

Networking Essentials

ITC 2243

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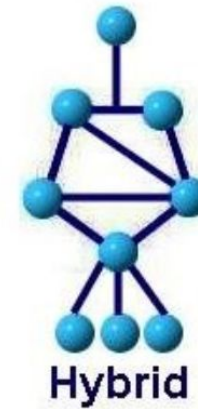
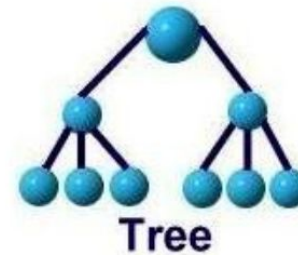
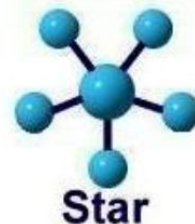
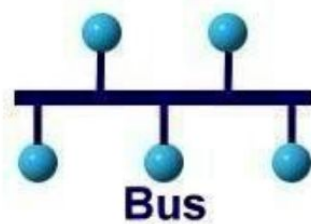
PHD (IS-READING), MSC (CS), PGD (CS), BSC (IT), DIP (TECH, IT), CCNA, NSE (CERT)

1) What is a Topology?

- A network topology describes the physical connections and logical communication pathways between objects in a network.
- The term is used to describe a variety of networking concepts.
- Topologies are used to describe connections between computers (or hosts) in a network, between routers in a network, or even between wide area network connections.
- There are two types of topologies.
 - ✓ Physical
 - ✓ Logical

Physical Topology

- A Physical Topology describes the way in which the devices are connected.
- It reflects physical layout of devices and cables to form a connected network.

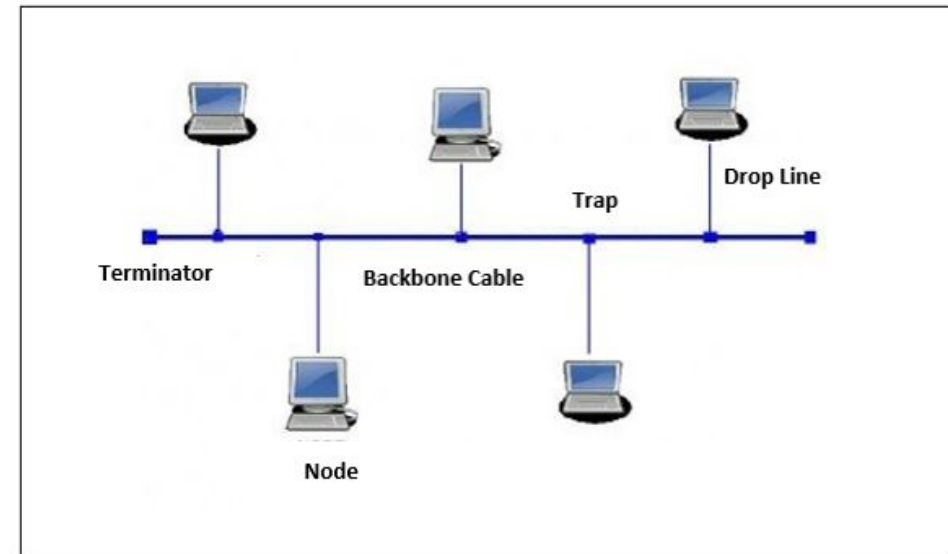


Logical Topology

- Logical topology means how the network device layout will be shown and how the data will be transferred.
- Logical Topology reflects arrangement of devices and their communication. It is the transmission of data over physical topology.
- Only Star and Bus topology is a part of logical topology.

Bus Topology

- In Bus topology, all devices share single communication line or cable.
- Bus topology either uses [CSMA/CD](#) technology or recognises one host as Bus Master to solve the issue while multiple hosts sending data at the same time.
- A failure of a device does not affect the other devices. But a failure of the shared communication line can make all other devices stop functioning.
- Both ends of the shared channel have a line terminator.
- The data is sent in only one direction and as soon as it reaches the extreme end, the terminator removes the data from the line.



