



NETWORK PROTOCOLS & SECURITY 23EC2210 R/A/E

Topic:

NETWORK HARDWARE: TOPOLOGIES

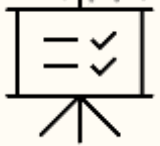
Session - 3

AIM OF THE SESSION



To familiarize students with the network topologies and different types of computer networks

INSTRUCTIONAL OBJECTIVES



This Session is designed to:

1. Demonstrate the network topologies
2. Describe the modes of data transmission.

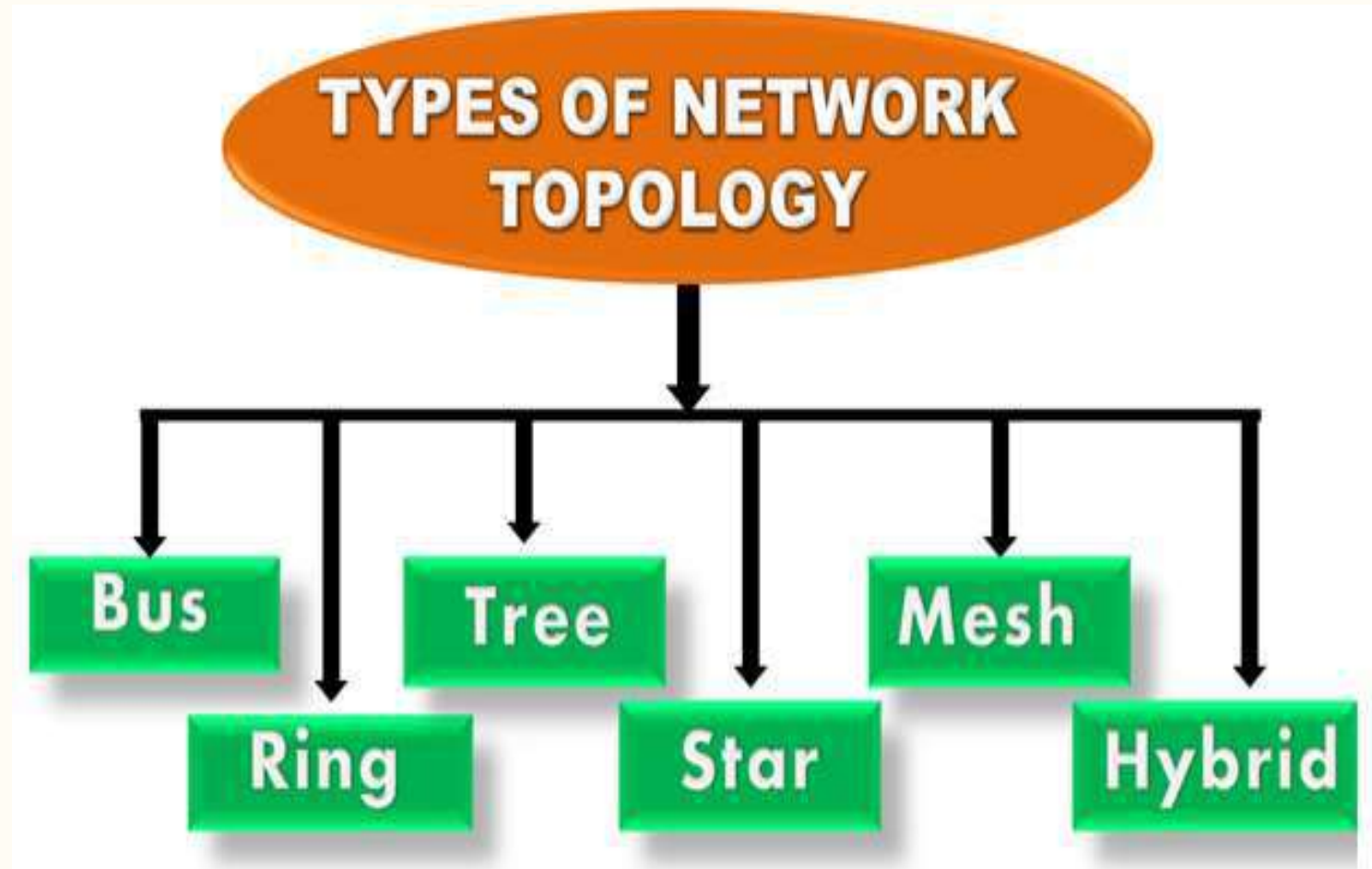
LEARNING OUTCOMES



At the end of this session, you should be able to:

1. Define topology and describe the way how systems are connected using different topologies.
2. Summarize the modes of data transmission.

