



Indian Institute of Information Technology,
Nagpur

Course: Computer Networks
(CSL 302, Core)
5th Semester



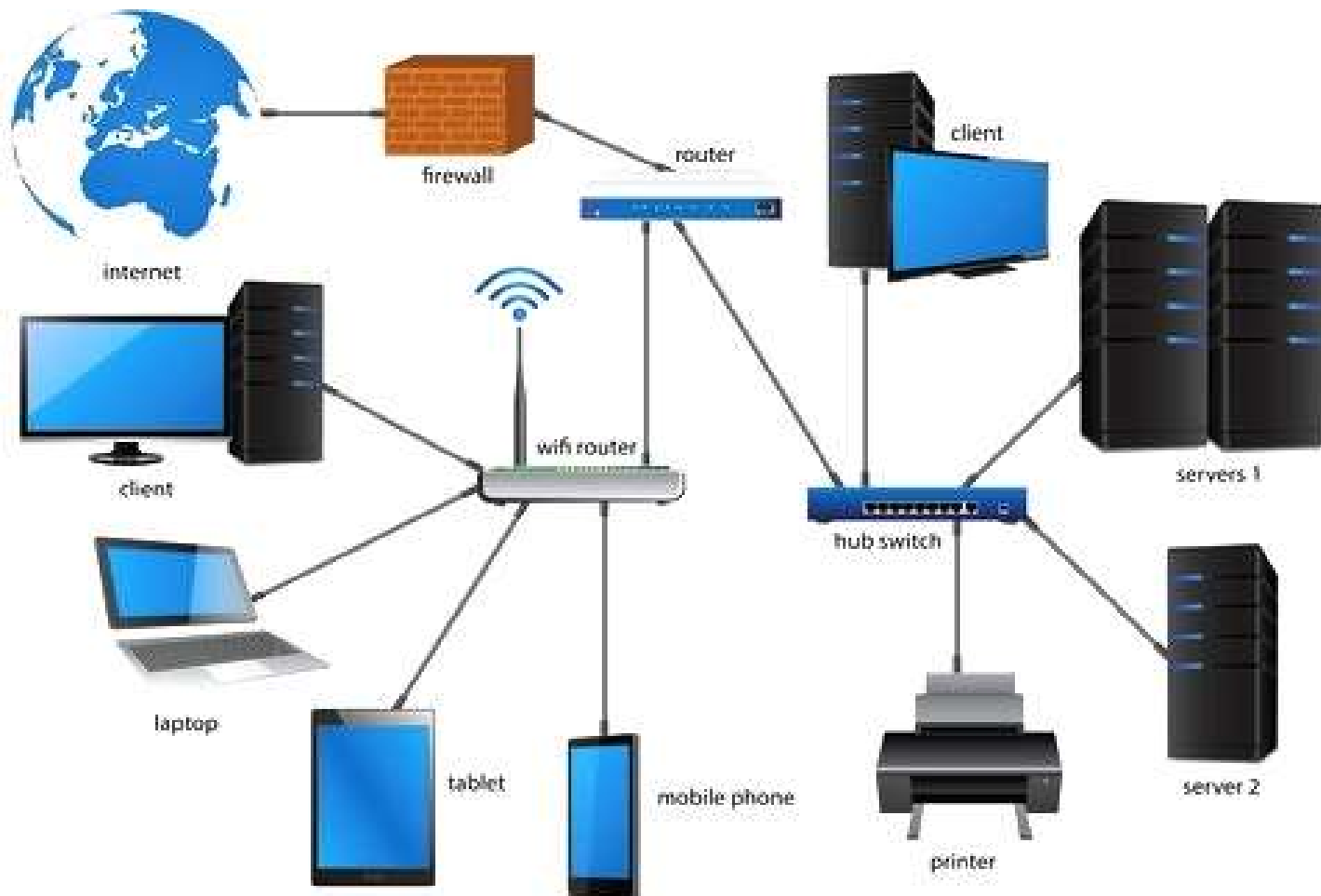
Topics Covered

- Introduction to Computer Networks

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Introduction

□ Computer Network



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□ Definition - Computer Network

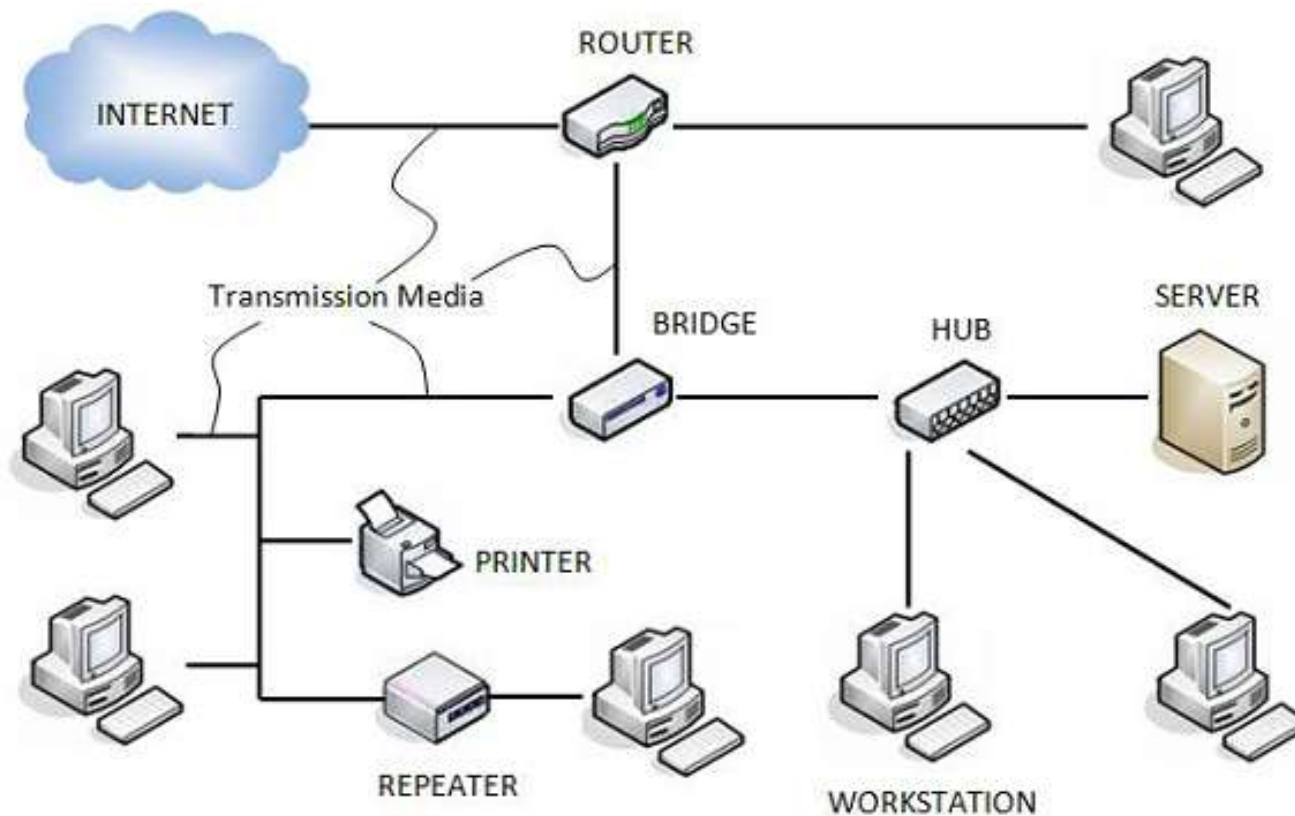
- ▣ A system that connects two or more computing devices for transmitting and sharing information
- ▣ A collection of computing devices that are connected with each other for the purpose of information and resource sharing
- ▣ An interconnection of multiple devices, also known as hosts, that are connected using multiple paths for the purpose of sending/receiving data or media
- ▣ A group of computers connected with each other through wires, optical fibres or optical links so that various devices can interact with each other with aim of sharing resources