Bus Topology

Advantages

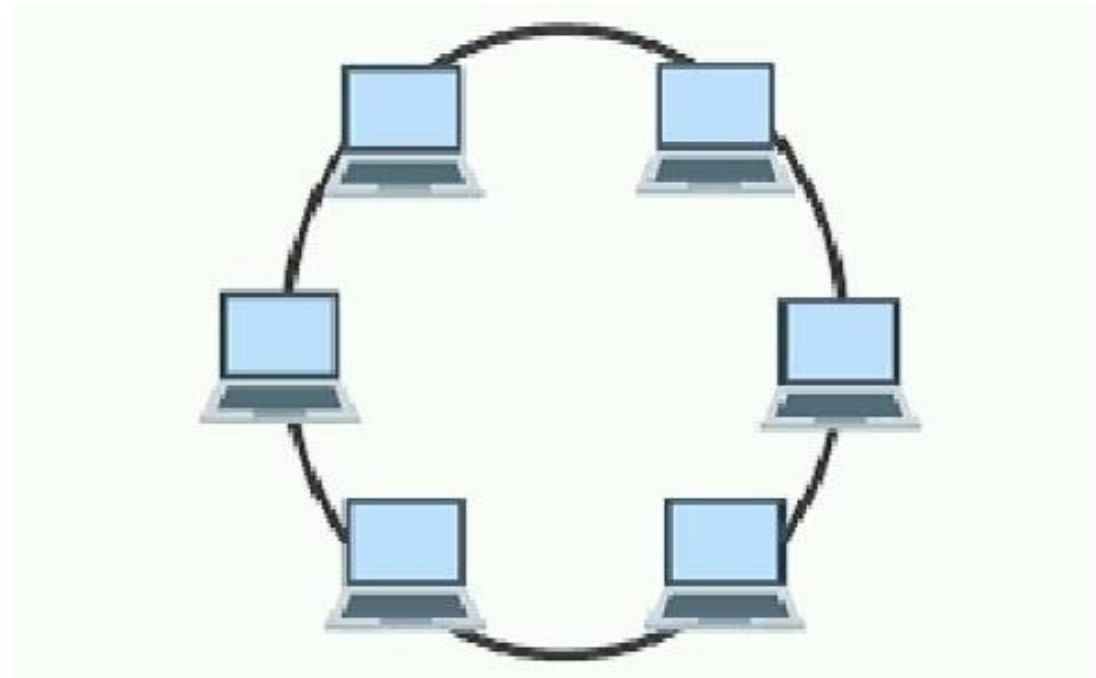
- 1) Easy to connect a computer or peripheral
 - 2) Requires less cable length than a star topology
 - 3) Inexpensive to install
 - 4) Works well for small networks
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Disadvantages

- 1) Entire network shuts down if there is a break in the main cable
 - 2) Terminators are required at both ends of the backbone cable
 - 3) Difficult to identify the problem if the entire network shuts down
 - 4) No longer recommended
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Ring Topology

- In ring topology, each host machine connects to exactly two other machines, creating a circular network structure.
- When one host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts.
- To connect one more host in the existing structure, the administrator may need only one more extra cable.
- Failure of any host results in failure of the whole ring. Thus, every connection in the ring is a point of failure. There are methods which employ one more backup ring.



Ring Topology

Advantages

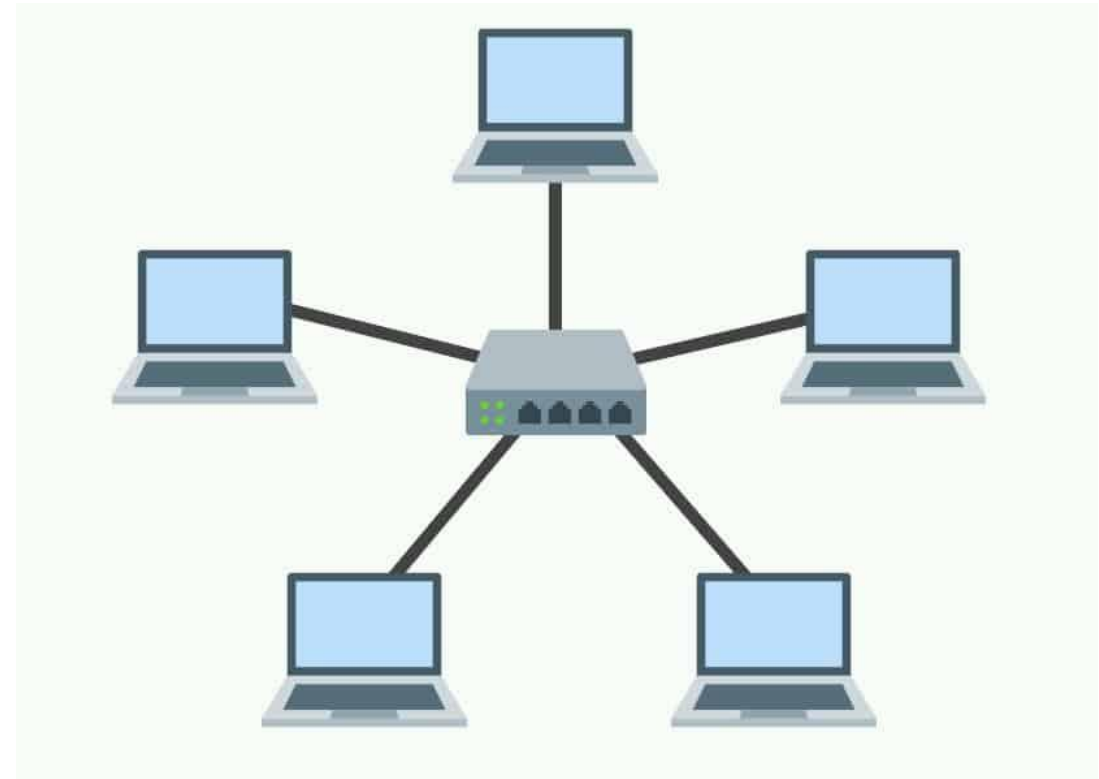
- 1) No collisions
 - 2) No hub/switch required
 - 3) Data packets can travel at great speed
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Disadvantages

