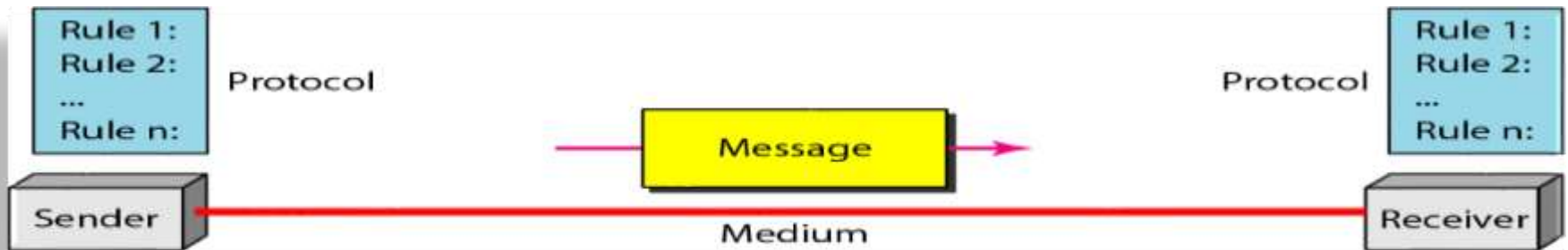# DATA COMMUNICATIONS

- Data communication " means exchange of data between two devices via some form of transmission medium such as a wire cable."
- It may be communicated from sender->receiver (or) from one station->another station.
- Data communications have 4 characteristics:-

Delivery
- Deliver the data

Accuracy
- deliver the data accuretely.

Timliness:-
In time or useless

Jitter:-
time lag between sender sending the message and reciever recieves it.

Five components of data *communication*

1.Message:- means information's (data) to be communicated. E.g.text,numbers,audio,video.

2.Sender:-sends the data message. It can be a computer ,workstation, video etc..

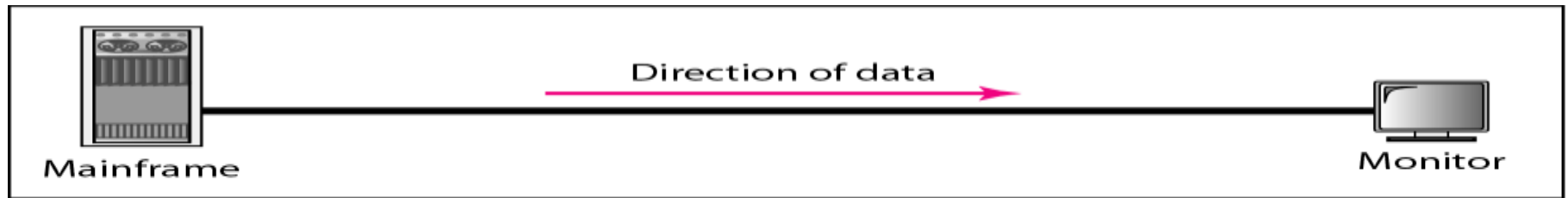3.Reciever:-receives the message send from the sender. It can be a computer ,work station etc.

5.Protocols:-a set rules that govern data communication. Without a protocols ,two devices may be connected but not communicated.
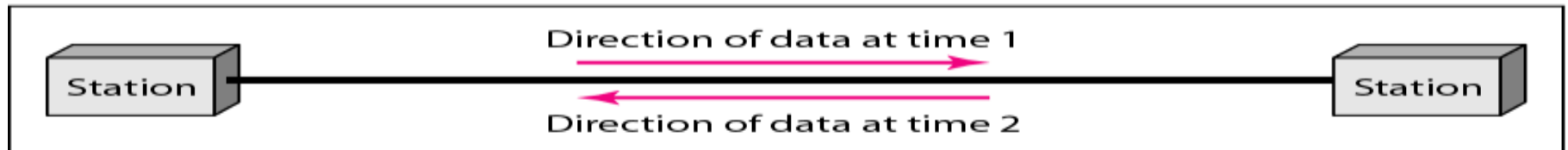
Data flow (simplex, half-duplex, and full-duplex)

1)Simplex:-unidirectional, one way street.