Cont...

- Computer Networks Features
 - ▣ Communication speed
 - ▣ File sharing
 - ▣ Back up and Roll back
 - ▣ Software and Hardware sharing
 - ▣ Security
 - ▣ Scalability
 - ▣ Reliability

Cont...

□ Computer Network Components



Cont...



□ Hardware Components

- ▣ Servers
- ▣ Clients
- ▣ Peers
- ▣ Transmission Media/Links
- ▣ Connecting Devices

□ Software Components

- ▣ Networking Operating System
- ▣ Protocol Suite
 - OSI Model (Open System Interconnection)
 - TCP/IP Model

Computer Network Architecture

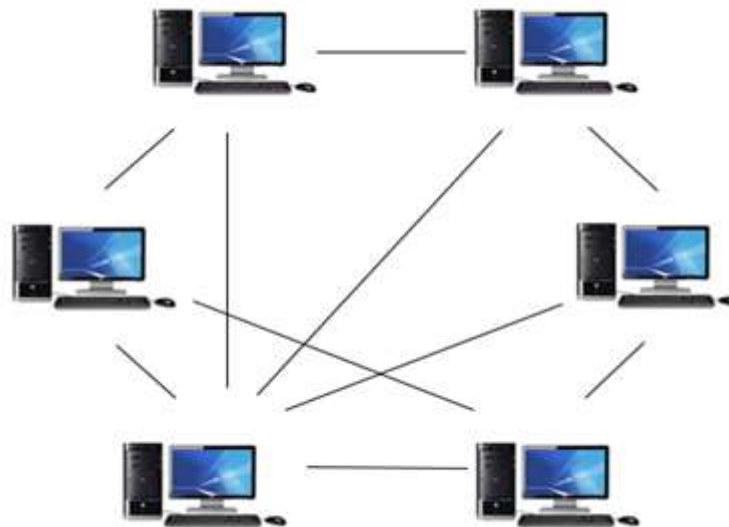


- Computer Network Architecture
 - ▣ The physical & logical design of the software, hardware, protocols, and transmission media
- Type of Network Architectures
 - ▣ Peer-To-Peer network
 - ▣ Client/Server network

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□ Peer-To-Peer network

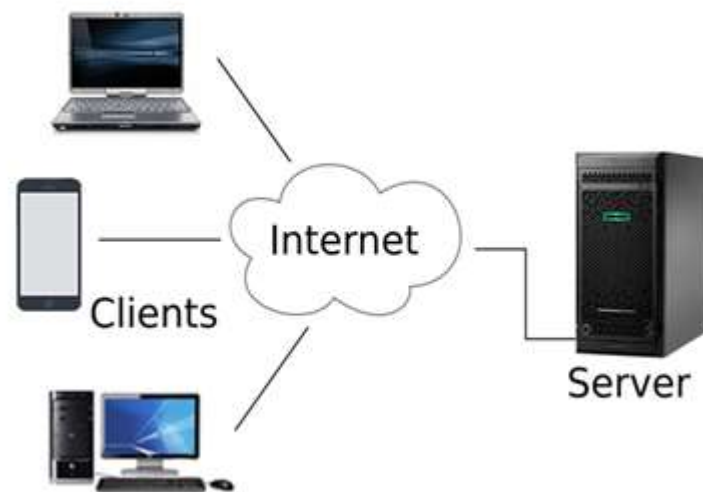
- ▣ All the computers are linked together with equal privilege and responsibilities for processing the data
- ▣ Useful for small environments i.e. up to 10 computers
- ▣ Has no dedicated server



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□ Client/Server Network

- ▣ Designed for the end users called clients, to access the resources from a central computer known as Server
- ▣ Server performs all the major operations
 - i.e. security and network management, and responsible for managing resources i.e. files, directories, printer, etc.



Computer Network Types



- Computer network is mainly of four types
 - ▣ Local Area Network (LAN)
 - ▣ Metropolitan Area Network (MAN)
 - ▣ Wide Area Network (WAN)
 - ▣ Personal Area Network (PAN)

Cont...



- Local Area Network (LAN)
 - ▣ Group of computers connected to each other in a small area such as building/office
 - ▣ Used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.
 - ▣ Less costly as it is built with inexpensive hardware such as hubs, network adapters, and Ethernet cables
 - ▣ The data is transferred at an extremely faster rate

