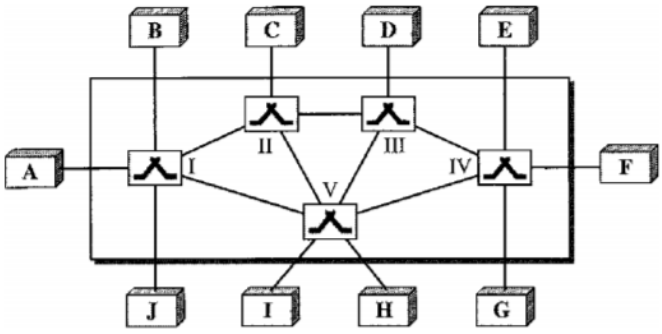
Unit-II

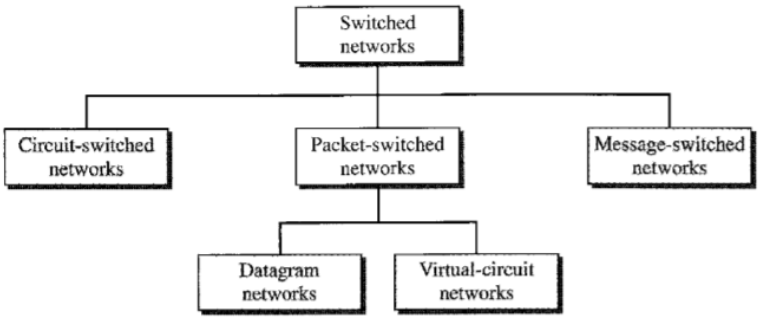
Switching in Networks

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. There are various topologies like Ring, Star, Bus, Mesh etc. to connect the multiple devices. These methods are impractical and wasteful when applied to very large networks.

The better solution for the above problem is **SWITCHING**. A switched network consists of a series of interlinked nodes, called switches. Switches are devices capable of creating temporary connections between two or more devices linked to the switch.

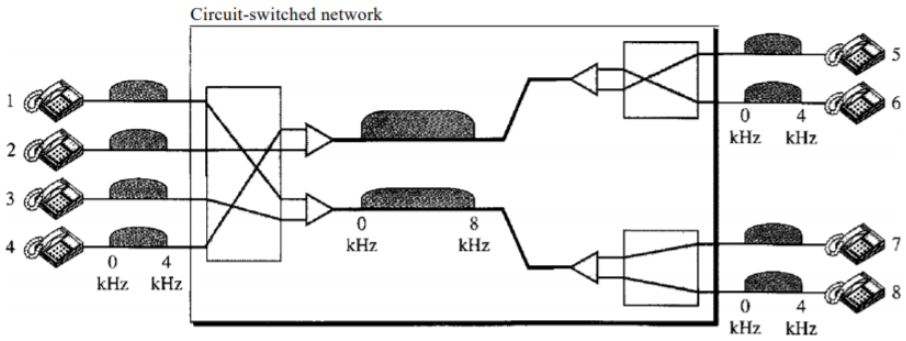


Types of Switching:



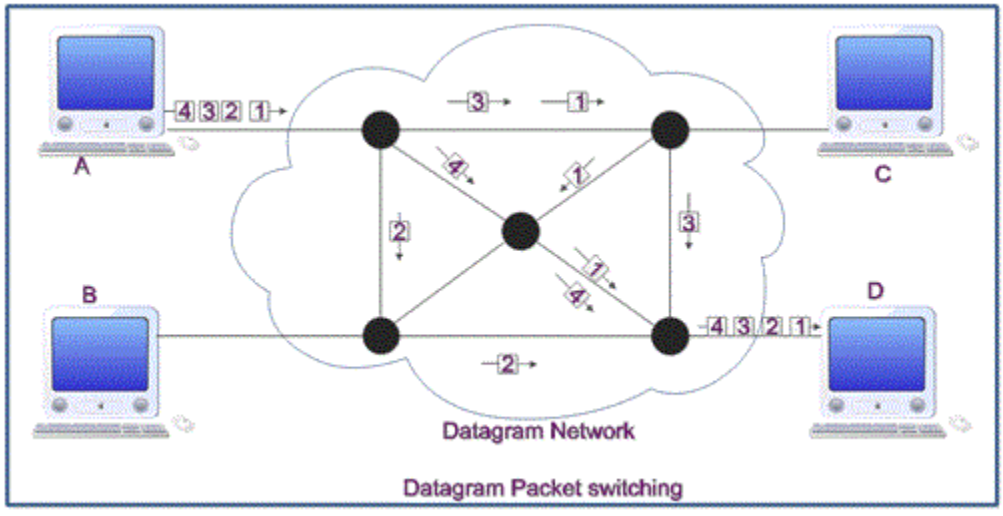
1. **Circuit Switching:** A circuit-switched network is made of a set of switches connected by physical links, in which each link is divided into n channels. The key points in circuit switching are:
   - Circuit switching takes place at the physical layer.
   - There are 3 phases:
     (i). Connection Establishment (or) Setup phase
     (ii). Data Transfer phase
     (iii). Connection Disconnection (or) Teardown phase
   - A dedicated path is established between Sender and Receiver.