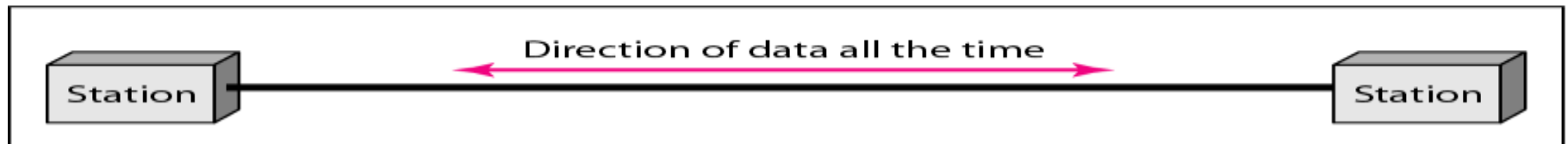*2)Half-duplex:-both transmit and receive but not at same time.*

3) Full-duplex:-both can transmit and receives simultaneously.

Direction of data

Mainframe

Monitor

a. Simplex

Direction of data at time 1

Station

Direction of data at time 2

Station

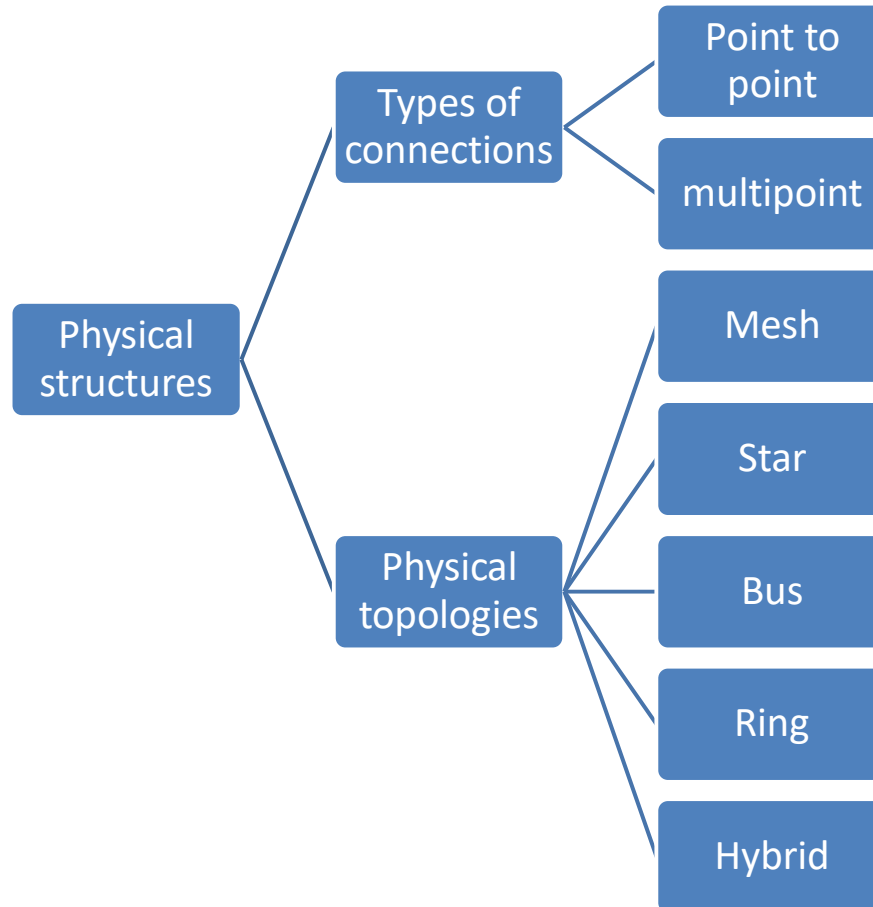b. Half-duplex

Direction of data all the time

Station

Station

c. Full-duplex

Physical structures
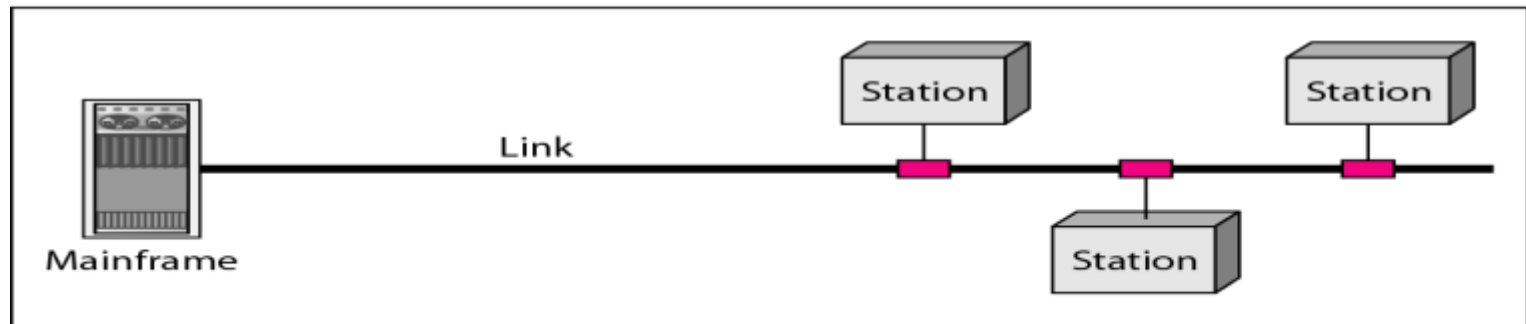
Point to point

- A dedicated link between two devices.