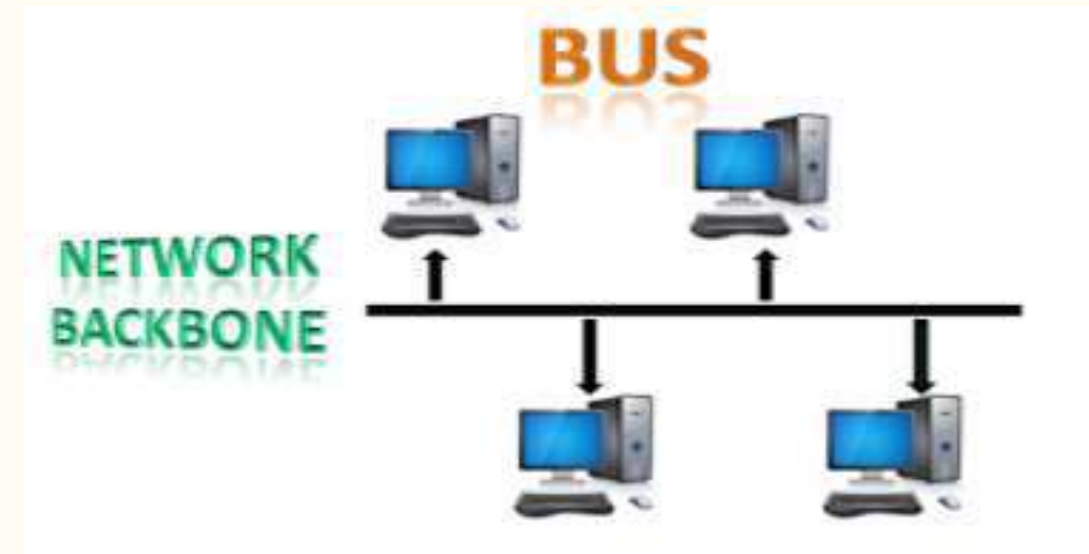
- Topology defines the structure of the network of how all the components are interconnected to each other.



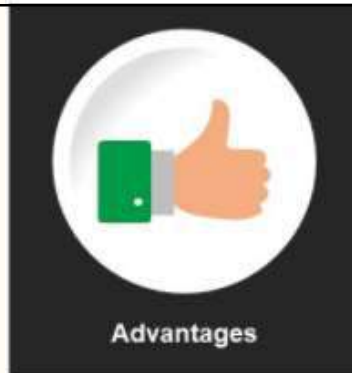
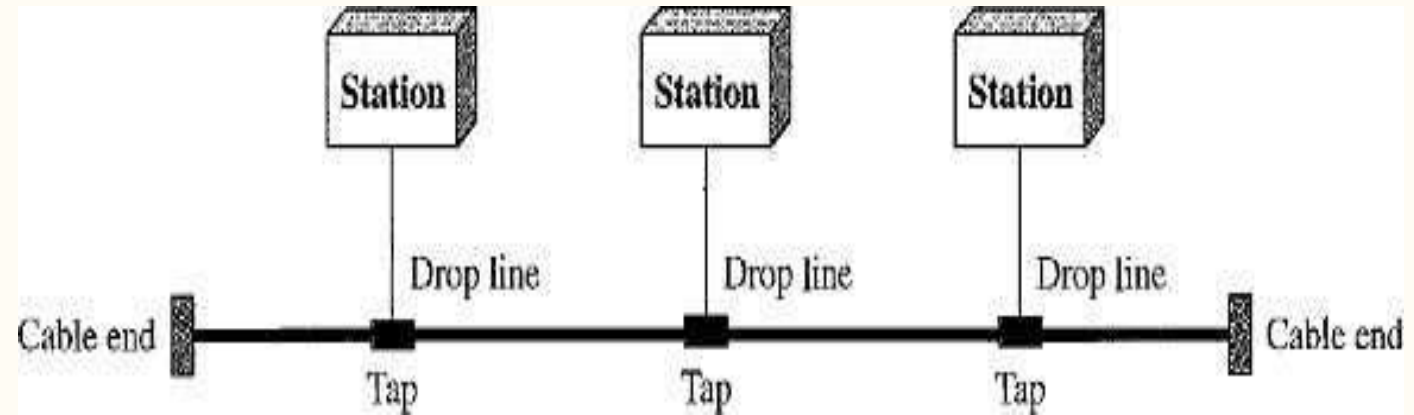
Network Topology..

Bus Topology:

- The bus topology is designed in such a way that all the stations are connected through a single cable known as a backbone cable. The backbone cable is considered as a "single lane" through which the message is broadcast to all the stations.
- When a node wants to send a message over the network, it puts a message over the network. All the stations available in the network will receive the message whether it has been addressed or not.



- Nodes are connected to the bus cable by drop lines and taps.
- A drop line is a connection running between the device and the main cable.
- A tap is a connector that splices into (attached to) the main cable.



- Installation is easy.
- A bus uses less cabling than mesh or star topologies.



- If the backbone cable fails, the entire system fails.
- There is a limit on the number of taps a bus can support and on the distance between those taps.
- More taps will generate more heat which degrades the quality of signal.

