PoQBA: A New Path Admission Control for Diffserv Networks

Enrique Pena, Miguel Rios, Christian Oberli, and Vladimir Marianov

Department of Electrical Engineering
Pontificia Universidad Catolica de Chile
Casilla 306, Correo 22, Santiago-Chile

Abstract. In most DiffServ networks there is a bandwidth broker (BB) that manages the network resources. One of the many tasks of this broker is to perform admission control on the flows entering the network. When there are many frequent calls, the network is large, or the admission control scheme is very complex, the bandwidth broker can become part of the problem instead of the solution. In those cases the broker might act as a bottleneck, limiting the number of flows entering the network and rejecting some of them even if there are still enough resources available. This is why distributed and hierarchical architectures of bandwidth brokers are needed. We introduce PoQBA: an algorithm that adapts book-ahead optimization to path oriented hierarchical broker architecture. The results show that the performance of this algorithm has several advantages compared to normal hierarchical systems and the Hose model.

Keywords: QoS Broker, Admission Control.

1 Introduction

The DiffServ architecture is capable of providing well defined end-to-end service not only inside, but between different network domains. It is based on two types of agents: edge and core routers. Core routers are kept as simple as possible in order to achieve scalable results. To do so, the edge routers aggregate traffic into flow classes based on previously negotiated service level agreements (SLA). These SLAs are complex business related contracts that cover a wide range of issues, including network availability guarantees, payment models and other legal and business necessities. Among these parameters, SLA also contains Service Level Specifications (SLS) that characterize the QoS requirements and the Per Hop Behavior (PHB) a flow class must receive. Core routers schedule the different packets based on these PHB. They only have to deal with a few flow classes instead of every single flow that arrives to the network. This makes them simple and independent of the amount of flows in the system.

The Bandwidth Broker (BB) is the management entity of the system. It has full knowledge of the topology and resources of the network. In general terms, BB's main function is to control and administrate the network resources, allowing

T. Enokido, L. Barolli, and M. Takizawa (Eds.): NBiS 2007, LNCS 4658, pp. 435–445, 2007.

new flows to enter the net, negotiating and monitoring the QoS constrains for every client, and configuring the resources to accomplish these tasks [1]. This paper will focus on one of the main functionalities of the BB: admission control. The BB must decide which flows to accept and which one to reject based on the actual resources available and the requirements of each flow. it is of great interest for network administrators to configure the BB, so it performs this admission control while trying to maximize their profit [11].

Centralized architectures are very efficient in resource allocation but might introduce some scalability problems. In particular, the ability of a single BB to handle large volumes of flows is debatable. The simplest solution is to use several BBs, in order to share the processing load between them. Distributed systems are a reasonable solution but require a very strict coordination [3].

Another way to achieve scalability is using hierarchical models, where a central agent coordinates several edge agents. Such idea is used in [4], where a central BB assigns bandwidth quotas dynamically to several edge BBs. These edge agents perform the admission control based on the amount of quota assigned to them. In [5] it is proposed some modifications to this quota-based scheme in order to reduce the complexity of the admission control process. A hybrid scheme is proposed in [6] where edge BBs start to work when the load on the central BB becomes large.

In this paper we use optimization techniques proposed for centralized architectures in order to reduce the overhead and increase the profit of a hierarchical architecture. Scalability and resource optimization are issues that have been studied separately, but there is no previous work that analyzes them together. The paper main contribution is proposing a scalable BB architecture, capable of performing resource allocation optimization. This new model achieves better results than common hierarchical architectures, and can be easily implemented in large networks, solving the traditional scalability problems of other optimization models.

The paper is organized as follows: Section 2 explains in detail the admission control module of a BB and the different approaches to perform this task, discussing their advantages and disadvantages. Section 3 shows the profit optimization model. Section 4 explores the potentiality of using path instead of link constrains and introduces PoQBA as a new approach to perform admission control. Section 5 presents simulation results of the proposed algorithm and some discussion based on them. Finally, there are some general conclusions.

2 Admission Control in Bandwidth Brokers

The admission control module is a fundamental part of a BB. Its main purpose is to evaluate if there are enough resources to satisfy the QoS requirements before allocating a new flow in the network [7]. It is possible to express all QoS constrains in terms of only a bandwidth requirement. Parameters like loss ratio can be assured if sufficient bandwidth is reserved. Other constraints such as delay and jitter can be pre-evaluated using PHB or PDB [1]. For monitoring the network resources, there are two major approaches: link and path based admission control. The first one uses link state information to see if there is