multipoint

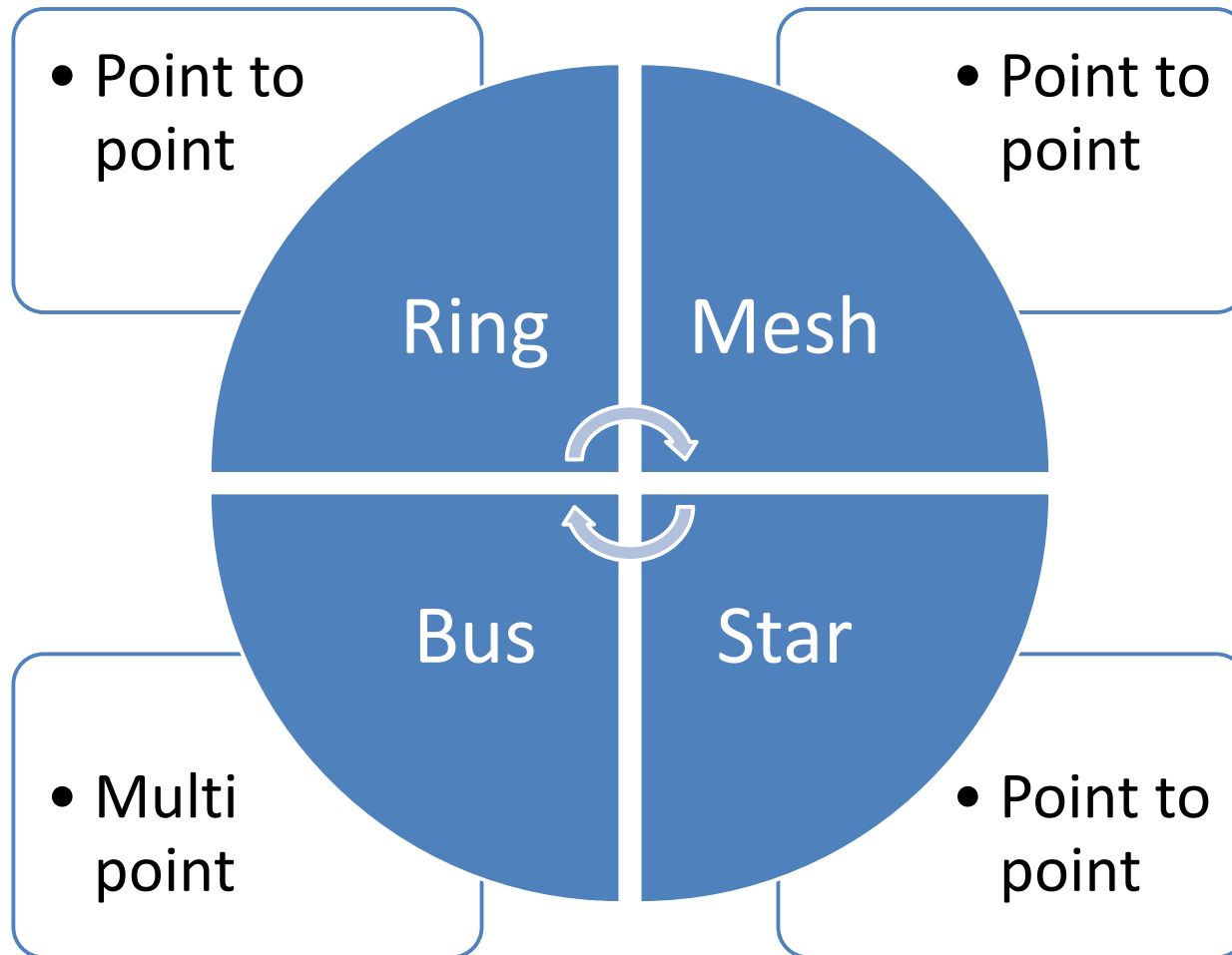- One in which more than two specific devices share a single link.
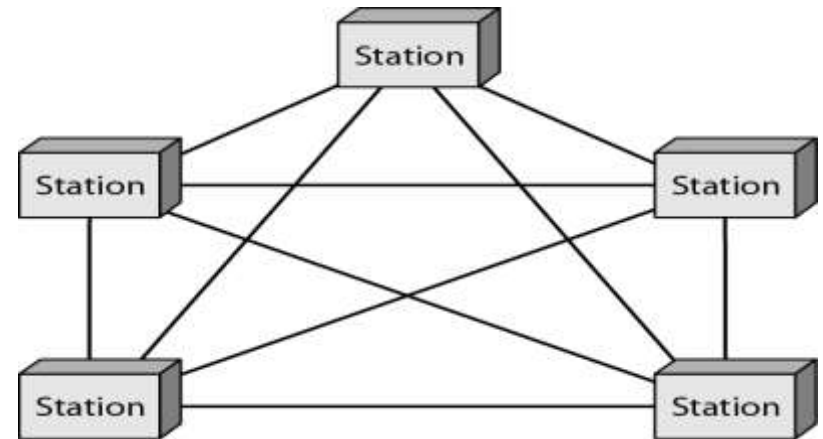

a. Point-to-point

b. Multipoint

Physical Topologies

- Point to point

- Point to point

Ring

Mesh

Bus

Star

- Multi point

- Point to point

A fully connected mesh topology (five devices)

Advantages:
1.Elimanting traffic problems.
2.Robust.
3.If one link became unusable, it does not incapacitate the entire system.
4.Privacy & security.

- Disadvantages:-

- Installation & reconnection .

- More space.

- Amount of cabling & I/o ports .

E.g.:-Telephone network.

A star topology connecting four stations

Advantages:-

1)A central controller called Hub.

2)Devices are not directly link to one another .

3)Here controller acts as mediator between two stations.

4) Less expensive than mesh topologies & less cabling .

5) Each devices needs one link & one I/o port to connect it .

6) Easy to install & reconfigure

7)Robustness & if one link fail only that link get affected.

