Switching

Switching is the process of transferring data packets from one device to another in a network, or from one network to another, using specific devices called switches.

A computer user experiences switching all the time for example, accessing the Internet from your computer device, whenever a user requests a webpage to open, the request is processed through switching of data packets only.

Switching takes place at the Data Link layer of the OSI Model. This means that after the generation of data packets in the Physical Layer, switching is the immediate next process in data communication.

It is operated in full duplex mode.

Packet collision is minimum as it directly communicates between source and destination.

It does not broadcast the message as it works with limited bandwidth.

Why is Switching Concept required?

Switching concept is developed because of the following reasons:

Bandwidth: It is defined as the maximum transfer rate of a cable. It is a very critical and expensive resource. Therefore, switching techniques are used for the effective utilization of the bandwidth of a network.

Collision: Collision is the effect that occurs when more than one device transmits the message over the same physical media, and they collide with each other.

To overcome this problem, switching technology is implemented so that packets do not collide with each other.

Advantages of Switching:

- ✓ Switch increases the bandwidth of the network.
- ✓ It reduces the workload on individual PCs as it sends the information to only that device which has been addressed.
- ✓ It increases the overall performance of the network by reducing the traffic on the network.
- ✓ There will be less frame collision as switch creates the collision domain for each connection.

Disadvantages of Switching:

- ✓ A Switch is more expensive than network bridges.
- ✓ A Switch cannot determine the network connectivity issues easily.
- ✓ Proper designing and configuration of the switch are required to handle multicast packets.

Switching techniques

In large networks, there can be multiple paths from sender to receiver.

The switching technique will decide the best route for data transmission.

Switching technique is used to connect the systems for making one-to-one communication.

**Classification Of Switching Techniques**
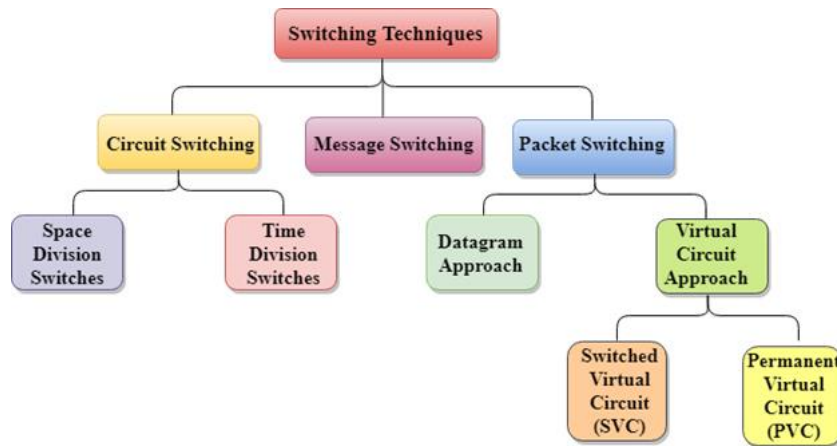
Circuit Switching
- ✓ a dedicated path between sender and receiver.
- ✓ once the connection is established then the dedicated path will remain to exist until the connection is terminated.
- ✓ operates in a similar way as the telephone works.
- ✓ A complete end-to-end path must exist before the communication takes place.
- ✓ when any user wants to send the data, voice, video, a request signal is sent to the receiver then the receiver sends back the acknowledgment to ensure the availability of the dedicated path.
- ✓ After receiving the acknowledgment, dedicated path transfers the data.
- ✓ used in public telephone network. It is used for voice transmission.
- ✓ Fixed data can be transferred at a time in circuit switching technology.

Communication through circuit switching has 3 phases:
- ✓ Circuit establishment
- ✓ Data transfer
- ✓ Circuit Disconnect
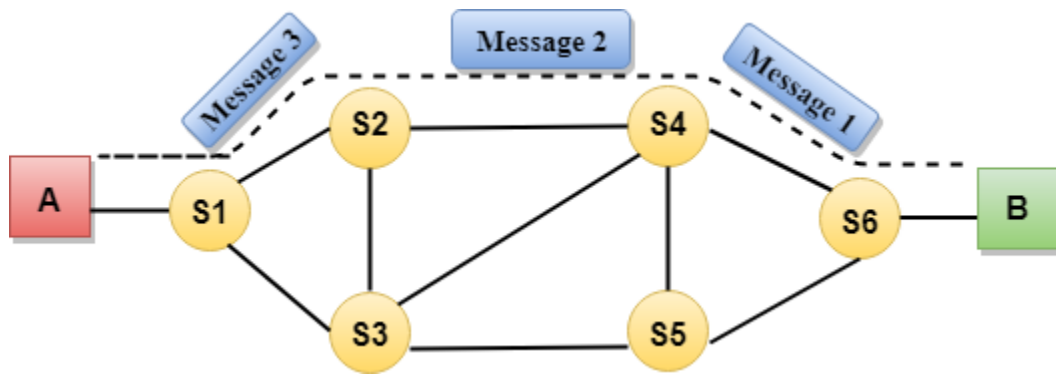
Advantages Of Circuit Switching:

- ✓ the communication channel is dedicated.
- ✓ It has fixed bandwidth.

Disadvantages Of Circuit Switching:

- ✓ Once the dedicated path is established, the only delay occurs in the speed of data transmission.
- ✓ It takes a long time to establish a connection approx 10 seconds during which no data can be transmitted.
- ✓ It is more expensive than other switching techniques as a dedicated path is required for each connection.
- ✓ It is inefficient to use because once the path is established and no data is transferred, then the capacity of the path is wasted.
- ✓ In this case, the connection is dedicated therefore no other data can be transferred even if the channel is free.

