

Chapter Six

Switching

Switching

A **network is a set of connected devices**. Whenever we have multiple devices, we have the problem of how to connect them to make one-to-one communication possible. One solution is to make a point-to-point connection between each pair of devices (a mesh topology) or between a central device and every other device (a star topology). These methods, however, are impractical and wasteful when applied to very large networks.



Switching

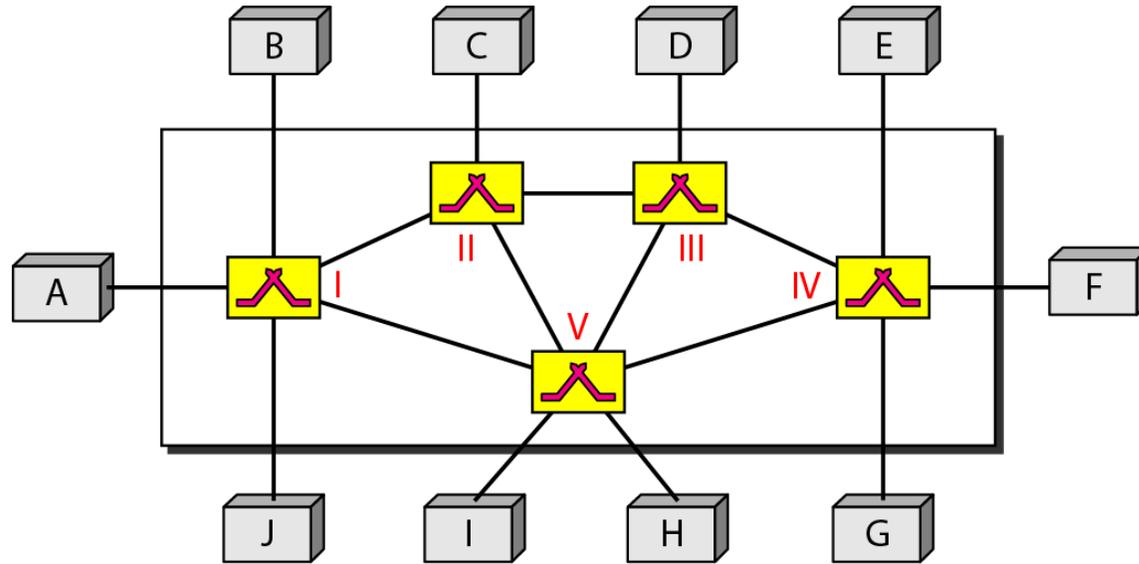


Figure 1 Switched network

Traditionally, three methods of switching have been important: circuit switching, packet switching, and message switching.

Switching

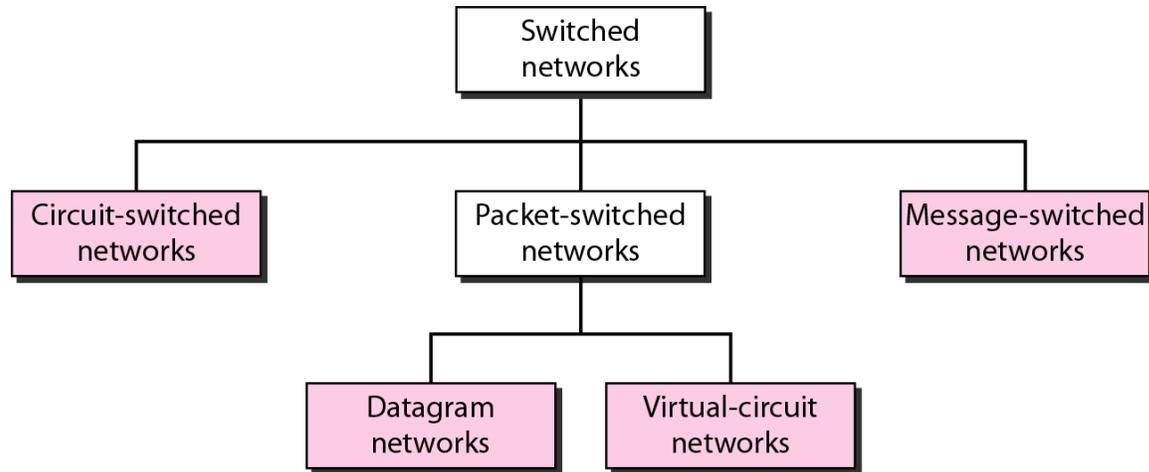
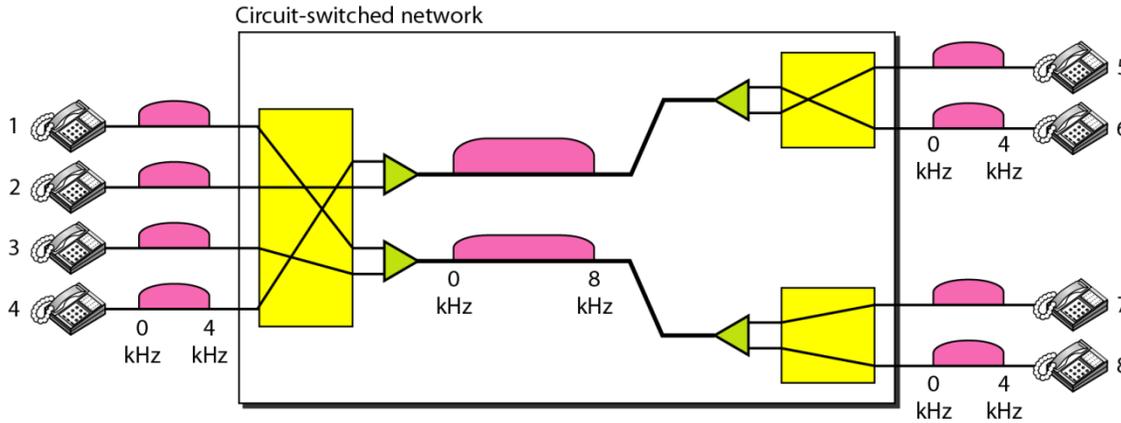