- Before Starting Communication, the connection will be established first.
- The stations must make a reservation for the resources to be used during the communication. These resources, such as channels (bandwidth in FDM and time slots in TDM).
- The data are a continuous flow sent by the source station and received by the destination station, although there may be periods of silence.
- There is no addressing involved during data transfer. The switches route the data based on their occupied band (FDM) or time slot (TDM).
- Example is Telephone Network.



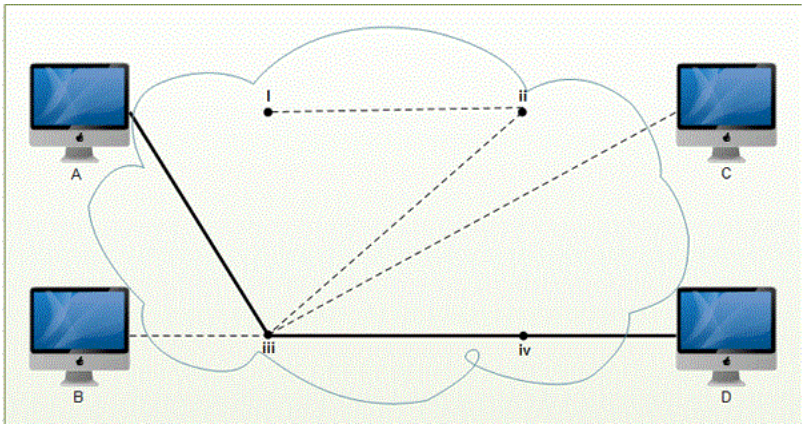
2. **Packet Switching:** Data is divided into small parts (chunks) called Packets. Packets are transmitted from node to node, processed and forwarded. It is also known as store-and-forward switching. In a packet-switched network, there is no resource reservation; resources are allocated on demand. There are Two connection types:
    - Connectionless: Datagram
    - Connection-oriented: virtual circuit

DATAGRAM NETWORKS: In a datagram 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. Datagram switching is normally done at the network layer. Example is Internet Network.



The above diagram approach is used to deliver 4 packets from station A to station D. All the four packets belong to same message but they may travel via different paths to reach the destination.

Virtual Circuit Packet Switching: In virtual circuit packet switching, a single route is chosen between the sender and receiver and all the packets are sent through this route. Every packet contains the virtual circuit number. As in circuit switching, virtual circuit needs call setup before actual transmission can be started. He routing is based on the virtual circuit number. Telephone Networks takes support of Virtual Circuit Packet Switching.



3. **Message Switching :** Circuit Switching and Packet Switching requires the following things during data transmission:

- Source and destination must be available at the time of data transfer.
- Nodes and links must be available in advance before the start of transmission and dedicated until the data transfer is completed.

When the source station does not have enough data to transmit continuously, resources are unnecessarily kept idle for the duration of time when there is no transfer of data. To avoid such situations, a different switching method called **message switching** is used. In this switching method, no dedicated physical path is established in advance. Instead, it is based on a technique called store and forward switching.

Some of the key points is Message Switching are:

- A message is a logical unit of information and can be of any length.
- In message switching, if a station wishes to send a message to another station, it first adds the destination address to the message.
- Each message is treated as an independent unit.
- In message switching, each complete message is then transmitted from device to device through the internetwork *i.e.* message is transmitted from the source node to intermediate node.
- The intermediate node stores the complete message temporarily, inspects it for errors and transmits the message to the next node based on an available free channel and its routing information. Because of this reason message switched networks are called store and forward network.

- The actual path taken by the message to its destination is dynamic as the path is established as it travels along.
- When the message reaches a node, the channel on which it came is released for use by another message.