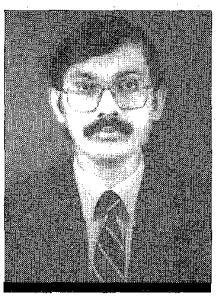
Traffic Management and Switching for Multimedia



Mohammed Atiquzzaman

Large-scale deployment of multimedia services over networks depends on the quality of Service (Qos) and cost effectiveness of these services. Efficient management of traffic inside the network and at the access link, network/switching support for multimedia are required to increase the cost effectiveness and QoS of multimedia applications. The large bandwidth requirement of digital video makes multimedia services very expensive, and has been a major obstacle to the widespread use of these services. It is expected that techniques to reduce the bandwidth requirements would increase the use of multimedia services over networks.

Optimum network design and efficient management of traffic requires realistic traffic models which will reflect the traffic to be transported over the network. Previous traffic models for data, such as Markovian models, are generally not applicable to model multimedia traffic. Researchers have reported long and short range dependencies in multimedia traffic over networks, resulting in self similarities in the traffic.

While a reasonable amount of work has been done in carrying multimedia traffic over networks, more work needs to be done in managing the traffic over the access network. Because of the existing infrastructure, Cable TV (CATV) has emerged as a promising access network for delivery of multimedia. An important issue is guaranteeing QoS required at the access network for diverse user applications.

In contrast to previous notions that video over asynchronous transfer mode (ATM) networks should typically use the constant or variable bit rate services, recent research results have shown that video can be effectively transported over the feedback-based ABR service of ATM. Multimedia transmission over ATM requires QoS guarantee and multicast support which is used by many multimedia applications.

The first article provides a broad overview of the various traffic management functions required to support multimedia transmission over ATM networks. The relationship between the various functions such as traffic shaping, congestion control, dynamic bandwidth allocation, and renegotiation are discussed. An example of running video on demand over an ATM network is given along with performance results.

The second article describes the characteristics of video, its high bandwidth and QoS requirements, followed by a survey of a number of approaches for reducing the bandwidth requirements of digital video. It also has an excellent discussion of the networking support available to transport video over different types of networks.

The third article surveys the cause of self-similarity in multimedia traffic and methods to measure self-similarity. The article also discusses the implication of self-similarity on QoS, network performance, and resource requirements such as bandwidth and buffers.

The fourth article looks at QoS and multipoint support required to transmit multimedia traffic over the ATM Available Bit Rate service. The article discusses switch algorithms to implement non-zero minimum cell rate (MCR), a parameter of ABR, which can be used to guarantee a minimum video quality over the ABR service. They also discuss problems and solutions for supporting multipoint ABR connections.

The fifth article describes a scheduling strategy for an ATM switch router which selectively transmits video slices in order to achieve high-quality video and efficient utilization of network bandwidth.

The large installed base of CATV networks makes it an attractive option as an access medium to multimedia networks. The sixth article discusses the QoS requirements to support integrated services over CATV. The authors discuss a MAC-layer scheduling protocol which efficiently multiplexes various types of traffic, and at the same time guarantees QoS.

BIOGRAPHY

MOHAMMED ATIQUZZAMAN [SM '94] (atiq@ieee.org) received M.Sc and Ph.D. degrees in electrical engineering and electronics from the University of Manchester Institute of Science and Technology, U.K. Currently he is faculty member in the department of Electrical & Computer Engineering at the University of Dayton, Ohio. He is a senior editor of *IEEE Communications Magazine* and member of the advisory editorial board of *Computer Communications journal*. He has guest edited many special issues of various journals including special issues on ATM Switching and ATM Networks in the *International Journal of Computer Systems Science & Engineering*, Next-Generation Internet in the *European Transactions on Telecommunications and Optical Networks*, and Communication Systems and Devices in *IEEE Communications Magazine*. He has also served in the technical program committee of many national and international conferences, including IEEE INFOCOM and the IEEE Annual Conference on Local Computer Networks. His current research interests are in broadband ISDN and ATM networks, multimedia over high-speed networks, and switching. He has over 90 refereed publications.