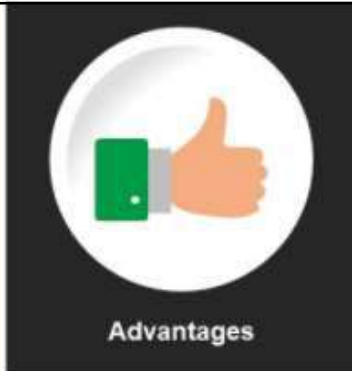
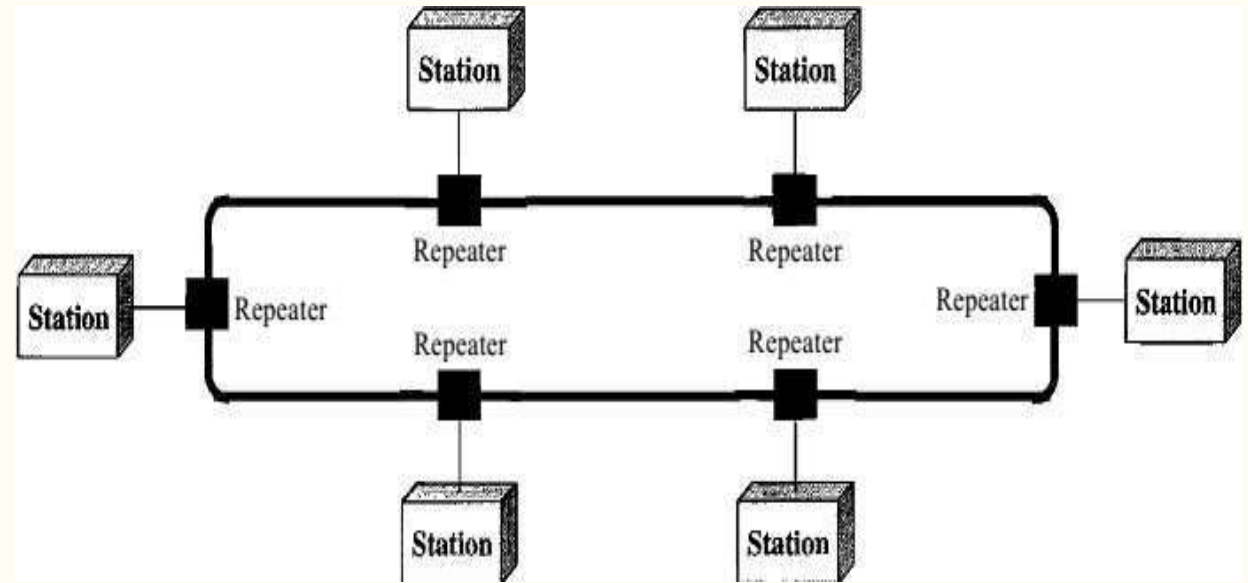
Network Topology..

Ring Topology:

- Ring topology is like a bus topology, but with connected ends.
- In a ring topology, each device has a dedicated point-to-point connection with only the two devices on either side of it.
- The node that receives the message from the previous computer will retransmit to the next node.
- A signal is passed along the ring in one direction(clockwise) from device to device, until it reaches its destination.



- Each device in the ring incorporates a repeater.
- When a device receives a signal intended for another device, its repeater regenerates the bits and passes them along.



- Easy to install and reconfigure.
- To add or delete a device requires changing only two connection.

