

Chapter 5

Concluding Remarks

In order to support considerable numbers of TCP applications over ATM, the compatibility problem with respect to congestion control between the TCP and ATM has been found and solved by intelligent schemes. The most representative methods are PPD and EPD. This dissertation targeted the throughput improvement of TCP over ATM based on those packet discard strategies.

First, this author generalized packet discard schemes in this dissertation. In the generalized form, if the queue length is larger than the threshold value, a D (discard) flag is set based on probability p . The actual discard operation begins after the D flag is set. On the basis of this generalization, PPD is a special case when $p = 0.0$ and EPD is another special case when $p = 1.0$. Based on this idea, the author proposed an optimistic packet discard scheme named the "Probabilistic Delayed Packet Discard" (PDPD) scheme. PDPD alleviates the aggressiveness of packet discard by EPD and tries to use more buffer resources than EPD.

The author examined the performance of PDPD with a simulation. For small buffer sizes, the PDPD with a smaller p achieved higher throughput than those with a larger p or EPD. This is because the aggressiveness of EPD over the input streams is substantially reduced by PDPD with a smaller p . For large buffer sizes also, almost all the PDPD with a large p achieves moderate throughput no lower than those of EPD. This author posits that the throughput is improved if: 1) the aggressiveness of packet discard strategy is appropriately reduced, or 2) buffer space is sufficient. Therefore, by using the optimistic PDPD scheme, the unused buffer space is utilized more effectively than by the strict EPD. At the same time, PDPD will succeed in preventing PPD's excessive buffering of packets to avoid buffer overflow. Thus it can be said that improvement of buffer utilization can be brought to the improvement of throughput. Consequently, it can be concluded that lenient and optimistic PDPD schemes can improve the network throughput by adapting appropriate probabilities.

There are some more advantages of PDPD in addition to the throughput improvement. Through the formalization of PDPD schemes, it has become much easier to understand the packet discard schemes. PPD and EPD are very simple methods. This is necessary because a

complex method is not recommended in high speed switching. Even though the PDPD needs one more instruction compared to PPD and EPD due to the calculation of the probability, it is still very simple.

Moreover, it is possible to change p according to network congestion, which is never possible in EPD and PPD. EPD and PPD achieved high throughput in some specific environments. But if a situation changes, it is not possible to obtain the highest throughput by both schemes. The PDPD scheme can improve this. Hence, the PDPD scheme produces more flexibility in packet discard schemes in TCP over ATM. This will result in throughput improvement by utilizing more buffer resources. This is the point of this study. How to estimate the appropriate value for p depending on the network condition deserves further study. The author will determine under what network conditions the PDPD works most effectively and achieves higher throughput with respect to the probability p .