Chapter 1

Multiservice Loss Systems

Figure 1.1: The generic loss system.
1.2. Loss Networks with Fixed Routing

The class of a call and the state of the network at the time of call are significant in determining the performance and cost of the network. A call's class is simply determined by the parameters of the call and the network state at the time of call. The cost of a call depends on the charge for the call and the time spent on the network.

For example, a telephone network with a star topology might have a call charge of $1 per minute and a maximum charge of $5 for any call. The cost of a call would be calculated by multiplying the charge per minute by the number of minutes the call lasts.

The network state at the time of call can also affect the cost of a call. For example, if the network is congested, the cost of a call might be higher due to the increased chance of call drops or longer wait times for service.

To model the telephone network as a loss system, we need to define the following:

- **Pbx**: The primary exchange, also known as the central office.
- **Bdx**: The branch exchange, also known as the local office.
- **Center Station**: A central station, also known as a central office.

The Pbx and Bdx are connected to the Center Station, forming a star topology.

1.2.1. The Bridge Loss System

The bridge loss system is the second of all loss systems, consisting of a bridge between two or more networks. The bridge loss system is used to model the performance of a bridge between two or more networks, such as a bridge between a public network and a private network.

The bridge loss system is modeled by the equation:

\[ \frac{P}{O} = \frac{1}{1 + G} \]

where:
- \( P \) is the probability of a call being blocked.
- \( O \) is the offered traffic, the rate at which calls arrive.
- \( G \) is the bridge loss factor, the fraction of calls that are blocked.

The bridge loss factor is determined by the design of the bridge and the characteristics of the networks it connects. The bridge loss factor can be calculated by dividing the number of calls blocked by the total number of calls attempted to reach the bridge.

1.2.2. Loss Networks with Fixed Routing

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I.2 LOSS NETWORKS WITH FIXED ROUTING

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1.4 ATM MUX/DEMUX

The section on ATM MUX/DEMUX addresses the topic of channel multiplexing and de-multiplexing using ATM technology. The ATM MUX/DEMUX is a critical component in the transmission and management of data in ATM networks. It enables multiple data streams to be multiplexed onto a single physical channel for transmission, and vice versa. This process is essential for efficient data transmission in ATM networks. The section explains the basic principles and implementation of ATM MUX/DEMUX, including their role in congestion control and traffic management, ensuring that data packets are delivered efficiently and without congestion.
We shall see that the probability of blocking a service-VC is

\[
\frac{Q}{Q_s} = 1 = \frac{Q}{Q_s}
\]

Let \( Q \subseteq \{ X_i : X_i \neq \emptyset \} \) denote the set of all VC problems that have room for another service-VC, that is,

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where \( C \) is the current VC profile. When appropriate

\[ C \leq \frac{1}{\gamma} \]

Then we shall see that

\[ 1.4 \text{ ATM MULTIPLEXER} \]
1.5 ATM NETWORKS

Admission is a function of the service capability function, which is dependent on the system's performance and congestion. The service capability function is defined by the service capability model, which determines the amount of traffic that can be supported by the network. The service capability model is a function of the system's capacity, the level of traffic, and the quality of service requirements.

Admission control in ATM networks is achieved through the use of admission control mechanisms, which include the following:

1. Credit control: This mechanism controls the amount of traffic that can be accepted by the network. It ensures that the network can handle the traffic load without exceeding its capacity.
2. Priority control: This mechanism controls the priority of traffic classes, ensuring that critical traffic is given priority over non-critical traffic.
3. Buffer control: This mechanism controls the size and allocation of buffers to ensure that the network can handle the traffic load without dropping packets.

Admission control is essential in ATM networks to ensure that the network can handle the traffic load without exceeding its capacity. It is achieved through the use of admission control mechanisms, which include credit control, priority control, and buffer control.
ATM networks with dynamic routing.

In Chapter 3 we studied static traffic. However, the problems of dynamic traffic require a different approach. The problems in ATM networks are typically more complex. The problems of routing in ATM networks are studied in Chapter 4.

Dynamic routing is used to provide a dynamic path for each connection. The path is chosen based on the traffic conditions in the network. This allows for efficient use of network resources.

The policy for the other service-options is defined in an analogous manner. We shall also describe how the combination of the two policies can be implemented.

For the network with two separate sources, we focus on the top source. We can analyze each one in isolation. Let

\[ \mathcal{P} \subseteq \mathcal{P}(u)(y) + (1 + \frac{1}{2}(u_1 + u_2)) \]

be the top route 0 and only if

Dynamic-routing/traffic-routing separation admits a new service-type. Let

\[ \mathcal{P}(u)(y) = (\mathcal{P}(u)(y_1) + \mathcal{P}(u)(y_2)) \]

be the top rule of the network. The set of sources is the set of all sources that are connected to the network. The set of services is the set of all service-types that are available in the network. The set of policies is the set of all policies that are used in the network. The set of rules is the set of all rules that are used in the network.

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Figure 1: A simple topology for an ATM network.
In Chapter 9 we explore how interconnection networks can be designed with minimum complexity so that VC switching in connection networks can be built with any number of input and output ports. But these networks can be built with any number of input and output ports. In order to build these larger switches, switch designers must interconnect a number of small switches, referred to as modules. Interconnection may introduce undesirable blocking within the interconnection networks. In this chapter we introduce an approach to avoid blocking problems and introduce a large switch that the switch designer can build in a single chip. This is in turn limits the number of input and output ports for the switch to some small value. But large ATM switches in practice have hundreds of input and output ports. Multiservice interconnection networks are especially difficult to design. Multiservice networks interconnect multiple protocols and functions on a single switch.