

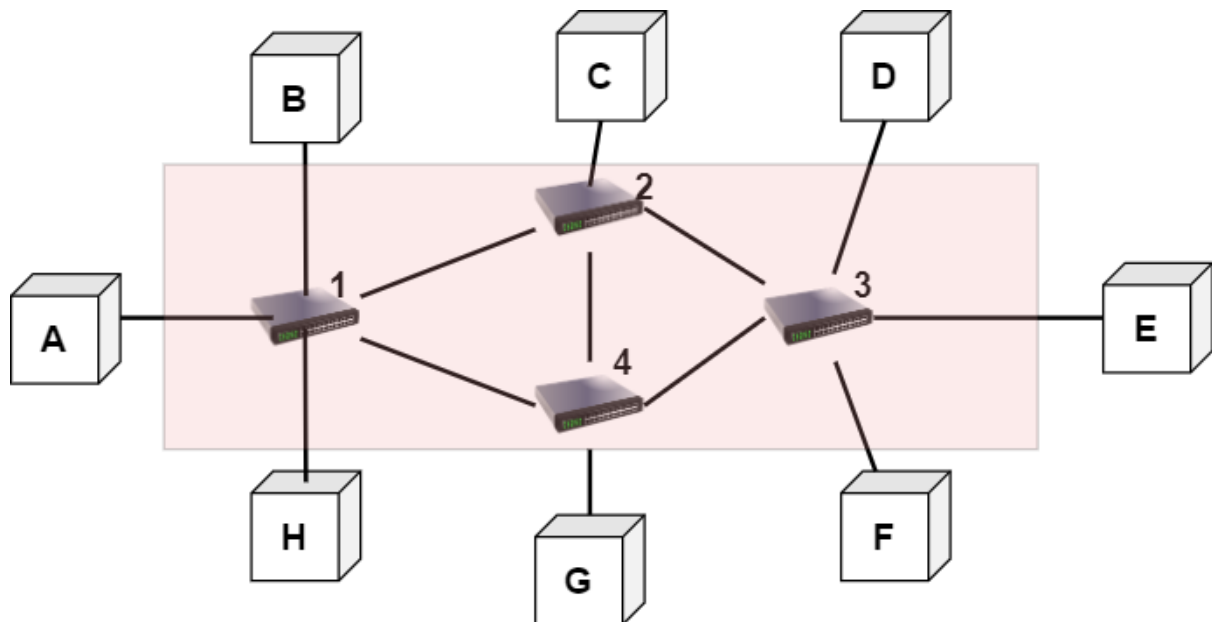
## Switching

**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**. 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.

### Switched Networks

A switched network basically consists of a series of **interlinked nodes**. These interlinked nodes are known as **switches**.

- Thus in a switched network, connectivity is usually provided by making the **use of switches**.
- Switches are those devices that are capable of creating temporary connections between two or more devices that are linked to them.
- In this network, some switches are connected to the end system (like computer systems or telephones) while other switches are used for routing.
- The network device switch is mainly a layer-2 device of the OSI model.
- Packet forwarding is done by the switch on the basis of the MAC address.
- Thus the Switch mainly transfers the data only to the device that has been addressed (means having proper mac address). Because verification of destination address is done by the switch in order to route the packet appropriately.