- 1) Requires more cable than a bus
 - 2) A break in the ring will bring it down.
-

Star Topology

- One of the most common network setups where each of the devices and computers on a network connect to a central hub.
- If the central hub fails, the entire network becomes unusable
- Star topology is not expensive as to connect one more host, only one cable is required, and configuration is simple.



Star Topology

Advantages

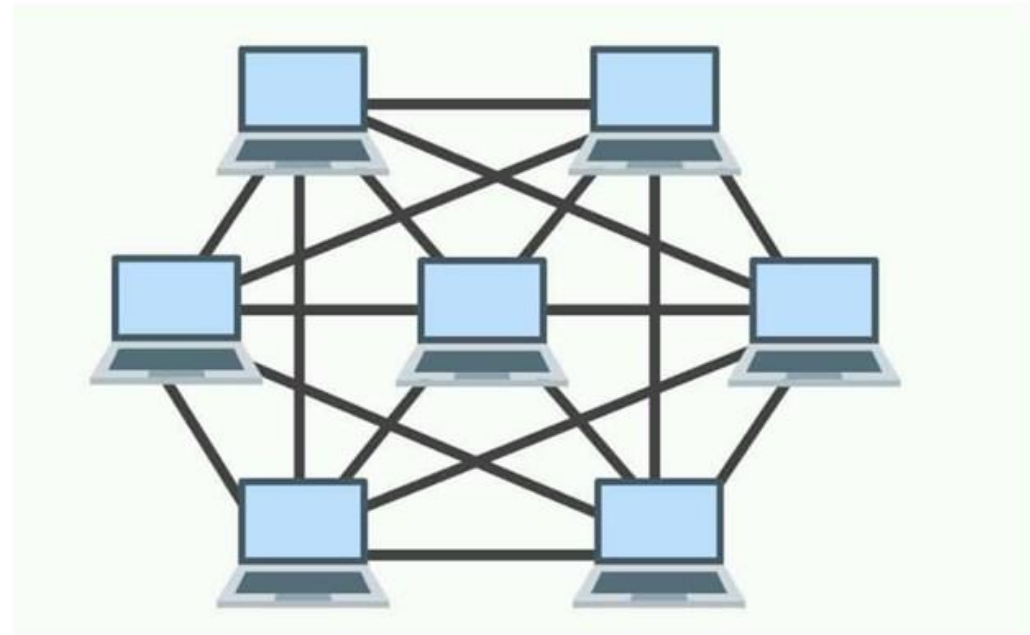
- 1) Easy to install and wire.
- 2) No disruptions to the network when connecting or removing devices.
- 3) Easy to detect faults and to remove parts.
- 4) Easy to add devices as the network expands.
- 5) One cable failure does not bring down the entire network.
- 6) Switch provides centralized management.
- 7) Lots of support as it is the most used.

Disadvantages

- 1) Requires more cable length than a linear/bus topology.
- 2) If the switch fails, the entire network fails.
- 3) More expensive than linear bus topologies.