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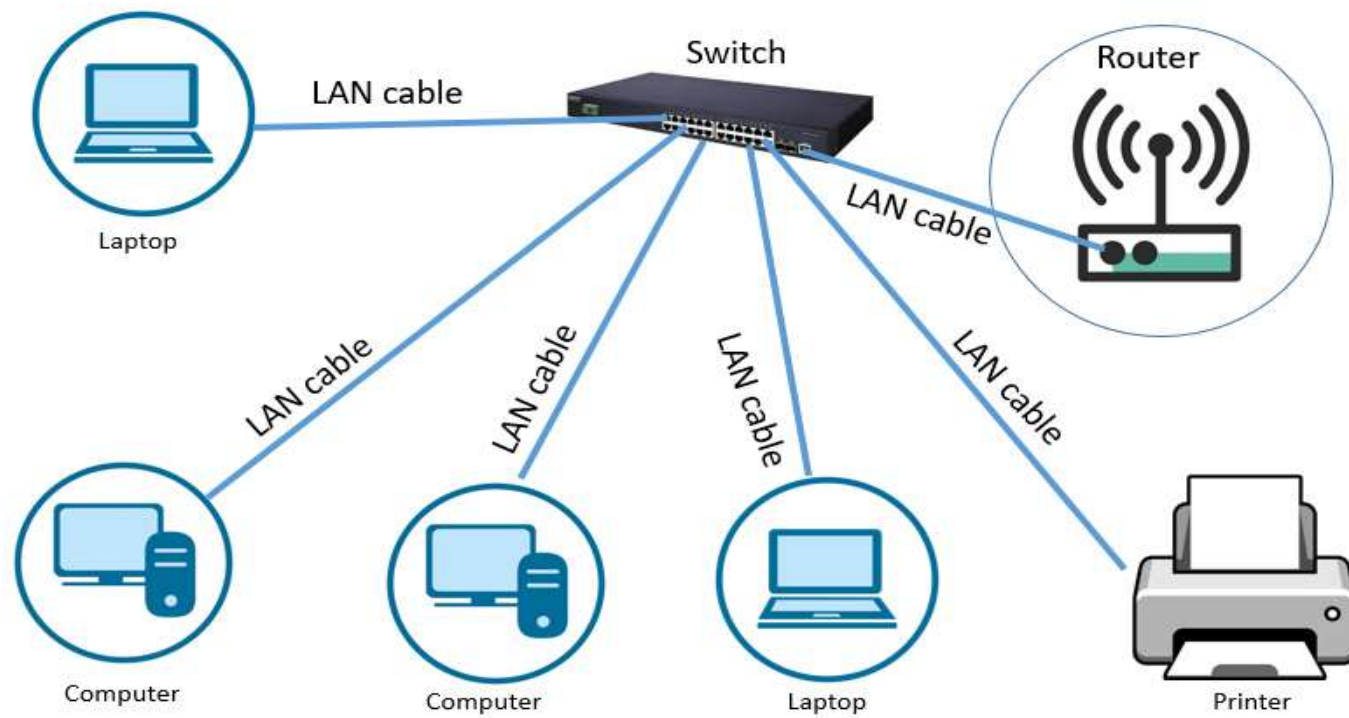


Fig: Local Area Network

Cont...

- Metropolitan Area Network (MAN)
 - ▣ Covers a larger geographic area by interconnecting a different LAN to form a larger network
 - ▣ Government agencies use MAN to connect to the citizens and private industries
 - ▣ The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc.
 - ▣ It has a higher range than LAN

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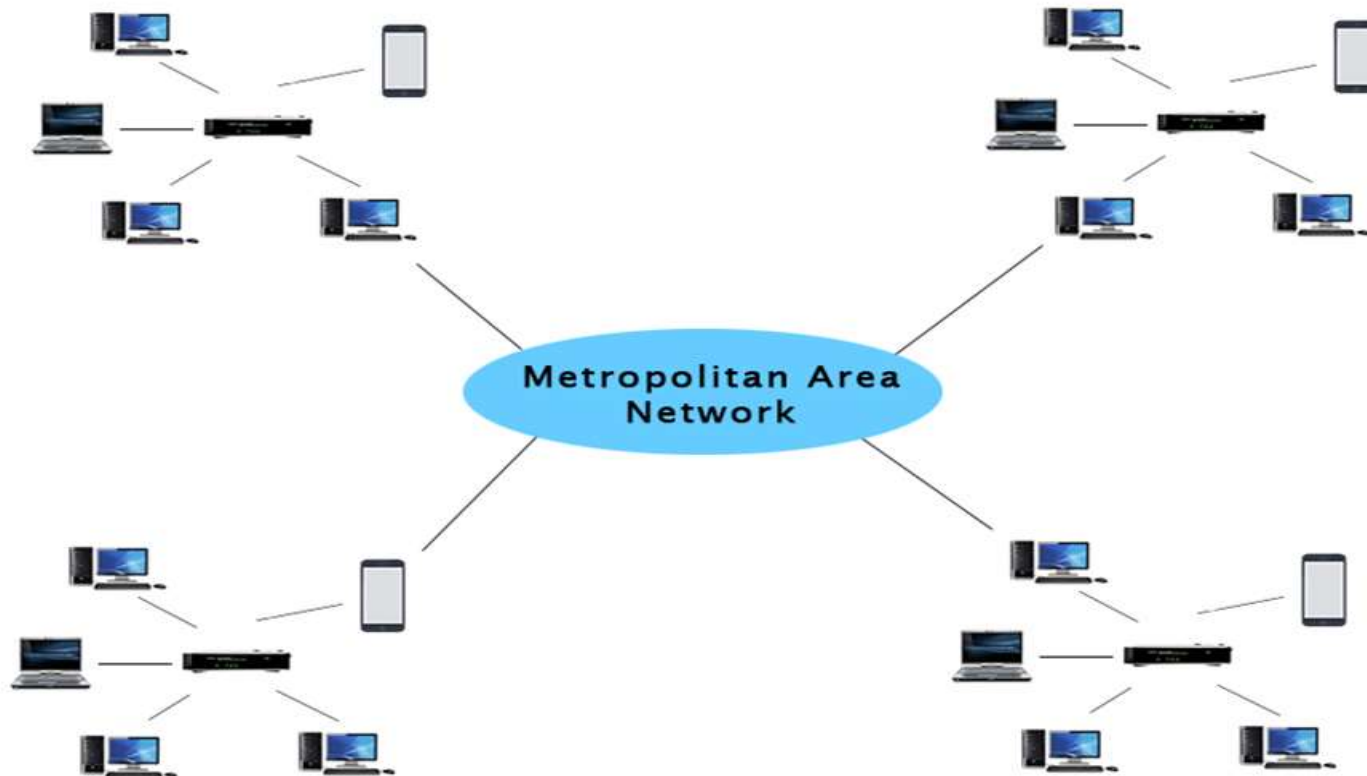


Fig: Metropolitan Area Network

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- Wide Area Network (WAN)
 - ▣ A network that extends over a large geographical area such as states or countries
 - quite bigger network than the LAN
 - ▣ Not limited to a single location
 - spans over a large geographical area through a telephone line, fibre optic cable or satellite links
 - ▣ The Internet is one of the biggest WAN in the world

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Fig: Wide Area Network

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□ Personal Area Network (PAN)

