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Chapter XII

A Model for Dynamic QoS Negotiation Applied to an MPEG4 Application

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The traffic generated by multimedia applications presents a great amount of burstiness, which can hardly be described by a static set of traffic parameters. The dynamic and efficient usage of the resources is one of the fundamental aspects of multimedia networks: the traffic specification should first reflect the real traffic demand, but optimize, at the same time, the resources requested. This chapter presents: a model for dynamically renegotiating the traffic specification (RVBR), how this can be integrated with the traffic reservation mechanism RSVP and an example of application able to accommodate its traffic to managing QoS dynamically. The remainder of this chapter focuses on the technique used to implement RVBR) taking into account problems deriving from delay during the renegotiation phase and on the performance of the application with MPEG4 traffic.

INTRODUCTION

Future applications will make use of different technologies such as voice, data and video. These multimedia applications require, in many cases, a better service than a best-effort service. This service is generally expressed in terms of Quality of Service (QoS), whereas network efficiency depends crucially on the degree of resources sharing inside the network.

To achieve both applications' QoS requirements and network resources efficiency, it is extremely important, for several reasons, network dimensioning or traffic charging.

The evolution of multimedia applications has pointed out how the QoS management must be supported by the network as well as at the application layer. The resource optimization is possible only if requests for reservation fit as much as possible the effective resource occupation. It follows that applications must be enabled to directly manage the QoS in order to limit the resource lost.

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The introduction of the renegotiable variable bit rate (RVBR) service (Giordano, 1999, 2000), at application layer is assumed to simplify and generalize this task. Whenever renegotiation is underway, the RVBR scheme generates a traffic specification conforming to the real demand to renegotiate the network resources in an optimal way while guaranteeing QoS to the traffic flows. The RVBR service uses the knowledge of the past status of the system and the profile of the traffic expected in the near future, which can be either prerecorded or known by means of exact prediction.

We propose an example of a multimedia application (called Armida) supporting dynamic QoS management based on RSVP that integrates RVBR services. Armida provides MPEG4 streaming video over an IP network in a Microsoft environment.

The rest of the chapter is organized as follows. In the next section we provide a short overview of the RSVP protocol. Then we describe the RVBR mechanism as defined in Giordano (2000). In the fourth section we introduce the Armida application, pointing out the component implementing the signalling protocol. Finally we provide a set of results related to a real case in which we compared the required bandwidth (derived from generated traffic) and the reserved QoS, varying the number of performed re-negotiations. We also provide an analysis of re-negotiation cost in terms of time required to set up the new QoS.

BACKGROUND

QoS Management via RSVP

The QoS management on the Internet is performed via the Resource ReSerVation Protocol (RSVP) (Braden,1997). RSVP is the signalling protocol implementing the QoS management according to the model defined by the Integrated Services (IS) group within IETF (Wroclawski-2210,1997).

RSVP allows the reservation of resources for a flow, seen as a sequence of datagrams. The sender sends the characteristics of the traffic in the *Tspec* traffic descriptor, contained in the PATH message. The receiver tries to set up a reservation related to the received PATH message issuing a RESV message.

The reservation is periodically refreshed (suggested refresh period is currently 30 seconds), i.e., the PATH and the RESV messages are reissued.

IS defines three classes of services: Guaranteed Service (GS) (Shenker, 1997), Control Load Service (CLS) (Wroclawski-2211,1997) and Best-Effort Service. In the rest of the chapter we will focus only on the CLS.

CLS provides the client data flow with a quality of service closely approximating the QoS that the same flow would receive from an unloaded network element, but uses a capacity (admission) control to assure that this service is received even when the network element is overloaded. The end-to-end behaviour offered by the controlled-load service to an application, under the assumption of a correct functioning of the network, is expected to provide little or no delay and congestion loss.

The sender provides the information of the data traffic it will generate in the *Tspec*. The parameters specified by the *Tspec* are:

- peak rate p
- bucket rate r
- bucket size b