Mesh Topology

- In this type of topology, a host is connected to one or multiple hosts.
- This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection to few hosts only.
- **Mesh technology comes in two types:**
 - ✓ **Full Mesh** - All hosts have a point-to-point connection to every other host
 - ✓ **Partial Mesh** - Not all hosts have a point-to-point connection to every other host



Mesh Topology

Advantage

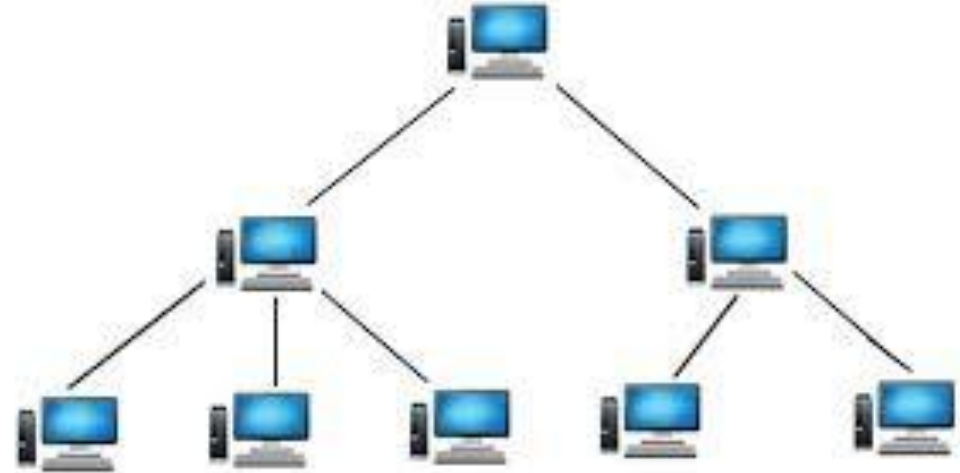
- ✓ Improves Fault Tolerance

Disadvantages

- ✓ Expensive
- ✓ Difficult to install and manage.

Tree Topology

- Also known as Hierarchical Topology, this is the most common form of network topology in use presently.
- This topology imitates an extended Star topology and inherits properties of bus topology.
- This topology divides the network into multiple levels/layers of network



Tree Topology

Advantages

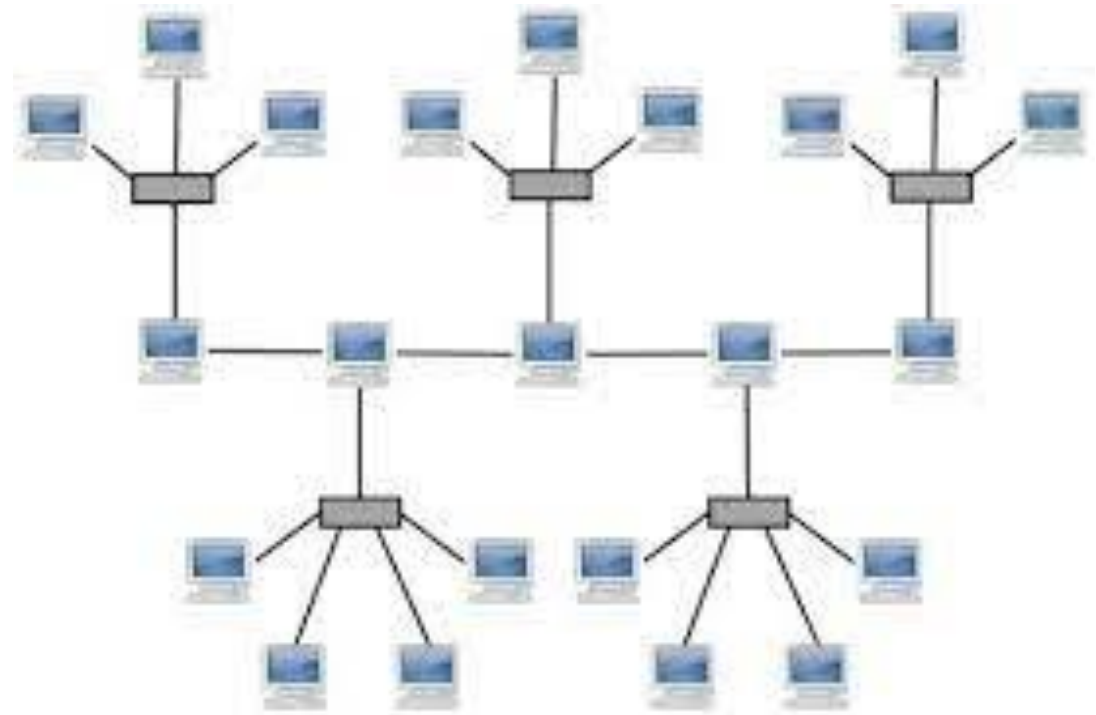
- ✓ Easier to detect errors
- ✓ Failure of a solo node will not impact other nodes

Disadvantages

- ✓ Difficulty to maintenance and configuration
- ✓ Difficulty in installation
- ✓ Costly

Hybrid Topology

- Hybrid topology is the combination of two or more networks.
- The network type could be Star, Ring, Bus, or Mesh. However, in most cases, only the Star and Ring topologies are used to create a Hybrid network.