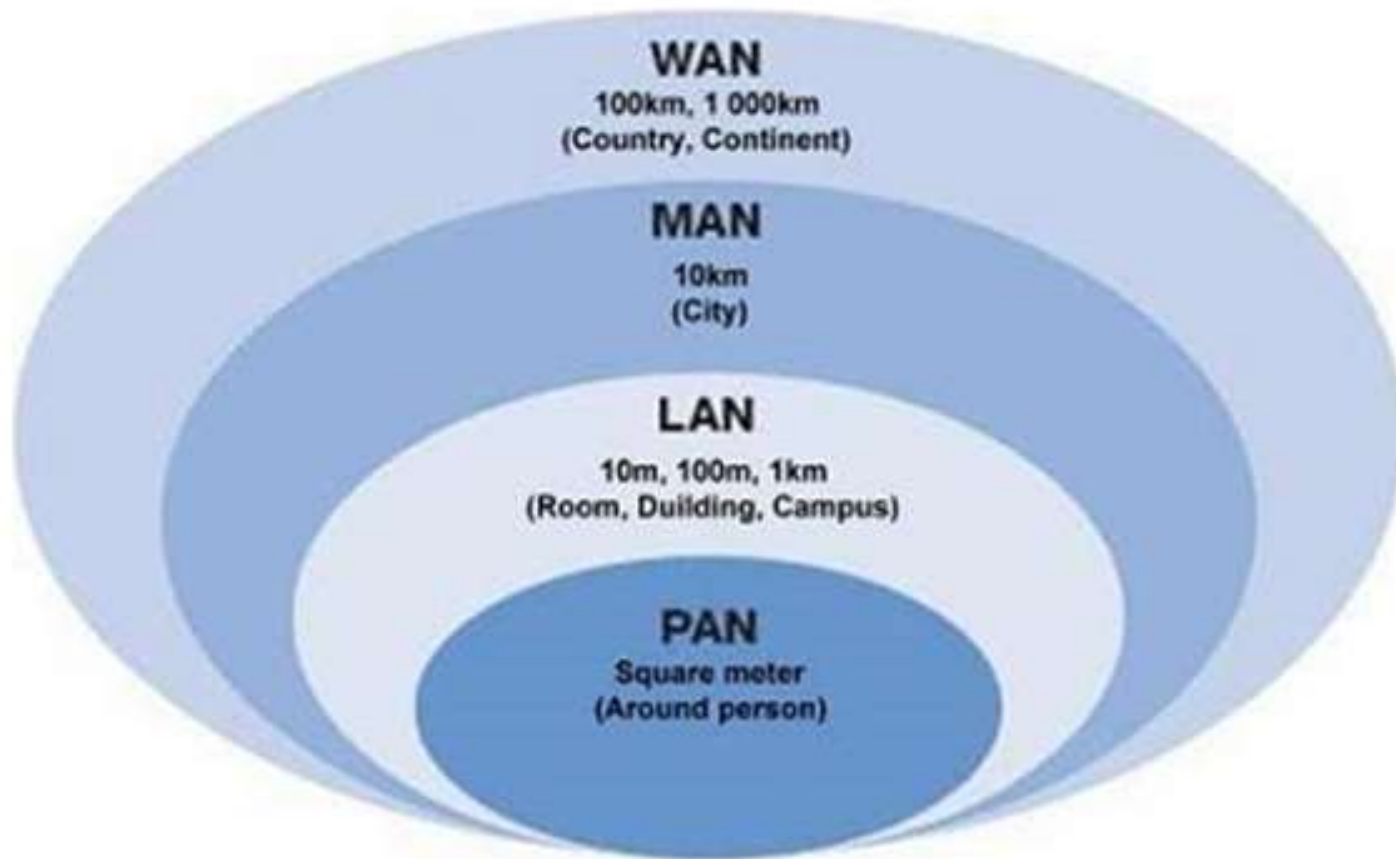
- A network arranged within an individual person, typically within a range of 10 meters
- Used for connecting computer devices of personal use
- Can covers an area of 30 feet
- Personal computer devices - the laptop, mobile phones, media player and play stations

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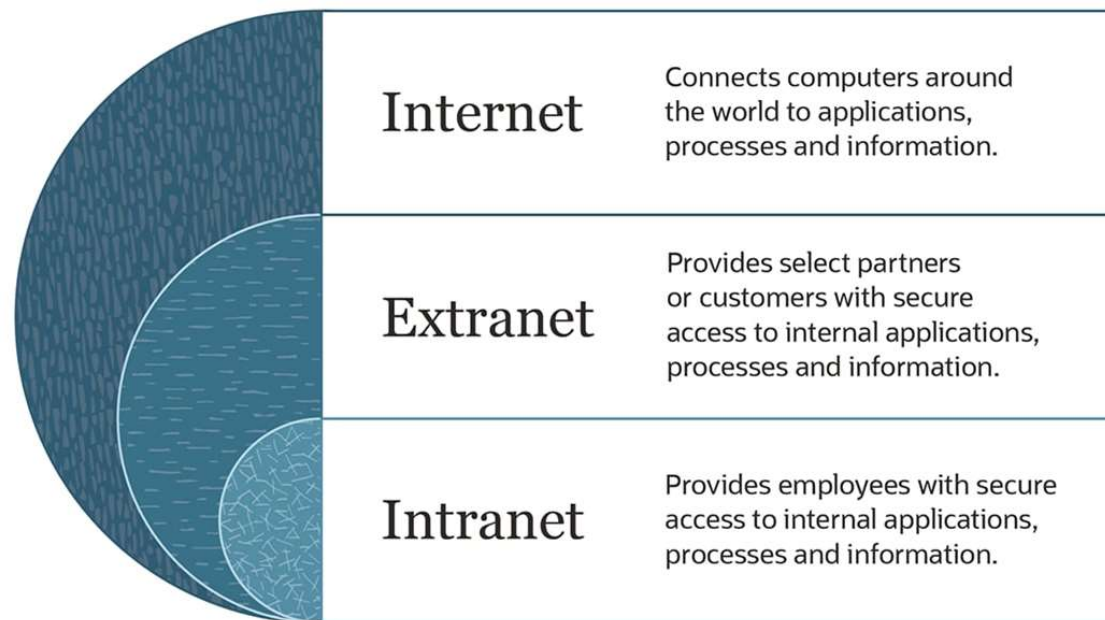
Fig: Personal Area Network (PAN)

Cont...



