TRAFFIC MANAGEMENT AT THE PACKET LEVEL

Traffic management is concerned with the delivery of QoS to specific packet flows. Traffic management entails mechanisms for managing the flows in a network to control the load that is applied to various links and switches. Traffic management also involves the setting of priority and scheduling mechanisms at switches, routers, and multiplexers to provide differentiated treatment for packets and cells belonging to different classes, flows, or connections. It also may involve the policing and shaping of traffic flows as they enter the network.

The dashed arrows show packets from other flows that ``interfere"with the packet of interest in the sense of contending for buffers and transmission along the path. We also note that these interfering flows may enter at one multi- plexer and depart at some later multiplexer, since in general they belong to different source-destination pairs and follow different paths through the network.

The performance experienced by a packet along the path is the accumulation of the performance experienced at the N multiplexers. For example, the total end-to-end delay is the sum of the delays experienced at each multiplexer. Therefore, the average end-to-end delay is the sum of the individual average delays. On the other hand, if we can guarantee that the delay at each multiplexer can be kept below some upper bound, then the end-to-end delay can be kept below the sum of the upper bounds at the various multiplexers. The jitter experienced by packets is also of interest. The jitter measures the variability in the packet delays and is typically measured in terms of the difference of the minimum

delay and some maximum value of delay.

Note that the discussion here is not limited solely to connection-oriented packet transfer. In the case of connectionless transfer of packets, each packet will experience the performance along the path traversed. On the other hand, this analysis will hold in connectionless packet switching networks for the period of time during which a single path is used between a source and a destination. If these paths can be ``pinned down'' for certain flows in a connectionless network, then the end-to-end analysis is valid.

Packet-switching networks are called upon to support a wide range of services with diverse QoS requirements. To meet the QoS requirements of multiple services, an ATM or packet multiplexer must implement strategies for managing how cells or packets are placed in the queue or queues, as well as control the transmission bit rates that are provided to the various information flows. We now consider a number of these strategies.

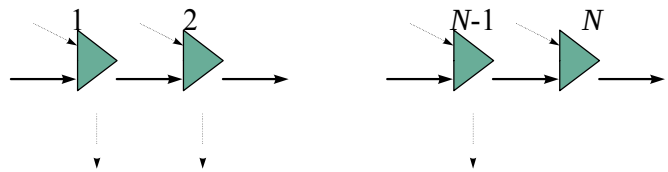

FIGURE 1.41 The end-to-end QoS of a packet along a path traversing N hops