Hybrid Topology

Advantages

- ✓ Efficiency
- ✓ Adaptability
- ✓ Scalability
- ✓ Reliable datalink and secure transmission method

Disadvantages

- ✓ High cost
- ✓ Installation challenges
- ✓ More hardware requirements

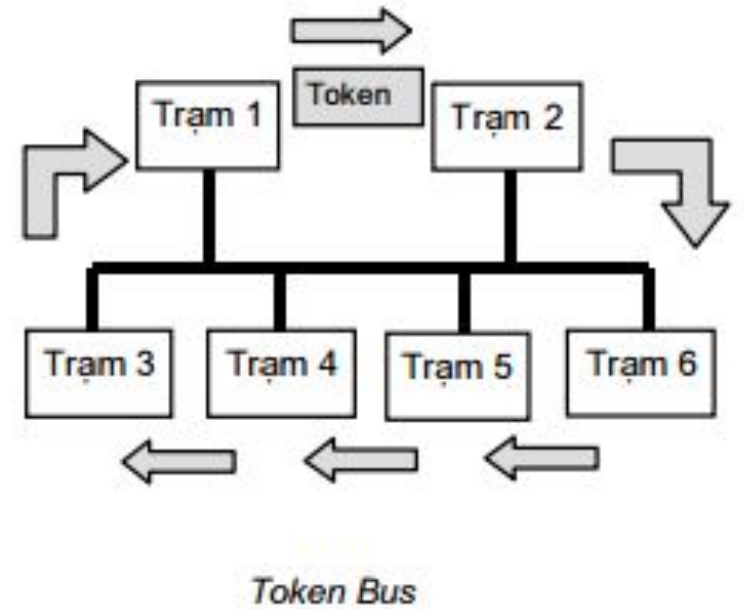
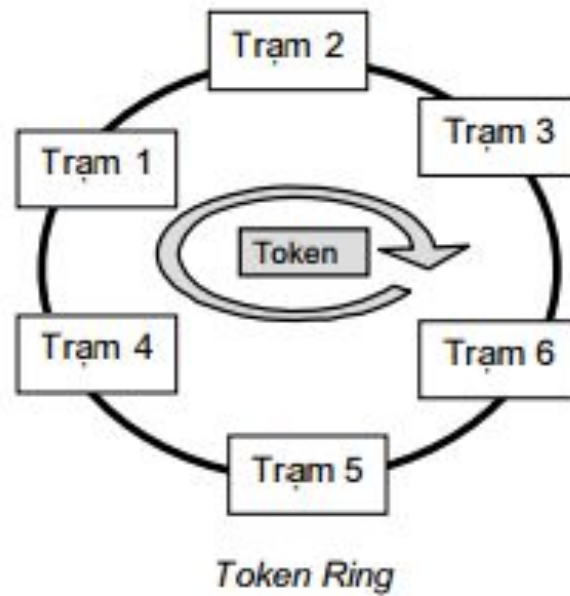
Difference Between logical and Physical Topology

Physical Topology	Logical Topology
Depicts physical layout of network.	Depicts logistics of network concerned with transmission of data.
The layout can be modified based on needs.	There is no interference and manipulation involved here.
It can be arranged in star, ring, mesh and bus topologies.	It exists in bus and ring topologies.
This has major impact on cost, scalability and bandwidth capacity of network based on selection and availability of devices.	This has major impact on speed and delivery of data packets. It also handles flow control and ordered delivery of data packets.
Physical connection of the network.	Data path followed of the network.
It is actual route concerned with transmission.	It is a high level representation of data flow.