Internetwork

- Two or more computer networks (i.e. LANs or WAN or computer network segments) are connected using devices
- Types



Network Topology



- Network Topology
 - ▣ Defines the structure of the network of how all the components are interconnected to each other
 - ▣ Geometric representation of all the nodes in a network
- Network Topology Types
 - ▣ Bus
 - ▣ Ring
 - ▣ Tree
 - ▣ Star
 - ▣ Mesh
 - ▣ Hybrid

Cont...

□ Bus topology

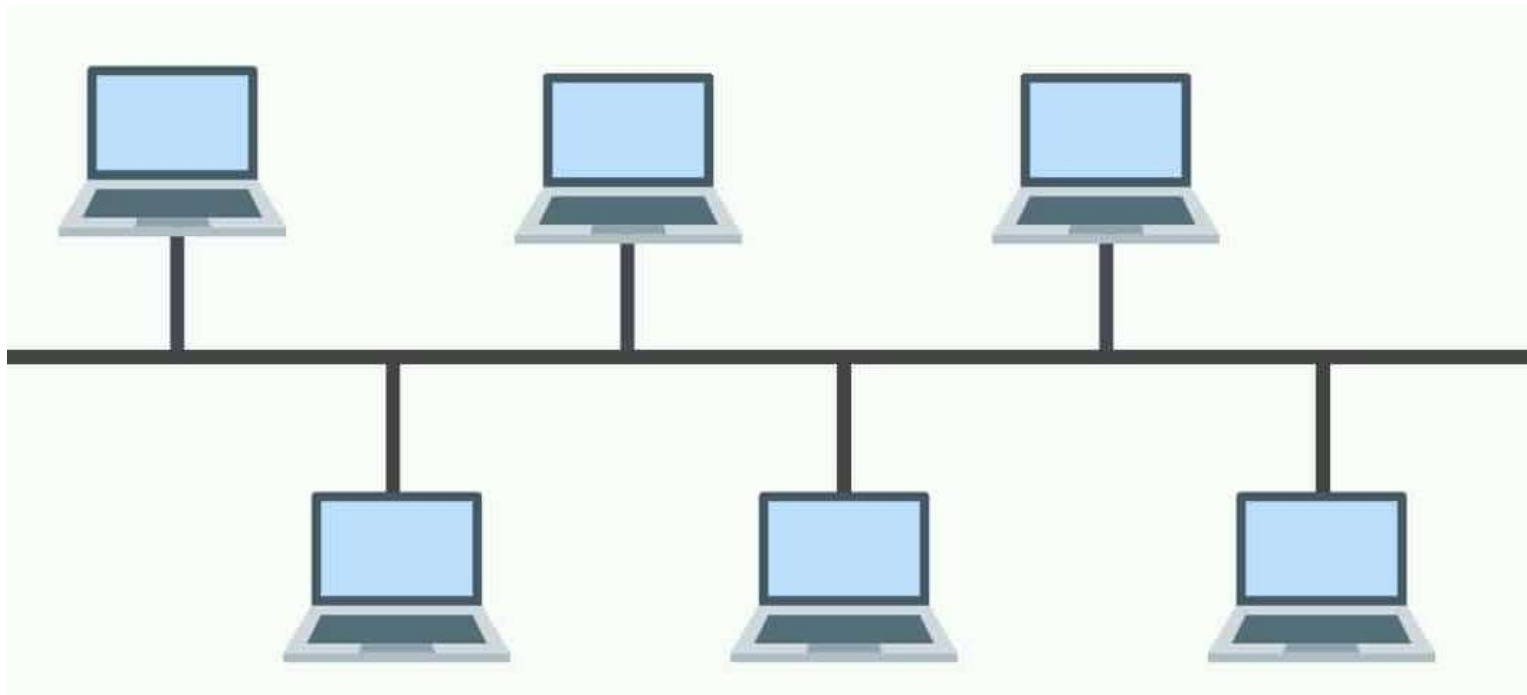


Fig: Bus topology

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□ Bus topology

- ▣ Designed in such a way that all the stations are connected through a single cable known as a backbone cable
- ▣ Each node is either connected to the backbone cable by drop cable or directly connected to the backbone cable
- ▣ 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
- ▣ Mainly used in 802.3 (Ethernet) and 802.4 (Token Bus) standard networks

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- Ring topology

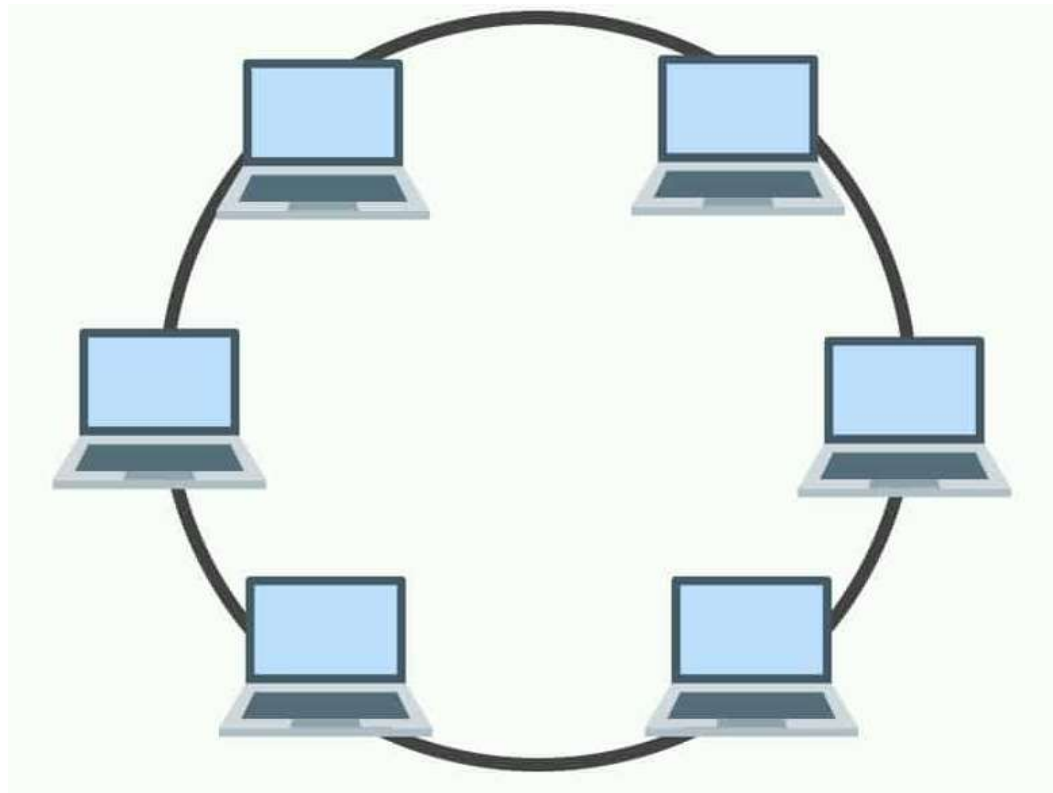


Fig: Ring topology

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□ Ring topology

- Similar to bus topology, but with connected ends
- The node that receives the message from the previous computer will retransmit to the next node
- The data flows in one direction, i.e. it is unidirectional
- The data flows in a single loop continuously known as an endless loop
- The most common access method of the ring topology is 802.5 (token ring)