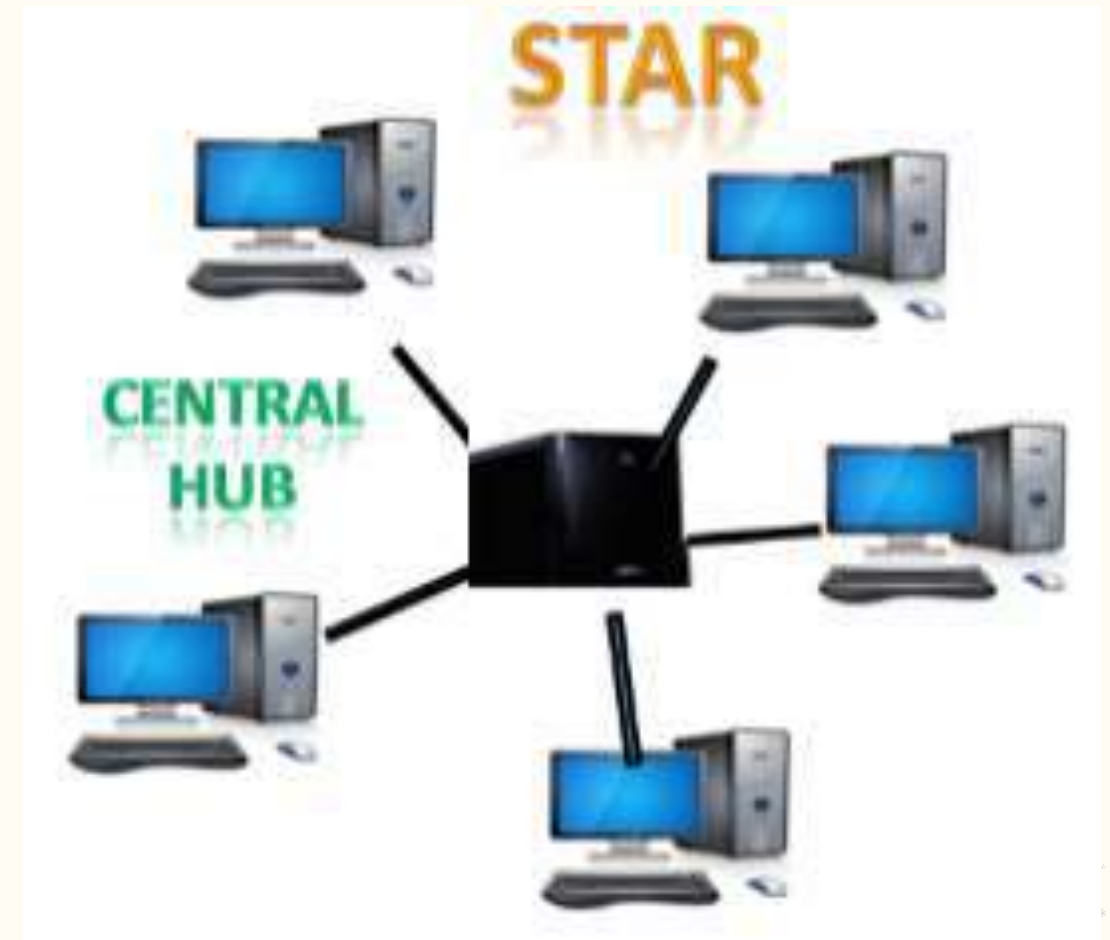


- Unidirectional traffic can be a disadvantage.
- A break in the ring (disabled station) can disable the entire network.

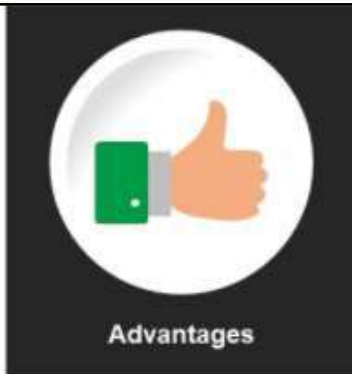
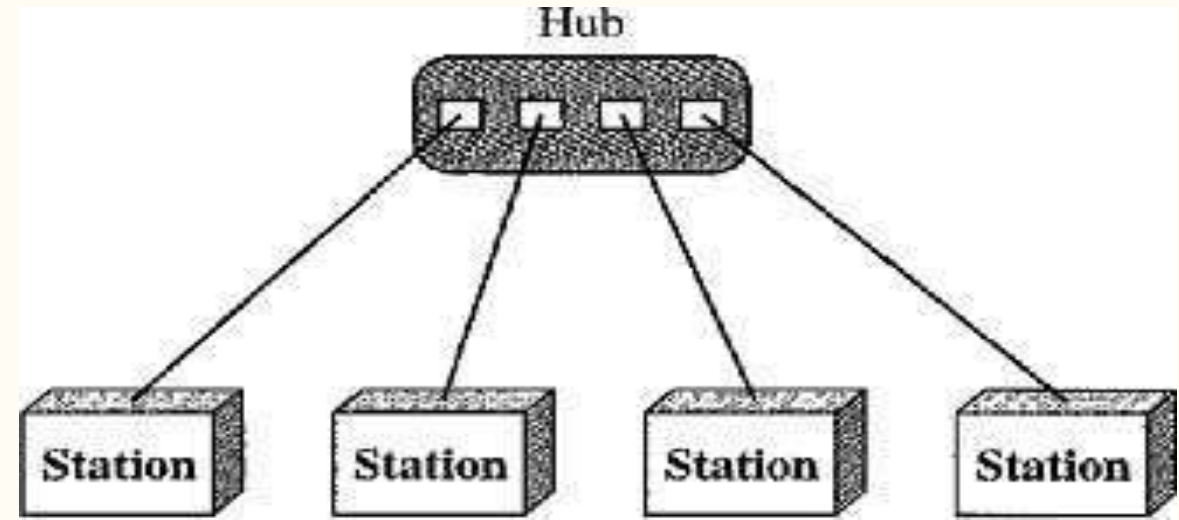
Network Topology..

Star Topology:

- Star topology is the most popular topology in network implementation.
- The devices are not directly linked to one another.
- Star topology is an arrangement of the network in which each device has a dedicated point-to-point link only to a central controller called a Hub or Switch.



- A star topology does not allow direct traffic between devices.
- The central controller acts as an exchange.



- Easy to install and reconfigure.
- Less cabling is required
- Star topology is robust, If one link fails, only that link is affected. All other links remain active.



- If hub fails, entire processing will be stopped working.

