

A Rate-Based Congestion Control Mechanism for the Internet

Hassan Mahmud, Mehedi Hassan, Rezwanul Haque Khan and Md. Abdur Razzaque

hmahmud@iut-dhaka.edu mehedi_2@hotmail.com rezwan@iut-dhaka.edu marazzaq@iut-dhaka.edu

Department of Computer Science and Information Technology (CIT)

Islamic University of Technology (IUT)

Gazipur, Bangladesh.

Abstract: *The recent explosive growth of the Internet in terms of size, traffic volume and spectrum of new and old applications has made it clear that traditional traffic control techniques based on Transmission Control Protocol (TCP) is not adequate to provide the Internet users fast access to unused network resources, avoid traffic congestion and prevent unfair use of network resources. We believe that time has come to introduce network level flow control in the Internet. In this paper, we present the concept and architecture of end to end network level flow control for the Internet or any IP-based networks.*

Keywords: Congestion Control, TCP, ATM, Edge Router, Core Router, ICMP.

1. INTRODUCTION

Traditionally, the traffic in the Internet has been mainly controlled by the TCP's flow and congestion control algorithms running at the end systems. These algorithms tried to estimate the network congestion level by monitoring several variables, such as round-trip-time between source and destination. TCP is implemented only at the end systems, it is not implemented in the network devices or routers. Network devices implement the network layer protocol called the Internet Protocol (IP). No network level flow control has been exercised so far.

Although TCP has provided a reasonable traffic control service in the past, recent explosive growth of the Internet in terms of size, traffic volume and spectrum of new and old applications has made it clear that TCP alone is no longer adequate to achieve the three key goals of traffic control namely, fast access to unused network resources, avoidance of traffic congestion and prevention of unfair use of network resources. One major source of problem is the rising number of UDP-based multimedia applications which do not use TCP and hence transforms the Internet from a homogeneous

(mainly TCP sources) to a heterogeneous (some TCP, some UDP) networking platform.

Several researchers have recently proposed different types of traffic control mechanisms to augment TCP's flow control. Some suggested that all new applications should behave like TCP [1] so the Internet will remain a homogeneous platform. Others propose new packet discarding algorithms for the routers to achieve fairness among all competing traffic streams [2]. Another proposal explores possibility of signaling impending network congestion to the TCP source using a bit in the TCP packet header [3]. Dropping selected packets at the entry to the network, in contrast to allowing these packets in the network and then drop them eventually, is explored in [4] to prevent congestion collapse for best effort service.

None of the above mentioned solutions employ end-to-end network-level flow control. Therefore, these proposals cannot provide fast access to available network resources, although they prevent congestion and unfairness to some extent. Earlier some work was done to integrate rate based congestion control scheme of ATM network with the Internet [5]. In this paper, we propose an end-to-end network level rate based congestion control architecture for the Internet best-effort service. Section 2 illustrates the overall architecture followed by detailed component and protocol designs. In section 3, we provide a qualitative complexity analysis and discuss some implementation issues for the proposed architecture.

2. PROPOSED ARCHITECTURE OF RATE-BASED CONTROL

The basic idea of end-to-end network level flow control is taken from the Asynchronous Transfer Mode (ATM) network's Available Bit Rate (ABR) service which deploys such rate control to provide fast access to any unused bandwidth in the core of the network. In the rate-based congestion control