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- Star topology

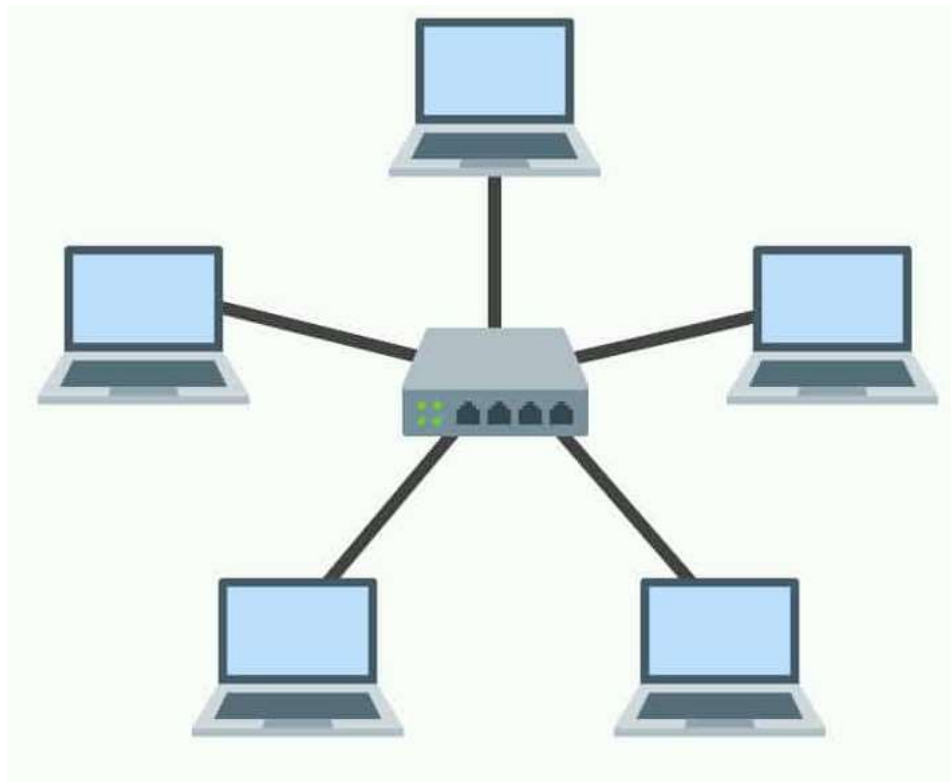


Fig: Star topology

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□ Star topology

- A network in which every node is connected to the central hub, switch or a central computer
- The central computer is known as a server, and the peripheral devices attached to the server are known as clients
- Coaxial cable or RJ-45 cables are used to connect the computers
- Hubs or Switches are mainly used as connection devices in a physical star topology
- Most popular topology in network implementation

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- Tree topology

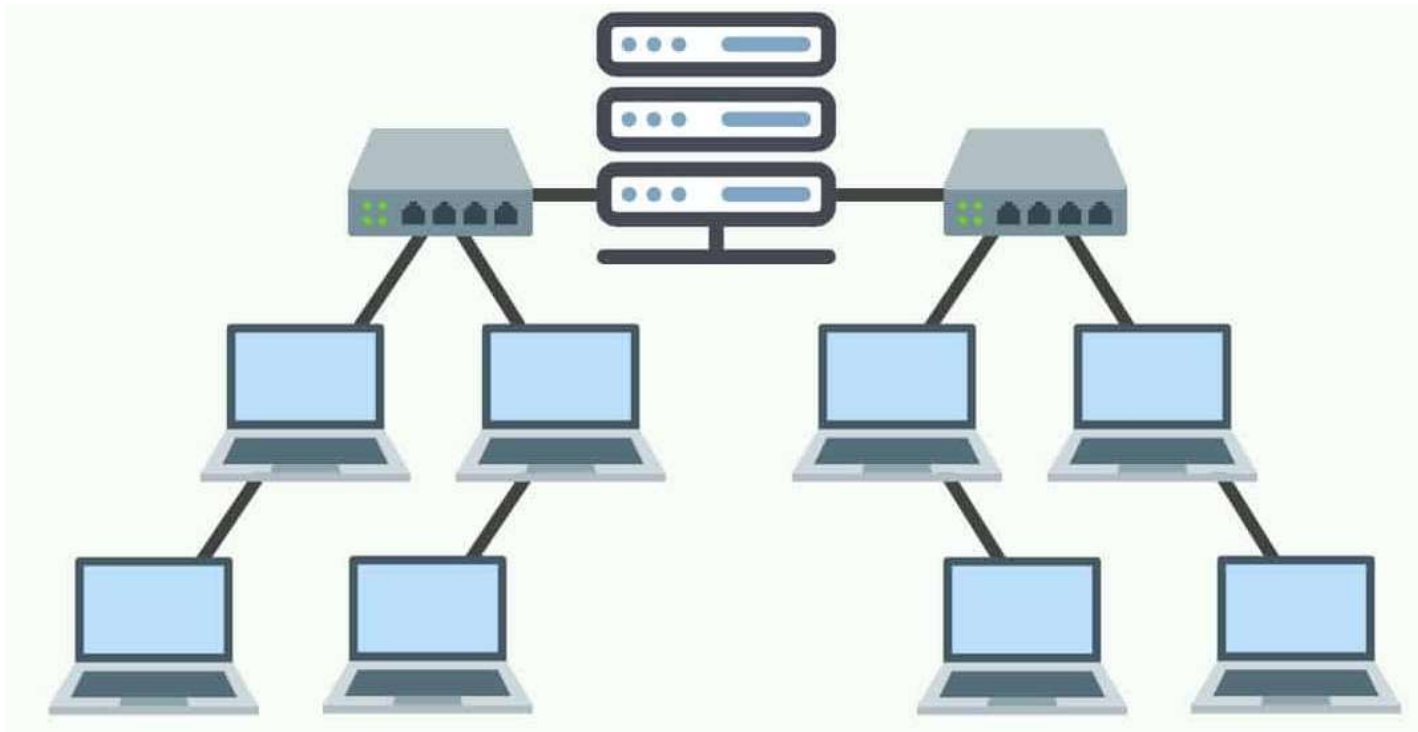


Fig: Tree topology

Cont...