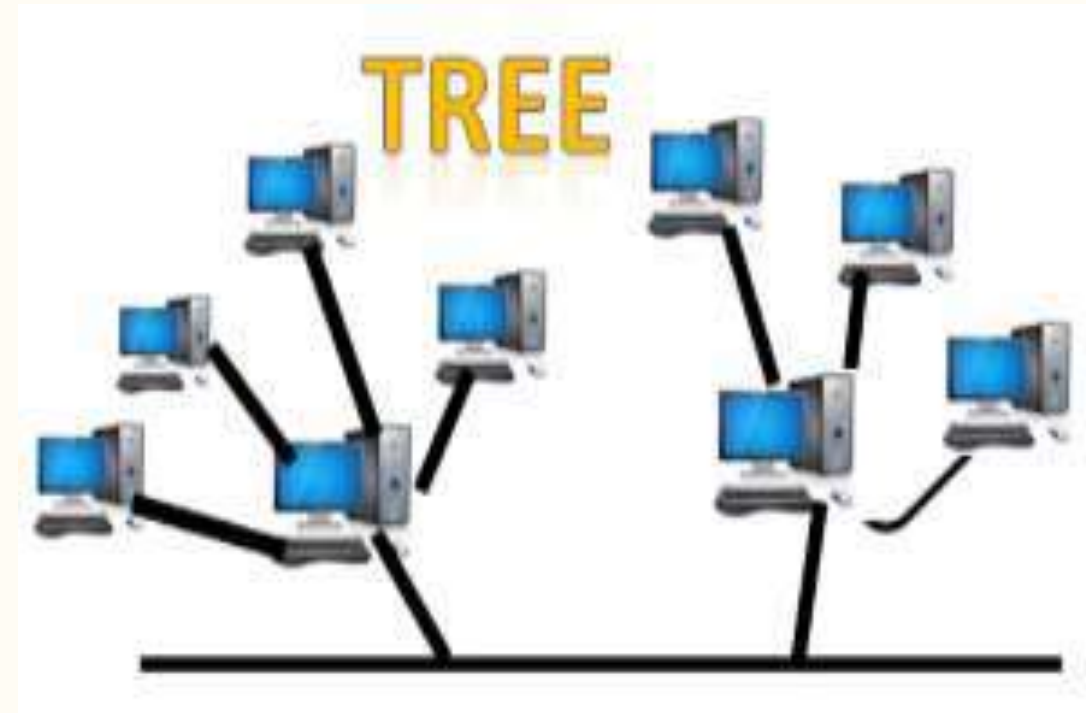
Network Topology..

Tree Topology:

- Tree topology combines the characteristics of bus topology and star topology.
- All the computers are connected with each other in hierarchical fashion.
- The top-most node in tree topology is known as a root node, and all other nodes are the descendants of the root node.
- There is only one path exists between two nodes for the data transmission. Thus, it forms a parent-child hierarchy.

Drawback:

- **Failure:** A tree topology mainly relies on main bus cable and failure in main bus cable will damage the overall network.
- **Reconfiguration difficult:** If new devices are added, then it becomes difficult to reconfigure.



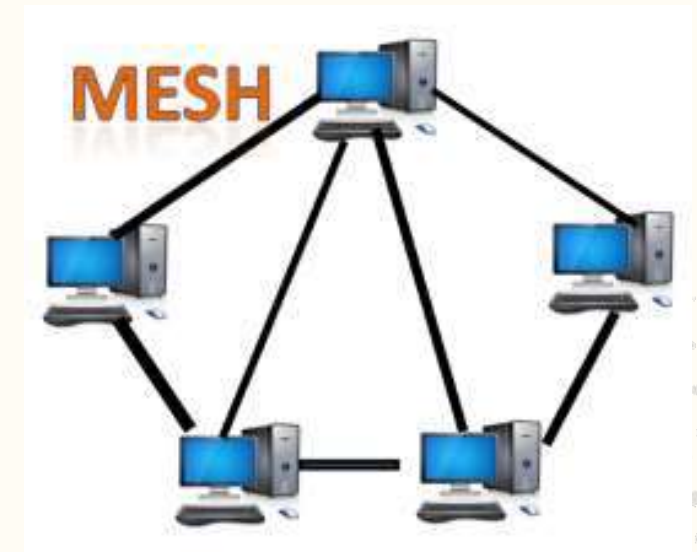
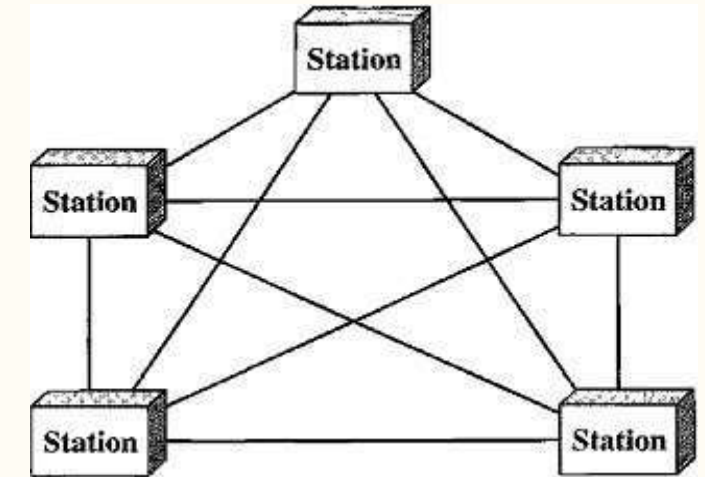
Network Topology..