Message Switching

- ✓ a message is transferred as a complete unit and routed through intermediate nodes at which it is stored and forwarded.
- ✓ In Message Switching technique, there is no establishment of a dedicated path between the sender and receiver.

- ✓ The destination address is appended to the message. Message Switching provides a dynamic routing as the message is routed through the intermediate nodes based on the information available in the message.
- ✓ Message switches are programmed in such a way so that they can provide the most efficient routes.
- ✓ Each and every node stores the entire message and then forward it to the next node. This type of network is known as **store and forward network.**
- ✓ Message switching treats each message as an independent entity.
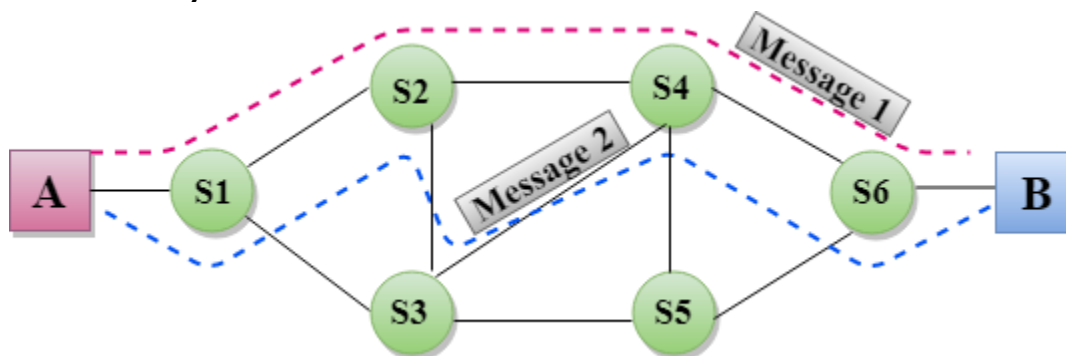
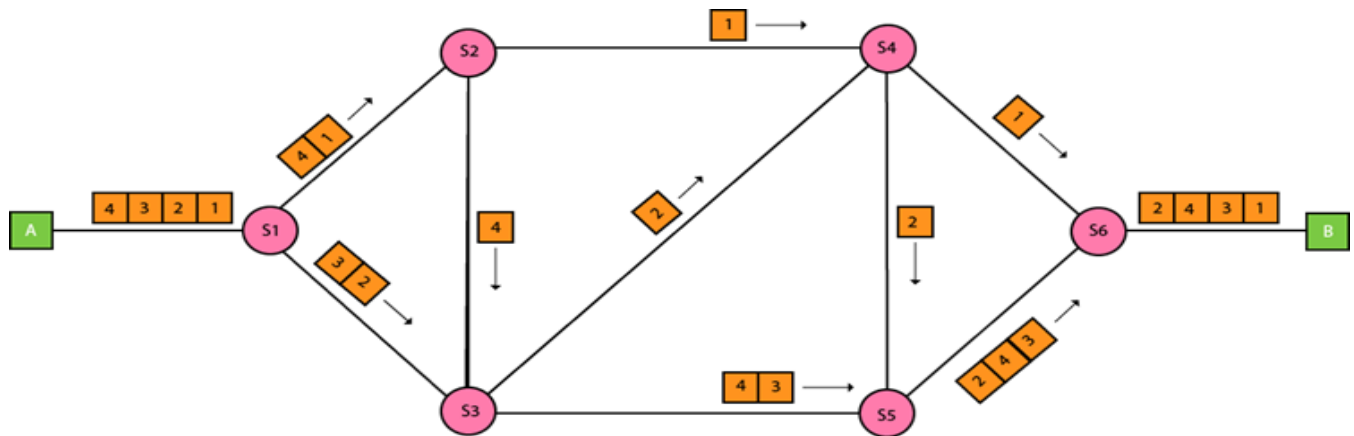

Advantages Of Message Switching
- ✓ Data channels are shared among the communicating devices that improve the efficiency of using available bandwidth.
- ✓ Traffic congestion can be reduced because the message is temporarily stored in the nodes.
- ✓ Message priority can be used to manage the network.
- ✓ The size of the message which is sent over the network can be varied. Therefore, it supports the data of unlimited size.

Disadvantages Of Message Switching

- ✓ The message switches must be equipped with sufficient storage to enable them to store the messages until the message is forwarded.
- ✓ The Long delay can occur due to the storing and forwarding facility provided by the message switching technique.

Packet Switching

- ✓ the message is sent in one go, but it is divided into smaller pieces, and they are sent individually.
- ✓ The message splits into smaller pieces known as packets and packets are given a unique number to identify their order at the receiving end.
- ✓ Every packet contains some information in its headers such as source address, destination address and sequence number.
- ✓ Packets will travel across the network, taking the shortest path as possible.
- ✓ All the packets are reassembled at the receiving end in correct order.
- ✓ If any packet is missing or corrupted, then the message will be sent to resend the message.
- ✓ If the correct order of the packets is reached, then the acknowledgment message will be sent.

Advantages Of Packet Switching:

- ✓ **Cost-effective:** switching devices do not require massive secondary storage to store the packets, so cost is minimized to some extent.
- ✓ **Reliable:** If any node is busy, then the packets can be rerouted.
- ✓ **Efficient:** does not require any established path prior to the transmission, and many users can use the same communication channel simultaneously, hence makes use of available bandwidth very efficiently.

Disadvantages Of Packet Switching:

- ✓ cannot be implemented in those applications that require low delay and high-quality services.
- ✓ The protocols used in a packet switching technique are very complex and requires high implementation cost.
- ✓ If the network is overloaded or corrupted, then it requires retransmission of lost packets.
- ✓ It can also lead to the loss of critical information if errors are nor recovered.