On Efficient Distribution of Data in Multicast Networks: QoS in Scalable Networks

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Abstract. Multimedia applications or real-time applications such as audio and video on demand, teleconferencing and whiteboard sharing require Quality of Service (QoS) guarantee assurance. QoS constraints, namely required bandwidth, end-to-end delay and delay jitter are the major parameters that need to be satisfied in order to have quality assurance in a dynamic multicast network.

In this paper we investigate the effect of the QoS constraints on multicast network applications and services during the processes of routing. Lastly, we propose linear routing tree algorithms for required bandwidth, end-to-end delay and delay jitter.

1 Introduction

1.1 Background

When Internet technology develops and grows, applications become more distributed and the need for group communication arises in the networks. This allows nodes in the network to share information. However there is a need for efficient and equally distributed QoS in the network during sessions, which can be provided within a multicast network that is responsible for multipoint information delivery. Internet Protocol(IP) and Asynchronous Transfer Mode (ATM) support multipoint information delivery in scaling networks, since most multicast networks use IP based services with support of User Datagram Protocol (UDP), the best-effort multicast service [11, 12]. It was found out [12] that best-effort multicast services do not support QoS guarantee such as message delivery, ordering, throughput and transmission delay. Transmission control protocol is reliable compared to UDP in ensuring that the delivered data stream is sequential. However it lacks the multicast applications requirement which support multipoint information delivery, but supports only peer-to-peer connections providing almost no support for latency control and uses only the go-back-n algorithm [11] for any error occurrence and recovery which brings about misuse of network resources. The receivers can also send information to the sender (source) giving an information about the packets that have not been received or that are lost due to error. After the information sent by the receiver has been verified and processed, a proof of whether the packets were lost is done and also whether there is need

I. Lirkov, S. Margenov, and J. Waśniewski (Eds.): LSSC 2005, LNCS 3743, pp. 518–525, 2006.

for a retransmission [11]. The previous research in multicast transport focused on providing reliable and ordered delivery sequence to distributed systems or groups [12]. Membership in these multicast groups is highly dynamic with group members leaving without permission or explicit knowledge of other hosts, while others join the groups. This changing of membership in the groups makes the integrity of the data transmitted along the multicast network lack efficiency. In case of many-to-many and one-to-many multicast and multimedia applications, TCP/IP and ATM network services become more inadequate [15]. Multicast protocols are important since they are used to bridge the gap between the demanding applications and the inadequate multicast networks. These protocols are needed to provide ordering, reliability, group management, error recovery and also to compensate bandwidth, latency receiver feedback rate and flow control requirements of multimedia applications [12]. Multimedia applications also must deal with the scalability and heterogeneity problems usually found in the distributed multimedia applications that use multicast technology in large-scale network infrastructure. If the scalability problem is dealt with, it will help in solving the QoS requirements for the dynamic multicast networks.

1.2 Overview

In Section 2 we formulate the problem statement; in Section 3 we discuss related work; in Section 4 we present the results and lastly in Section 5 we give concluding remarks.

2 Problem

In this paper we consider multicast networks running distributed applications and services that face a problem of QoS in scalable networks. This problem impacts greatly on the efficiency of distributed applications and services in large-scale networks. Multicast groups are dynamic and therefore the group members have different QoS requirements for any scaling network. Therefore there is need for an efficient routing tree algorithm that could improve data distribution in scaling multicast networks.

3 Related Work

Many multicast routing protocols have been proposed. However the QoS requirements in the network for efficient routing have not been fully solved. There is a need for more efficient routing algorithms for distributed multicast networks. Jose [11] focused on how to provide a full reliable data transmission to a large number of receivers, bandwidth saving and maintaining a suitable performance in heterogeneous environment. For reliable data transfer all receivers get an error free copy of the transmitted data. Here multicast flow control and congestion control issues were not well discussed. Jasleen *et al.* [9] worked on the effect of TCP on assigning higher priority to traffic requesting expected forwarding (EF)