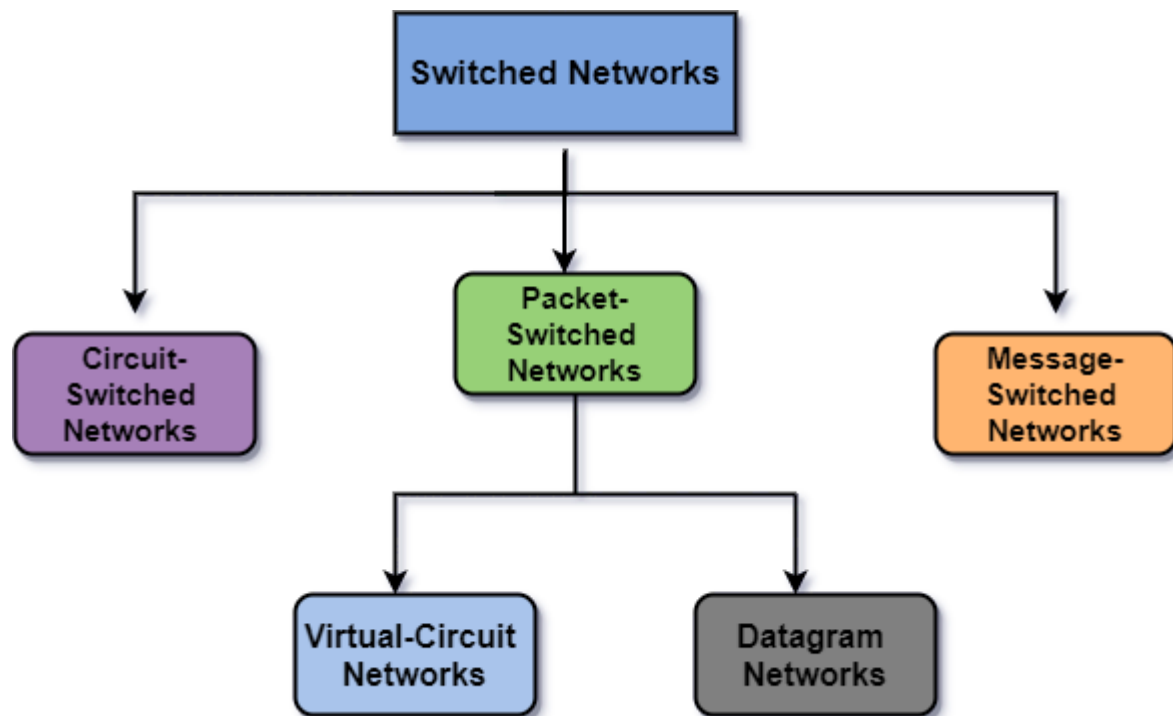
In the above figure; A, B, C, D, E, F, G, H are **end systems** or we can say communicating devices. And there are 4 switches labeled as 1,2,3,4. Also, you can see that each switch is connected to multiple links.

The concept of switching is needed for the effective utilization of the bandwidth. Also whenever two or more devices communicate with each other then there are many chances for

the occurrence of the collision of data packets in the network; switching is the best solution for this problem.

### Methods of Switching

- Circuit Switching
- Packet Switching
- Message Switching



### Circuit Switching:

In circuit switching network resources (bandwidth) are divided into pieces and bit delay is constant during a connection.

Telephone system network is one of the example of Circuit switching. **TDM (Time Division Multiplexing)** and **FDM (Frequency Division Multiplexing)** are two methods of multiplexing multiple signals into a single carrier.

- **Frequency Division Multiplexing** : *Divides into multiple bands*  
Frequency Division Multiplexing or FDM is used when multiple data signals are combined for simultaneous transmission via a shared communication medium. It is a technique by which the total bandwidth is divided into a series of non-overlapping frequency sub-bands, where each sub-band carry different signal. Practical use in radio spectrum & optical fibre to share multiple independent signals.
- **Time Division Multiplexing** : *Divides into frames*  
Time-division multiplexing (TDM) is a method of transmitting and receiving independent signals over a common signal path by means of synchronized switches at

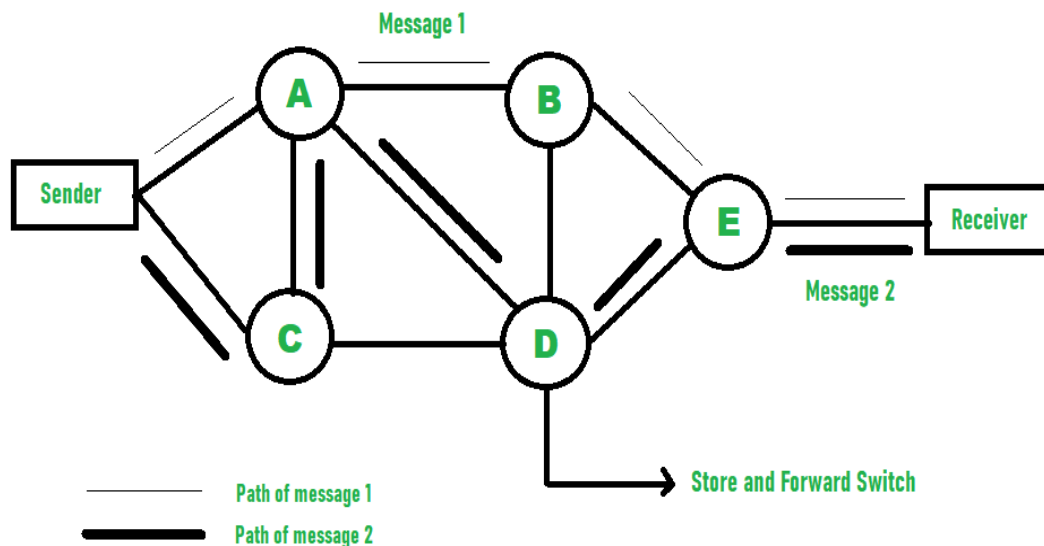
each end of the transmission line. TDM is used for long-distance communication links and bears heavy data traffic loads from end user.