Mesh Topology:

- In a mesh topology, every device has a dedicated Point-to-Point link to every other device. (i.e.) for each node there is a link to all other nodes.
- It does not contain the switch, hub or any central computer which acts as a central point of communication.
- Mesh topology is mainly used for wireless networks and Internet is an example of the mesh topology.
- Mesh topology is mainly used for WAN implementations where communication failures are a critical concern.
- Mesh topology can be formed by using the formula:
Number of cables = $(n*(n-1))/2$.

Types:

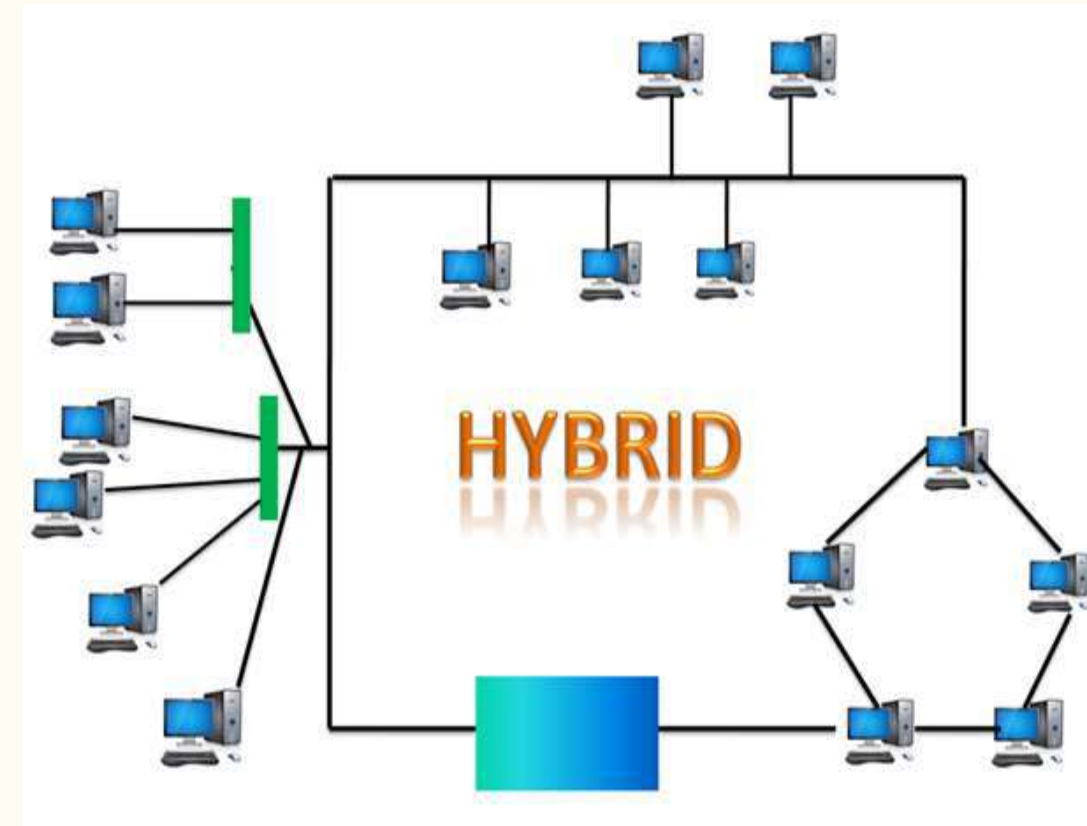
- Full Mesh Topology
- Partial Mesh Topology



Network Topology..

Hybrid Topology:

- The combination of various topologies is known as Hybrid topology.
- When two or more different topologies are combined together is termed as Hybrid topology and if similar topologies are connected with each other will not result in Hybrid topology.
- Example: if there exist a ring topology in one branch of ICICI bank and bus topology in another branch of ICICI bank, connecting these two topologies will result in Hybrid topology.



Drawbacks:

