【CN】Day5

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Materials	Circuit Switching: FDM and TDM
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【Ch1】Computer Networks and the Internet

1.3.2 Circuit Switching

There are two fundamental approaches to moving data through a network of links and switches: circuit switching and packet switching.

- In circuit-switched networks, the resources needed along a path to provide for communication between the end systems are reserved for the duration of the communication session between the end systems.
- In packet-switched networks, these resources are not reserved. A session's messages use the resources on demand and, as a consequence, may have to wait.

Traditional telephone networks are examples of circuit-switched networks. Consider what happens when one person wants to send information to another over a telephone network.

Before the sender can send the information, the network must establish a connection between the sender and the receiver. The switches on the path stay connection state for that connection. This is called a circuit.

It also reserves a constants transmission rate in the network's links for the duration of the connection.

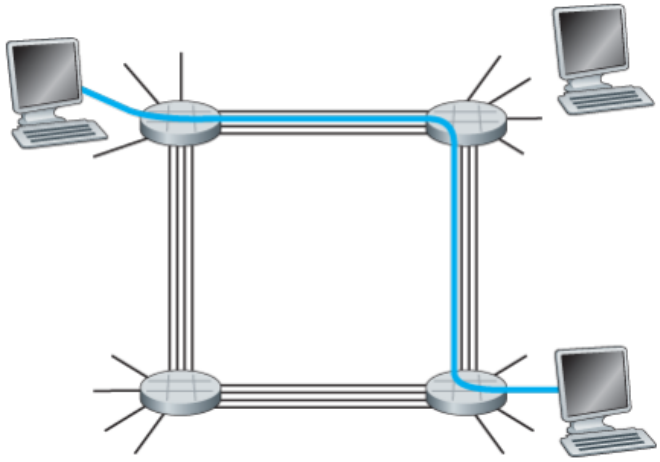

Figure 1.13 A simple circuit-switched network consisting of four switches and four links

When two hosts wants to communicate, the network establishes a dedicated end-to-end connection between the two hosts.

In order for Host A to communicate with Host B, the network must first reserve one circuit on each of two links. In this example, the connection uses the second circuit in the first link and the fourth circuit in the second link.

Multiplexing in Circuit-Switched Networks

A circuit in a link is implemented with either frequency-division multiplexing(FDM) or time-division multiplexing(TDM).

With FDM, the frequency spectrum of a link is divided up among the connections established across the link. Specifically, the link dedicates a frequency band to each connection for the duration of the connection. The width of the band is called the bandwidth.

For a TDM link, time is divided into frames of fixed duration, and each frame is divided into a fixed number of time slots. When the network establishes a connection across a link, the network dedicates one time slot in every frame to this connection.

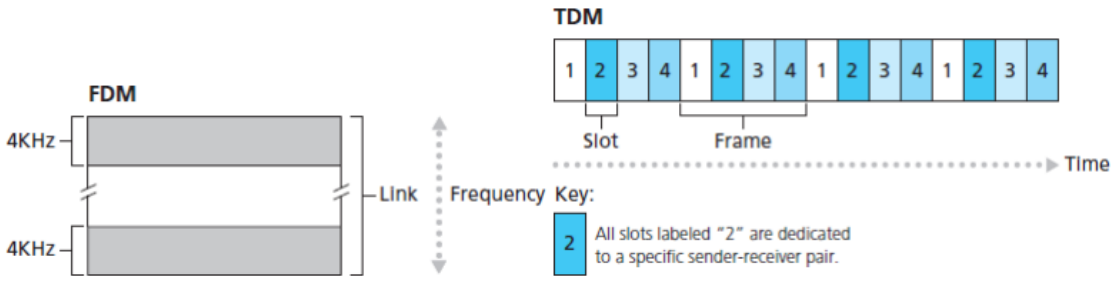

Figure 1.14
With FDM, each circuit continuously gets a fraction of the bandwidth. With TDM, each circuit gets all of the bandwidth periodically during brief intervals of time (that is, during slots)

For TDM, the transmission rate of a circuit is equal to the frame rate multiplied by the number of bits in a slot.

For example, if the link transmits 8,000 frames per second and each slot consists of 8 bits. The transmission rate of each circuit is then 64kbps.

Proponents of packet switching have always argued that circuit switching is wasteful because the dedicated circuits are idle during silent periods.

For example, when one person in a telephone call stops talking, the idle network resources cannot be used by other ongoing connections.

Packet Switching vs. Circuit Switching

Critics of packet switching have often argued that packet switching is not suitable for real-time services(for example, telephone calls and video conference calls) because of its variable and unpredictable end-to-end delays.(due primarily to variable and unpredictable queuing delays).

Proponents of packet switching argues that: (1)it offers better sharing of transmission capacity than circuit switching and (2)it is simpler, more efficient, and less costly to implement than circuit switching.