A Study on Probabilistic Delayed Packet Discard Schemes for TCP over ATM

Doctoral Program in Engineering
University of Tsukuba

March 2001

Manhee Jo

ABSTRACT

ATM is one of the most essential techniques to support B-ISDN which deals with a fixed-sized transfer unit called a cell. Among the diverse applications, TCP/IP has been vigorously propagated over the networking arena due to its open characteristics. Now, TCP/IP is a ubiquitous application protocol suite in computer communication network having considerable numbers of users all around the world. Meanwhile, in order to provide reliable services over internetworks, TCP uses flow control algorithms and acknowledges the receipts of packets in the TCP layer. However, ATM, which is located under the TCP/IP layer, basically does not provide any explicit flow control scheme in the ATM layer. It transmits a cell at any time if possible, and deletes a cell if a network is congested. The properties of both layers cause a critical problem in TCP over ATM. Many studies considering this kind of problem within ATM have been conducted. They include the PPD (partial packet discard) and the EPD (early packet discard) scheme. They drop ATM cells intelligently under a certain congestion condition to relieve the incompatibility problem. Particularly, the EPD exploits a much more intelligent policy than the PPD to control congestion. The EPD has been thought to be one of the most optimal congestion control schemes in ATM. However, considering the traffic characteristics of TCP and the aggressiveness of EPD, network throughput is not high enough.

In this dissertation, the author has formalized the ordinary congestion control schemes in ATM. Based on this generalization, a new packet discard scheme named "Probabilistic Delayed Packet Discard" (PDPD) scheme in ATM has been proposed. On the basis of this generalization, the EPD and PPD are parts of the PDPD. The PDPD scheme is quite an optimistic method. However, the PDPD not only utilizes buffer resources in a network more efficiently but also achieves higher throughput than the ordinary EPD scheme. The new PDPD scheme has been examined by a computer simulation. From the simulation results, the PDPD achieved throughput improvement compared to the EPD by utilizing more buffer resources.

Contents