- Complex Design
- Costly Hub
- Costly Infrastructure

SELF-ASSESSMENT QUESTIONS

1. Physical or logical arrangement of network is _____

- (a) Topology
- (b) Routing
- (c) Networking
- (d) Control

2. Which network topology requires a central controller or hub?

- (a) Star
- (b) Mesh
- (c) Ring
- (d) Mesh

3. A network comprising of multiple topologies is?

- (a) Complex
- (b) Hybrid
- (c) Bus
- (d) Star

SELF-ASSESSMENT QUESTIONS - Answers

1. Physical or logical arrangement of network is _____

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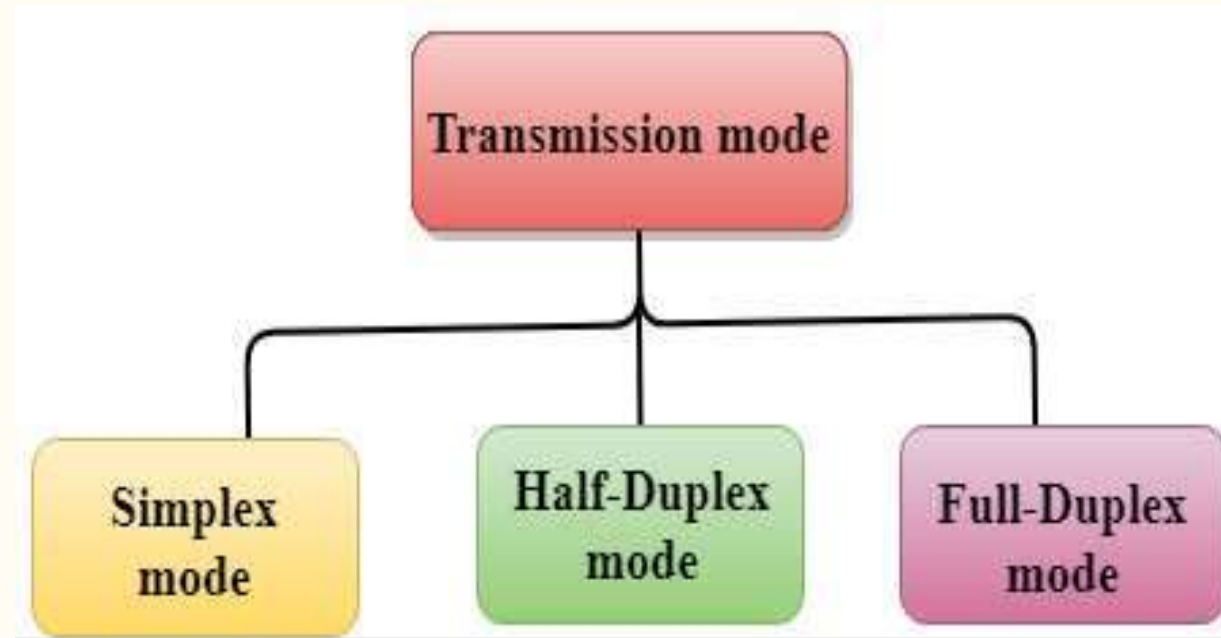
Topic Summary



Network Topologies

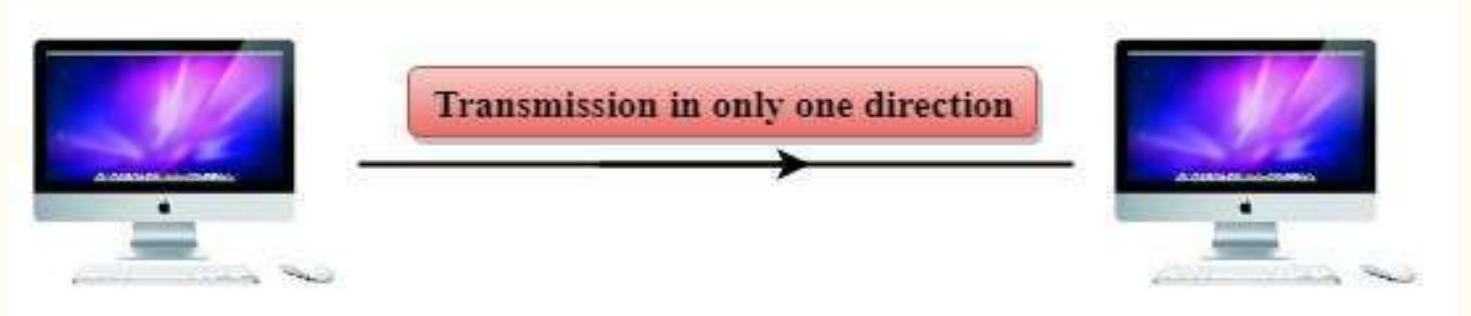
- Bus
- Ring
- Star
- Tree
- Mesh
- Hybrid

- The way in which data is transmitted from one device to another device is known as *Transmission mode*.
- Also called as Communication mode/Direction mode.
- Transmission mode is defined in physical layer.



Transmission Modes.