2) Token Passing

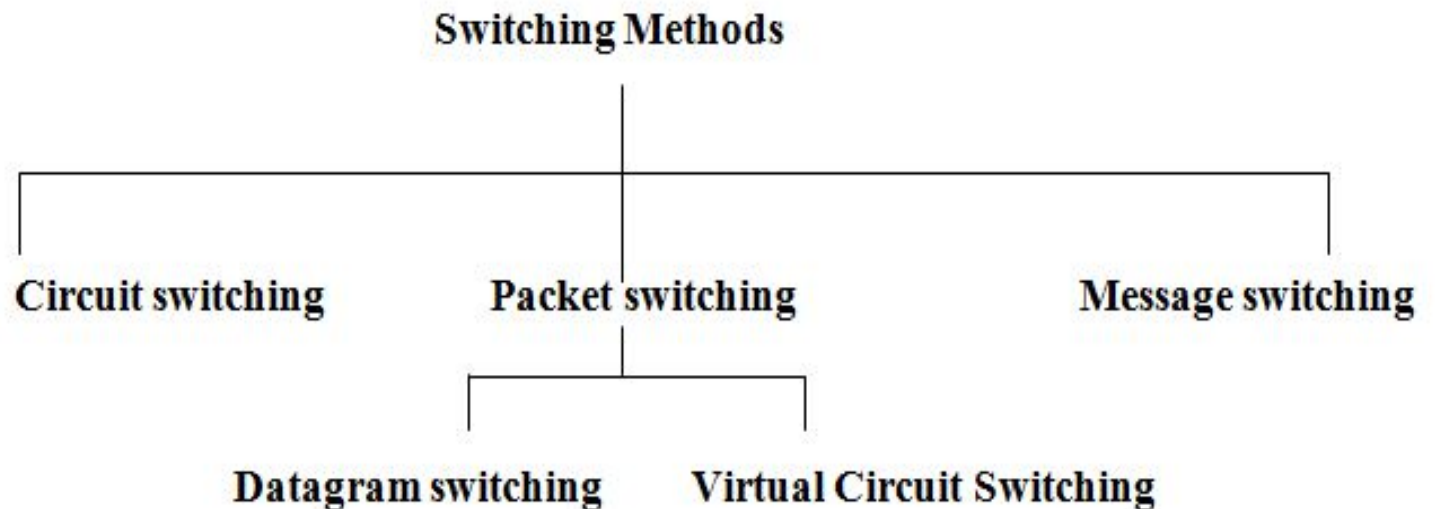
- A station is authorized to send data when it receives a special frame called frames.
- Here there is no master node.
- A small special purpose frame known as a token is exchanged among the nodes in some fixed order.
- When a node receives a token, it holds onto the token only if it has some frames to transmit: otherwise it immediately forwards the token to next node.
- If a node does have a frame to transmit when it receives the token, it sends up to a maximum number of frames and then forwards the token to next node.
- Token passing is a decentralized and high efficient. But it has problems as well.
- For example, failure of one node can crash the entire channel. Or if a node accidentally neglects to release the token, then some recovery procedure must be invoked to get the token back to the circulation.

Token Passing Example



3) Switching Technologies

- Communication networks are those in which data transferred from source to destination is routed/switched between various intermediate nodes. There are mainly three typical Switching Techniques available.



Circuit Switching

- Originated in public telephone networks.
- Well suited to Analog transmission of voice signal.
- Dedicated communication path between two stations.