- Tree topology
 - ▣ Combines characteristics of bus and star topology
 - ▣ 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 i.e. forms a parent-child hierarchy.

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- Mesh topology

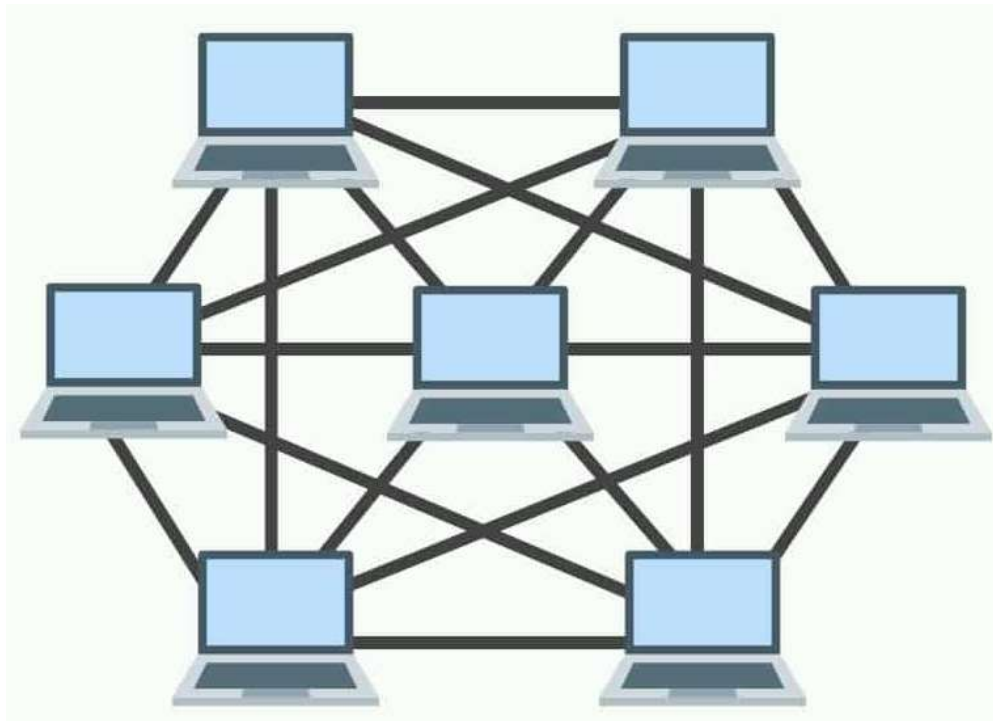


Fig: Mesh topology

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□ Mesh topology

- ▣ An arrangement of the network in which computers are interconnected with each other through various redundant connections
- ▣ Multiple paths from one computer to another computer
- ▣ Does not contain the switch, hub or any central computer which acts as a central point of communication
- ▣ The Internet is an example of the mesh topology
- ▣ Mainly used for WAN implementations where communication failures are a critical concern

Cont...