Simplex Mode

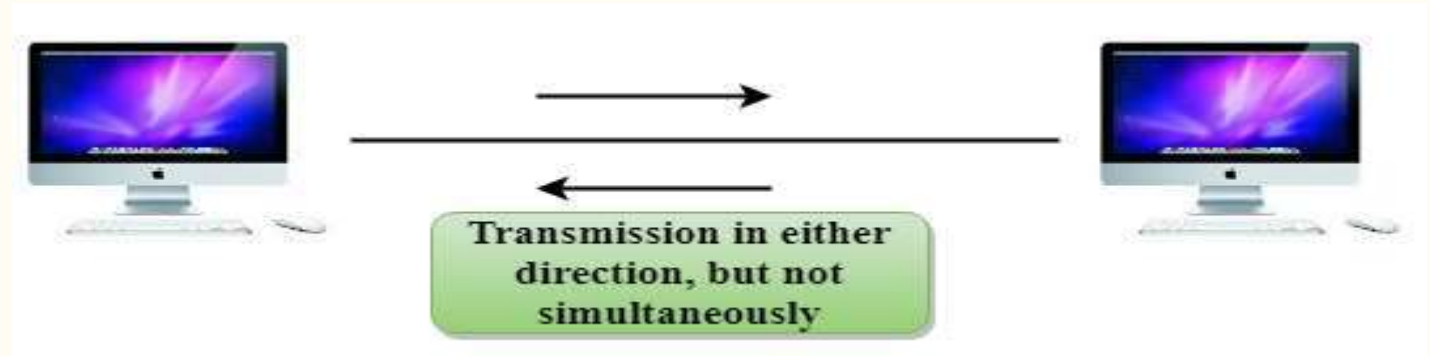


- In Simplex mode, the communication is unidirectional, i.e., the data flow in one direction.
- A device can only send the data but cannot receive it or it can receive the data but cannot send the data.
- Keyboard and Monitor are the examples of the simplex mode.



Transmission Modes...

Half-Duplex Mode

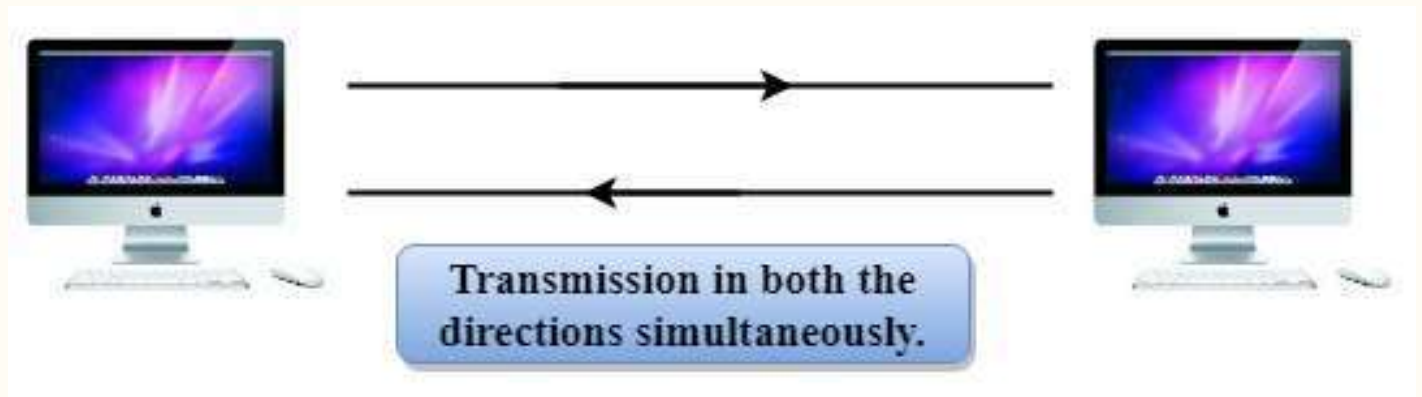


- In a Half-duplex channel, direction can be reversed, i.e., the station can transmit and receive the data as well.
- Messages flow in both the directions, but not at the same time.
- A **Walkie-talkie** is an example of the Half-duplex mode. In Walkie-talkie, one party speaks, and another party listens. After a pause, the other speaks and first party listens. Speaking simultaneously will create the distorted sound which cannot be understood.



Transmission Modes...

Full-Duplex Mode



- In Full duplex mode, the communication is bi-directional, i.e., the data flow in both the directions.
- Both the stations can send and receive the message simultaneously.
- Full-duplex mode has two simplex channels. One channel has traffic moving in one direction, and another channel has traffic flowing in the opposite direction.
- The Full-duplex mode is the fastest mode of communication between devices.

Test your knowledge

WAN stands for _____	a. World area network
	b. Wide area network
	c. Web area network
	d. Web access network
Which topology uses a single cable which connects all the including nodes?	a. Star
	b. Mesh
	c. Ring
	d. Bus
A term that defines the direction of flow of information between devices.	a. interconnectivity
	b. intra connectivity
	c. transmission mode
	d. Communication

Test your knowledge...

WAN stands for _____	a. World area network
	b. Wide area network
	c. Web area network
	d. Web access network
Which topology uses a single cable that connects all the including nodes?	a. Hybrid
	b. Mesh
	c. Ring
	d. Bus
A term that defines the direction of flow of information between devices is?	a. interconnectivity
	b. intra connectivity
	c. transmission mode
	d. Communication



Network Hardware Concepts

- Network Topologies
- Transmission modes

1. Illustrate different types of network topologies
2. Summarize the modes of data transmission.

Reference Books:

1. A.S. Tanenbaum, David J. Wetheral "Computer Networks" Pearson, 5th Edition.
2. Kurose, J and Ross, K Computer Networking: A Top-Down Approach Addison-Wesley- 6th edition.

Sites and Web links:

1. <https://www.geeksforgeeks.org/types-of-transmission-technology/>
2. https://www.tutorialspoint.com/data_communication_computer_network/computer_network_topologies.htm
3. <https://www.javatpoint.com/computer-network-transmission-modes>

THANK YOU



Team – Network Protocols & Security