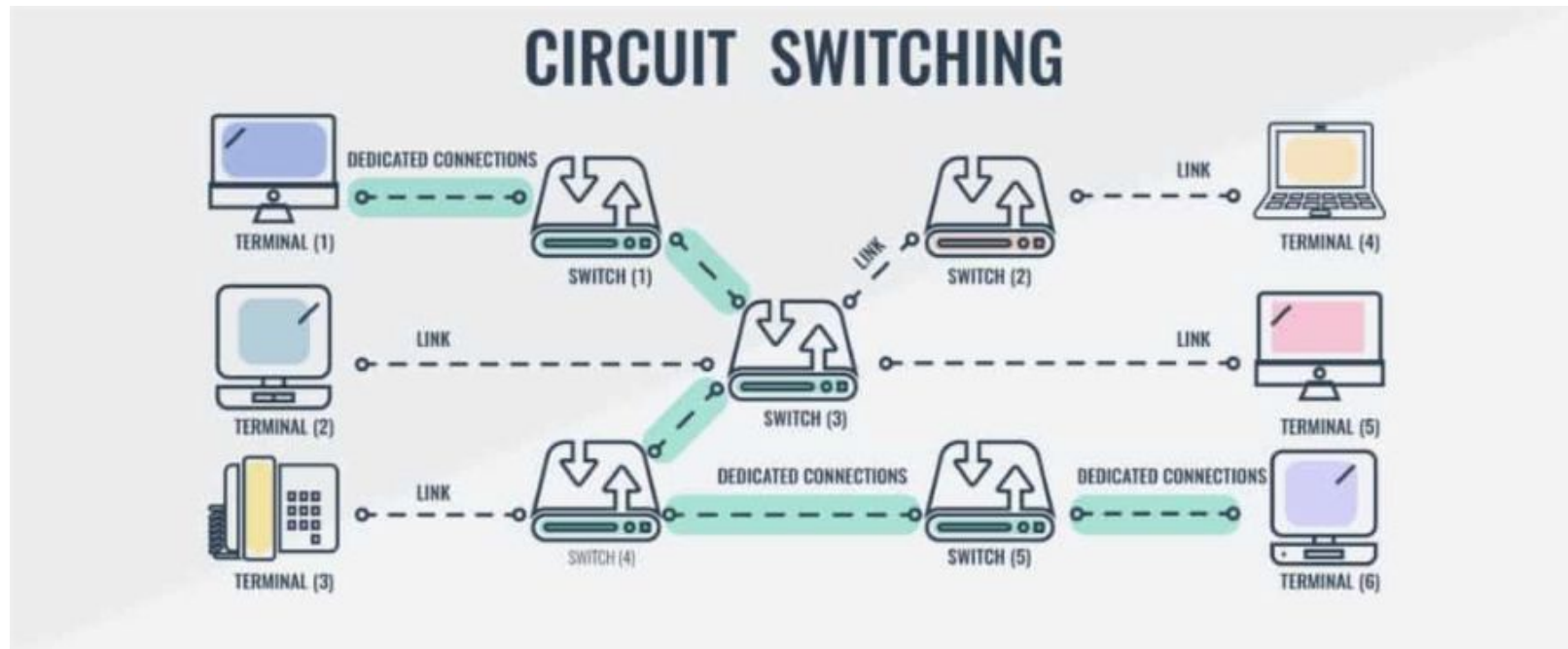
Three phases

- ✓ Establish
- ✓ Transfer
- ✓ Disconnect

- Once connected, transfer is transparent.
- Inefficient - Channel capacity dedicated for duration of connection. If no data, capacity wasted.

Circuit Switching

- Circuit switching is the oldest switching technology in the world.



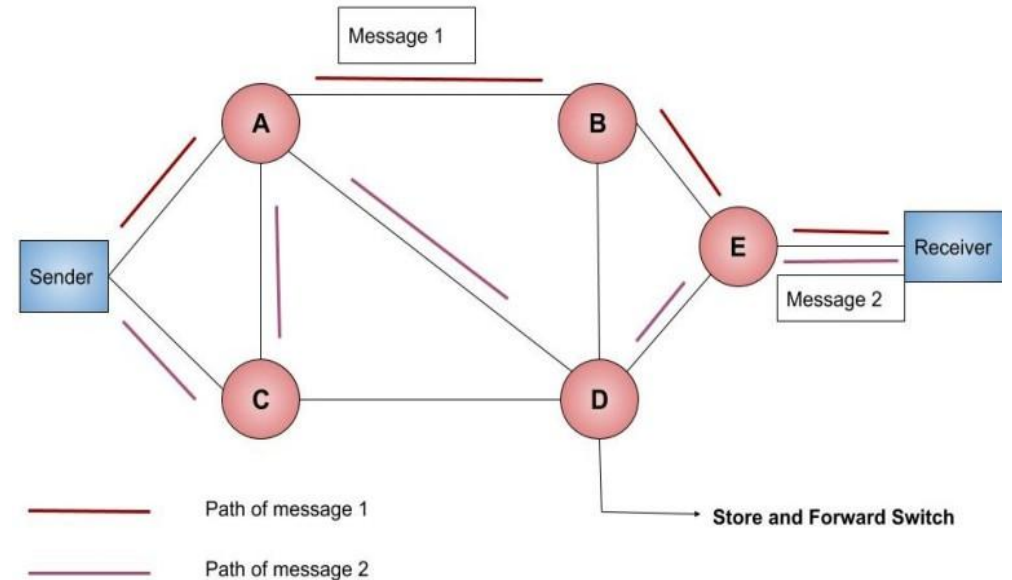
Message Switching

- An alternative switching strategy is message switching. When this form of switching is used, no physical path is established in advance between sender and receiver.
- When the sender has a block of data to be sent, it is stored in the first switching office (i.e., router) and then forwarded later, one hop at a time.
- Each block is received in its entirety, inspected for errors, and then retransmitted.
- A network using this technique is called a store-and-forward network.

Message Switching

Message switching has the following disadvantages:

1. In message switching, message has to be stored for which every intermediate devices in the network requires a large storing capacity.
2. Message switching cannot be used for real time applications as storing of messages causes delay.