- Hybrid topology
 - ▣ The combination of various different topologies

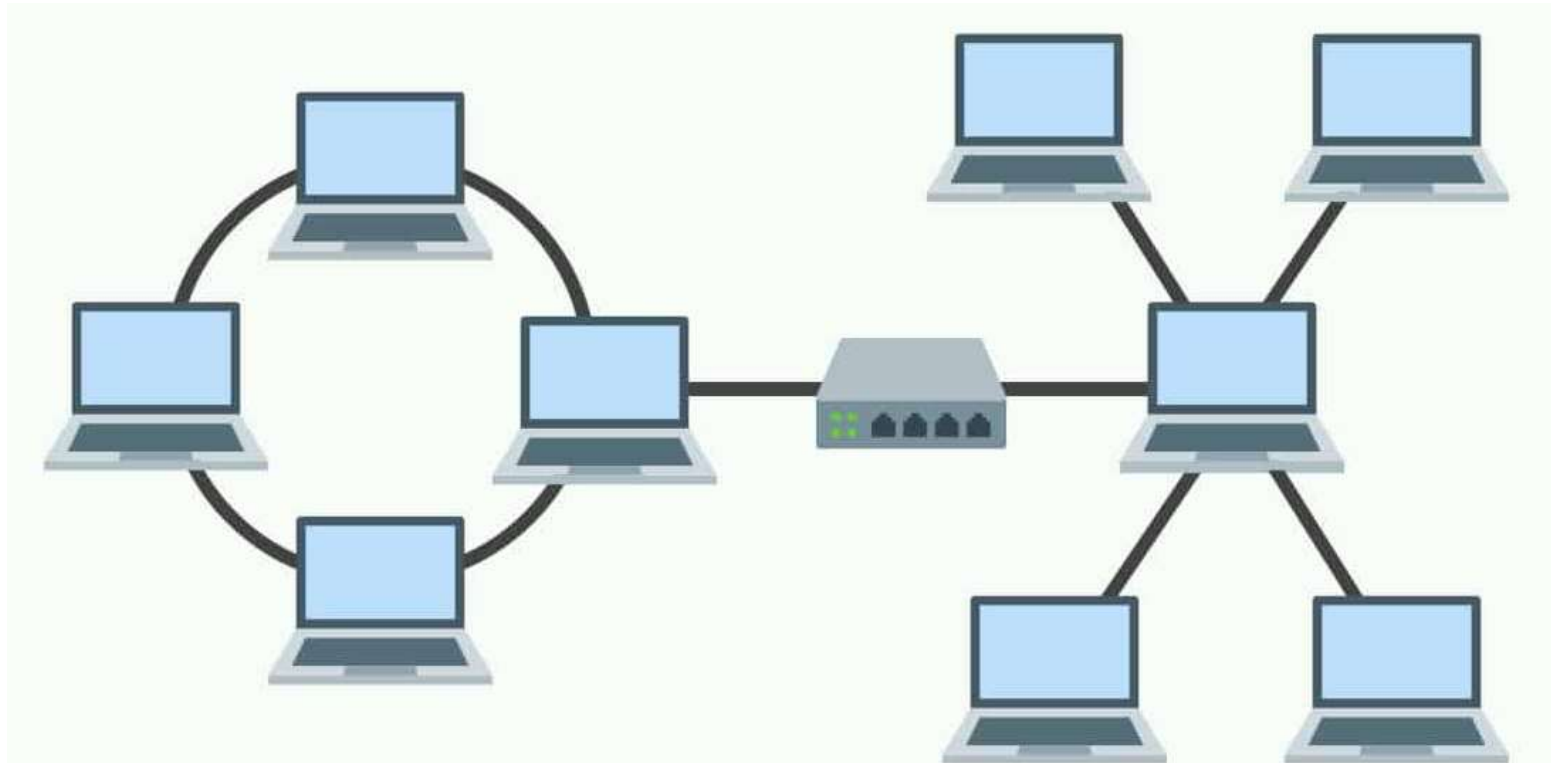


Fig: Hybrid topology

Transmission Mode

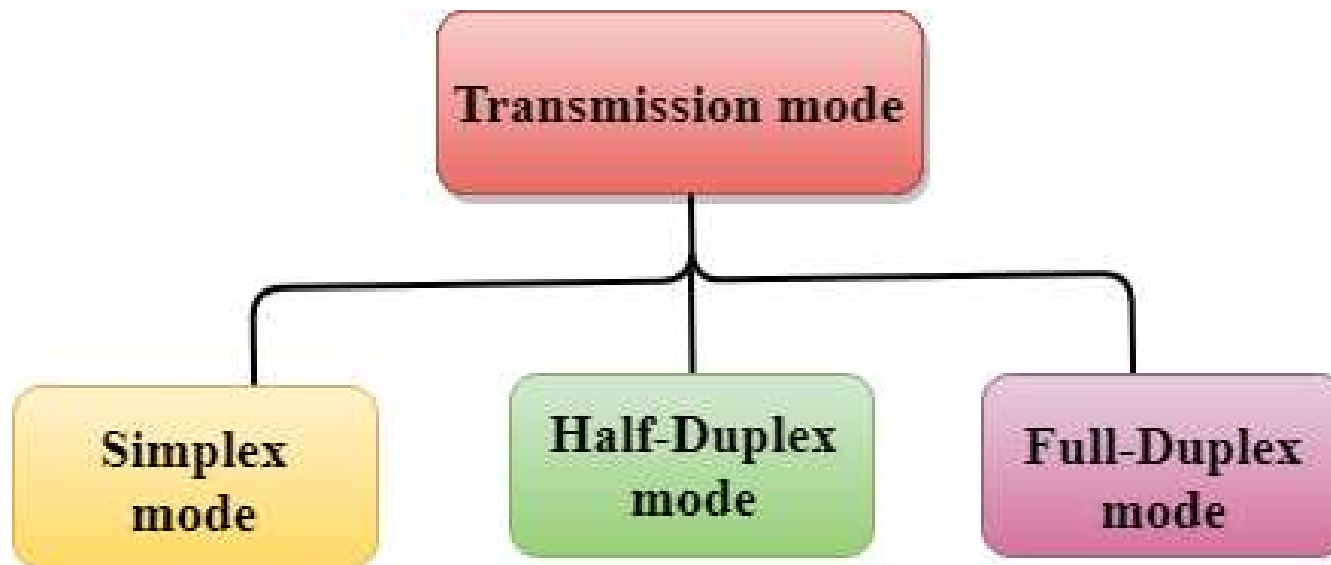


- Transmission mode

- The way in which data is transmitted from one device to another device
- Also known as the communication mode
- Each communication channel has a direction associated with it, and transmission media provide the direction. Therefore, the transmission mode is also known as a directional mode
- Defined in the physical layer

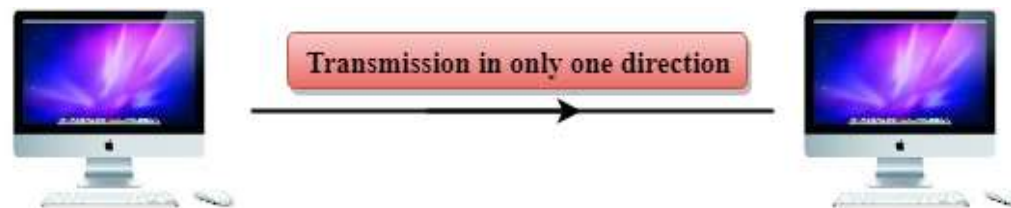
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- Transmission mode categories



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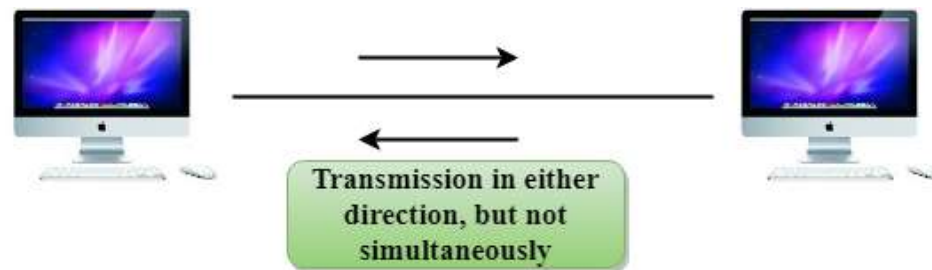
□ Simplex mode



- 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
- Not very popular, used in the business field that do not require any corresponding reply
- Ex: Radio station

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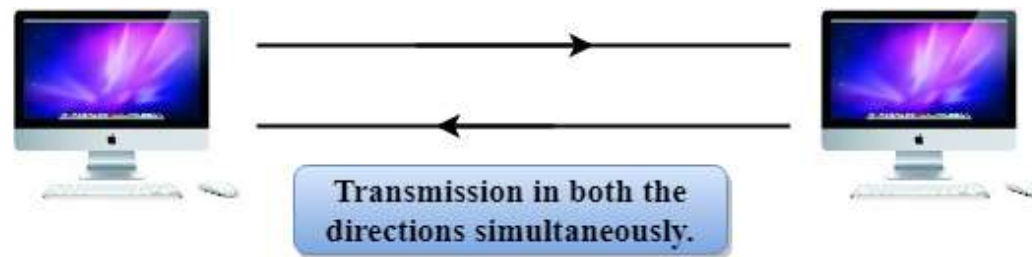
□ Half-duplex mode



- The station can transmit and receive the data as well
- Messages flow in both the directions, but not at the same time
- The entire bandwidth of the communication channel is utilized in one direction at a time
- Possible to perform the error detection, and if any error occurs, then the receiver requests the sender to retransmit the data
- Ex: A Walkie-talkie

Cont...

□ 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 fastest mode of communication between devices
- Ex: Telephone network