CHAPTER 6

CONCLUSIONS SUGGESTIONS FOR FUTURE WORK

6.1 CONCLUSIONS

With the emergence of integrated services networks, QoS based dynamic routing schemes are very essential for maintaining better quality of service (QoS) in the network. However the performance characteristics of these schemes are not known, especially in the presence of dynamic traffic loads. In this work, attempts are made to address this area in a multi-source environment. Using the NETSLIM simulator, it is analyzed the effects of various dynamic routing schemes on the flow blocking probabilities of different service classes. Some of the main observations of this work are summarized here. Due to dynamic routing, the dynamic traffic load on one node pair can affect the flow blocking probabilities of not only that node pair but also other node pairs in higher load situation in the case of no or low trunk reservation. The performance of Multi-Source Virtual Dynamic Routing (MSVDR) scheme is consistently better compared to other schemes. Additional studies are going on to understand possibly other implications of network traffic dynamics on dynamic routing schemes and the role network control plays.

In this research work, a new QoS - based routing algorithm called the Multi-Source Virtual Dynamic Routing Scheme (MSVDR) has been proposed. The algorithm is compliant with the PNNI protocol and supports multiple QoS requirements, using an adaptive and iterative path search approach that takes advantage of the PNNI hierarchical structure to reduce
path computation complexity and maximize network throughput. The MSVDR shows that call setup time is significantly reduced, and the computational overhead and call blocking probability are lower, compared to other PNNI routing algorithms. Network throughput is also improved by evenly distributing the traffic among several eligible paths.

This research study proposed a new queue mechanism to use inside the ATM switches before calling the MSVDR algorithm. This scheme depends on the ABR rate-based scheme for coping with congestion control in ATM networks. The MSVDR scheme uses the positive feedback rate control and intelligent holding in each switch in order to resolve the problems which happen in FECN, BECN and PRCA. The behavior of the MSVDR scheme was evaluated by simulations. From the simulations results we conclude:

- In transient behavior, the MSVDR scheme ramps up quickly to the fair rate.
- There are not noticeable rate oscillations. This means, the MSVDR scheme improves bandwidth efficiency and reduces the buffer length.
- For MAN and WAN environments, the MSVDR scheme in which each VC has more than one RM cells offer adequate performance.

The VS/VD is an option that can be added to switches which implement per-VC Queuing. The addition can potentially yield improved performance in terms of response time, convergence time, and smaller queues. This is especially useful for switches at the edge of satellite networks or switches that are attached to links with large delay-bandwidth product. The
fast response and convergence times also help support burst traffic like data more efficiently.

In this research, a doubly finite shared buffer switch with shortest-queue-length buffer management in ATM networks was proposed. In the buffer structure, if the queue length of an input queue reaches B, the control logic chooses a shortest-length input queue among the other output queues to store the new arriving cell. This structure will decrease the number of out-of-order and lost packets for high-traffic loads. In addition, an increased network throughput and an increased network performance is achieved. Thus, by using the model, a superior and efficient ATM switch is achieved.

In this work, what is considered first is that each VC knows its bottleneck switch. However, in real environments the bottleneck switches of the VCs may change dynamically. Therefore, we are investigating a method to determine the bottleneck switch of a VC in a dynamic environment.

The fairness of the multiple protocols running over a simple ATM ABR network is studied through simulation under ABR RTT and ABR DFQ mechanisms, considering variable background traffic levels. With our results showing that ABR DFQ mechanism which we conceived has improved the fairness among multiple connections with difference protocols, throughput and efficiency performance level are increased, especially when the background traffic level is high, finally resulting in the state that enough buffer space mitigates this overhead problem. In this research, only the findings of a preliminary study are provided about ABR DFQ mechanism. Much more work is necessary to carefully analyze the performance in a more complex network.
6.2 SUGGESTIONS FOR FUTURE WORK

The local area networks can support a large number of VCs with large $B_{VC}$, using only a moderate amount of memory. Each of these VCs may assume a high bandwidth at various times whenever network load permits. For example, on a 1 km link, one megabyte of memory can maintain 1,000 VCs, each of which can operate at a speed as high as 100 Mbps, i.e., at $B_{VC}=100$ Mbps. These VCs obviously cannot all operate at their peak bandwidth simultaneously, over the same physical link of bandwidth $B_{link}$, equal to say, hundreds of megabits per second. That is the “overbooking” inequality holds:

$$B_{VC} > B_{link}$$

Where, the summation is over all the VCs on the link. In fact, the idea of Link to Link Flow Control is to make the left-hand side much larger than the right-hand side, in order to maximize link utilization. The Rate-based flow control schemes of this research will flow control these VCs dynamically so that they can slow down when the link is congested. However, as soon as the link congestion situation lightens, each of these VCs can immediately operate at speeds as high as possible, up to its peak bandwidth $B_{VC}$, to make the maximum possible use of the available bandwidth and maintained the maximum link utilization. The congestion control algorithm presented in this thesis is designed to be general and independent of the network topology, size and link type. This thesis work presents the results of the algorithm tested for a linear network depicting one satellite connection and near zero control information delay. The algorithm needs to be further tested for larger networks with cross traffic and more realistic control message delays to verify its potential as a general congestion detection and rate control algorithm.

In this thesis work, the capacity of the satellite link is fixed at 6 Mbps. In future work, the benefits of dynamic bandwidth allocation, which is of interest in satellite networks, should also be explored.