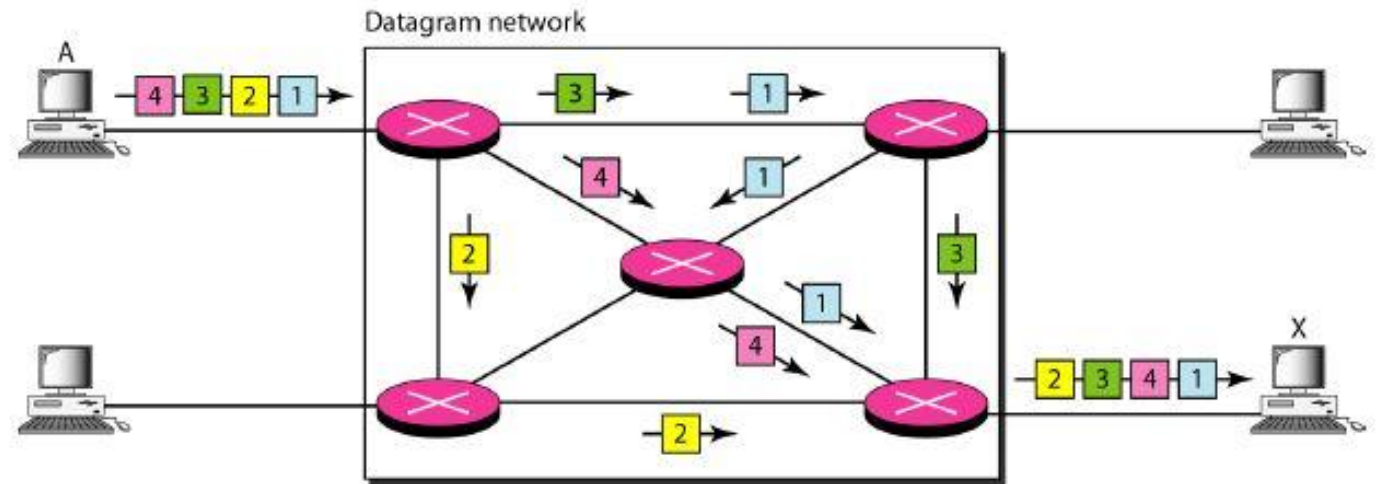


Packet Switching

- Data transmitted in small packets.
 - Longer messages are split into series of packets.
 - Each packet contains a portion of user data plus some control info. Control info - Routing (addressing) info.
 - Packets are received, stored briefly (buffered) and passed on to the next node (Store and forward).
 - There are two approaches for this.
- ✓ Datagram approach
 - ✓ Virtual circuit approach

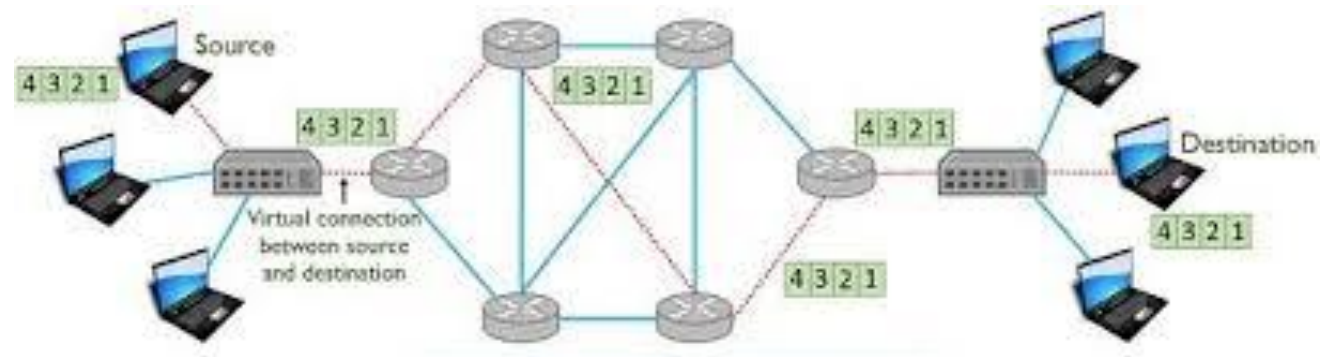
Datagram

- Each packet is treated independently
- Packets can take any practical route
- Packets may arrive out of order.
- No sequencing is guaranteed.
- Packets may go missing
- Up to receiver to re-order packets and recover from missing packets
- Reliable delivery may or may not be guaranteed.



Virtual Circuit

- Pre-planned route established before any packets sent.
- Appears to be similar to circuit switched in that all data is received in order sent.
- Call request and call accept packets establish connection (handshake).
- No routing decisions required for each packet.
- Each connection is associated with a particular Virtual Circuit Identifier.
- Provides error and flow control.
- Not a dedicated path.





Thank you!!!