Figure 2 *Taxonomy of switched networks*

6.1 CIRCUIT-SWITCHED NETWORKS

A circuit-switched network consists of a set of switches connected by physical links. A connection between two stations is a dedicated path made of one or more links. However, each connection uses only one dedicated channel on each link. Each link is normally divided into n channels by using FDM or TDM



When end system 1 needs to communicate with end system 5, system 1 needs to request a connection to 5 that must be accepted by all switches as well as by 5 itself. This is called the setup phase; a circuit (channel) is reserved on each link, and the combination of circuits or channels defines the dedicated path. After the dedicated path made of connected circuits (channels) is established, data transfer can take place. After all data have been transferred, the circuits are shutdown.

The main prosperity of Circuit switching

- 1: Circuit switching takes place at the physical layer.
- 2: Reservation for the resources.
- 3: Data transferred between the two stations are not packetized (physical layer transfer of the signal).
- 4: no addressing need.

6.1.1 Circuit switching phase

The actual communication in a circuit-switched network requires three phases: 1: connection setup. 2: data transfer. 3: connection teardown.

Setup Phase

Before the two parties (or multiple parties in a conference call) can communicate, a dedicated circuit (combination of channels in links) needs to be established. The end systems are normally connected through dedicated lines to the switches, so connection setup means creating dedicated channels between the switches.

For example when system A needs to connect to system M, it sends a setup request that includes the address of system M. In the next step to making a connection, an acknowledgment from system M needs to be sent in the opposite direction to system A. Only after system A receives this acknowledgment is the connection established.

Note that end-to-end addressing is required for creating a connection between the two end systems.

Data Transfer Phase

After the establishment of the dedicated circuit (channels), the two parties can transfer data.

Teardown Phase

When one of the parties needs to disconnect, a signal is sent to each switch to release the resources.

6.2 Packet-switched network

If the message is going to pass through a packet-switched network, it needs to be divided into packets of fixed or variable size. The size of the packet is determined by the network and the governing protocol.

In packet switching, there is no resource allocation for a packet. This means that there is no reserved bandwidth on the links, and there is no scheduled processing time for each packet. Resources are allocated on demand. In a packet switching network, each packet is treated independently of all others. Even if a packet is part of a multi packet transmission, the network treats it as though it existed alone. Packets in this approach are done at the network layer. No connection need before data begin transfer. All packets belong to the same message may be travel in different paths to reach their destination.

If there are no setup or teardown phases, how are the packets routed to their destinations? In this type of network, each switch (or packet switch) has a routing table which is based on the destination address. The routing tables are dynamic and are updated periodically. The destination addresses and the corresponding forwarding output ports are recorded in the tables.

Different between packet switch and circuit switch

Circuit switch	packet switch
Used for voice communication	Used for data communication
Take place at physical layer	Take place at network layer (datagram) or data link layer (virtual circuit)
There is a resources allocation	Resources allocation on demand
Data are not packetized	Data are packetized
Connection oriented	Connectionless oriented
Consist three phase (connection establishment, data transfer and connection teardown)	Consist one phase to transfer
Use same path to transfer all data	Use different path to transfer all packet