Time division multiplexing (TDM) is also known as a digital circuit switched.

- **Message Switching :**

In this technique, the entire message is transmitted without any break from one node to another. It firstly stores and then forwards information that requires more time. Due to this, the access time is increased. No direct link is present between the sender and the receiver.

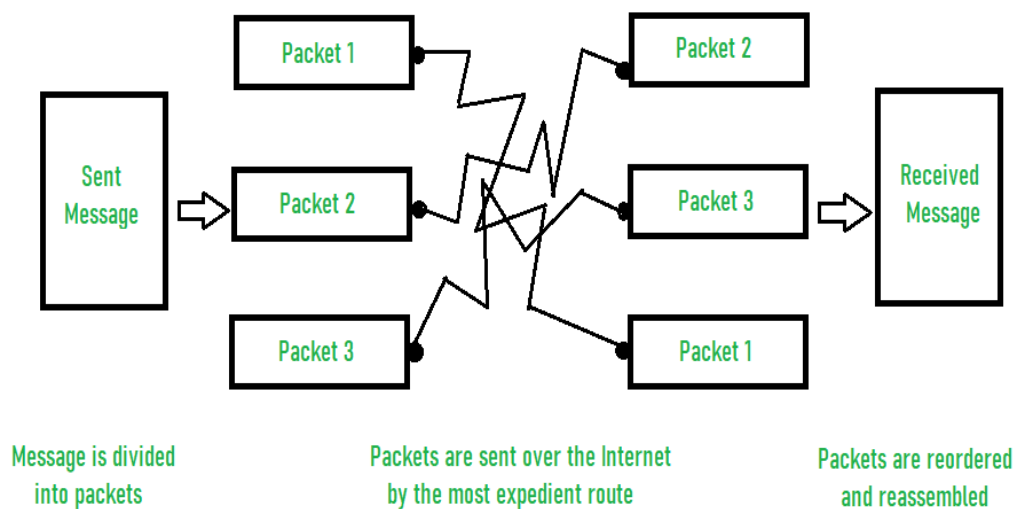
- Example of message switching –



- **2. Packet Switching :**

In packet switching, information is transferred in the form of data packets between the sender and the receiver. These packets are forwarded one by one from the sender to the receiver. Each packet is associated with a Header. Then, these packets then reassembled into the original message. This improves the performance as the time require to access the data packet is reduced. Due to this, the overall performance of the network is improved.

- Example of packet switching –



- **Difference between Message and Packet Switching :**

<b>Message Switching</b>	<b>Packet Switching</b>
A complete message is passed across a network.	Message is broken into smaller units known as Packets.
In this, computer language used is ASCII, baudot, morse.	In packet switching, binary type is used.
In message switching there is no limit on block size.	Packet switching places a tight upper limit on block size.
Message exist only in one location in the network.	Parts i.e. packets of the message exist in many places in the network.
Example: Hop-by-hop Telex forwarding and UUCP(UNIX-to-UNIX Copy Protocol)	Example: Frame Relay, IP, and X. 25
Physical links are allocated dynamically.	Virtual links are made simultaneously.
Access time is reduced due to increase in performance as packets are stored in disk.	Packets are stored in main memory.