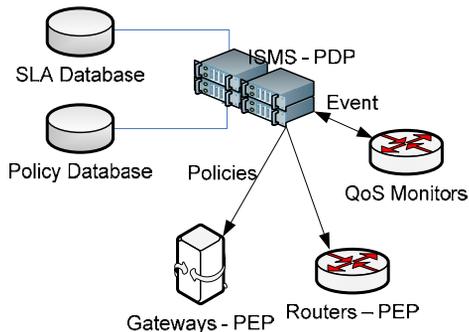

Fig 2: Policy enforcement using COPS

exist, which compromise some flows for certain important flows. This SLA ignorance can cost a service provider a loss of customer to its competitors.

Our management server (ISMS) is always monitoring the network performance and end-to-end QoS by getting feedback from the set-top box at the customer's end. Whenever there is a situation when a SLA needed to be compromised, ISMS starts a renegotiation of SLA with the customer equipment as shown in figure 2. As ISMS is the centralized information collector, it can easily assist in negotiating an SLA between a customer and service provider.

We use SIP signaling to provide this SLA negotiation. SIP INVITE and INFO messages are used communicate with the customer device,

while a web services architecture based on XML schema is used to communicate with the service provider.

5. Conclusion

Most of the traffics in service delivery scenarios are audio and video communication with constraints on delay. Hence, the system must monitor the network parameters and guarantee network resources for the traffic flows by using a
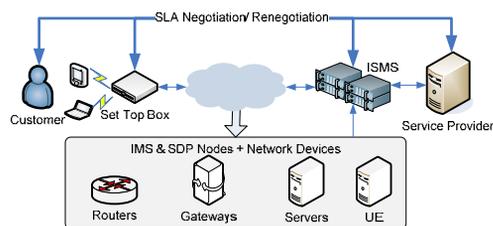

Fig. 3. SLA negotiation between STB and ISMS

comprehensive QoS management scheme. In this paper, we have discussed the use of dynamic QoS and SLA management in IMS networks. We have accomplished this by using simple SIP signaling in between the IMS's management server and the end user's device. The ISMS performs the renegotiation of SLA in between the consumer and the service provider and enables dynamic QoS for service delivery in IMS networks.

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