E.g.:-LANs

Hub

Station Station Station Station
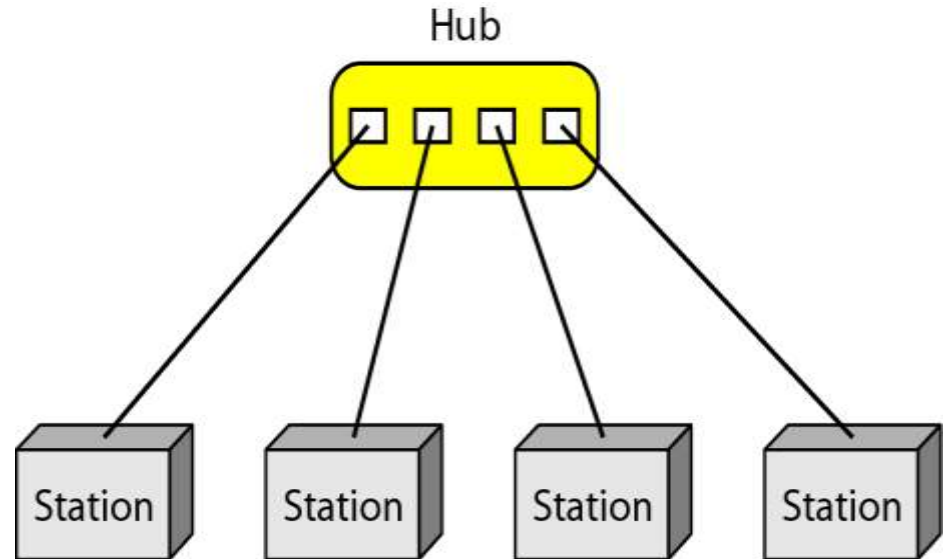
• Disadvantage:-

Topology depends on Hubs,if hub goes down dead , then whole system is dead.

A bus topology connecting three stations

1.Connect to bus cable by drop lines & taps.

2.A droplines means a connection running between the devices & the main cable.
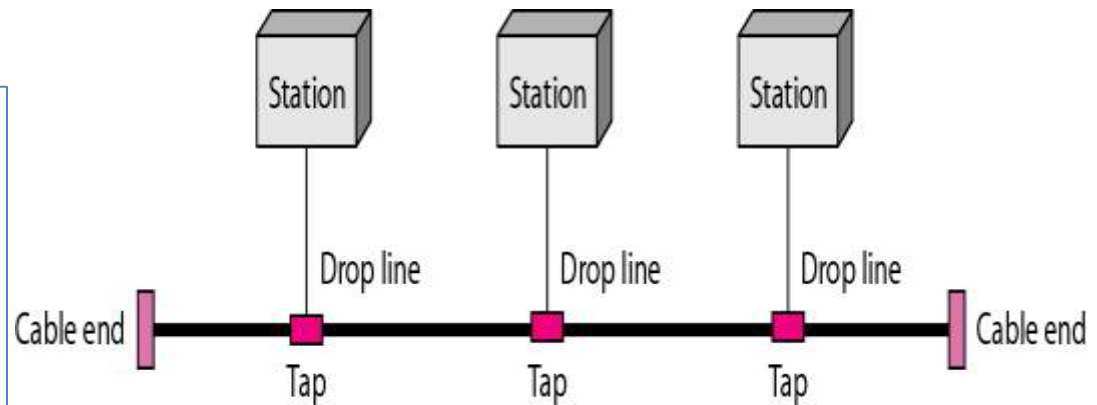
3.A tap is connector that splices into the main cable.

Advantages:-

1.Ease of installation.

2.Less cabling than mesh & star.

E.g.:-Ethernet LANs

Disadvantages:-

- 1)Reconnection

- 2)A bus is designed optimally efficient in installation, so, difficult to add new devices.

[Diagram labels: Station, Station, Station, Drop line, Drop line, Drop line, Cable end, Tap, Tap, Tap, Cable end]
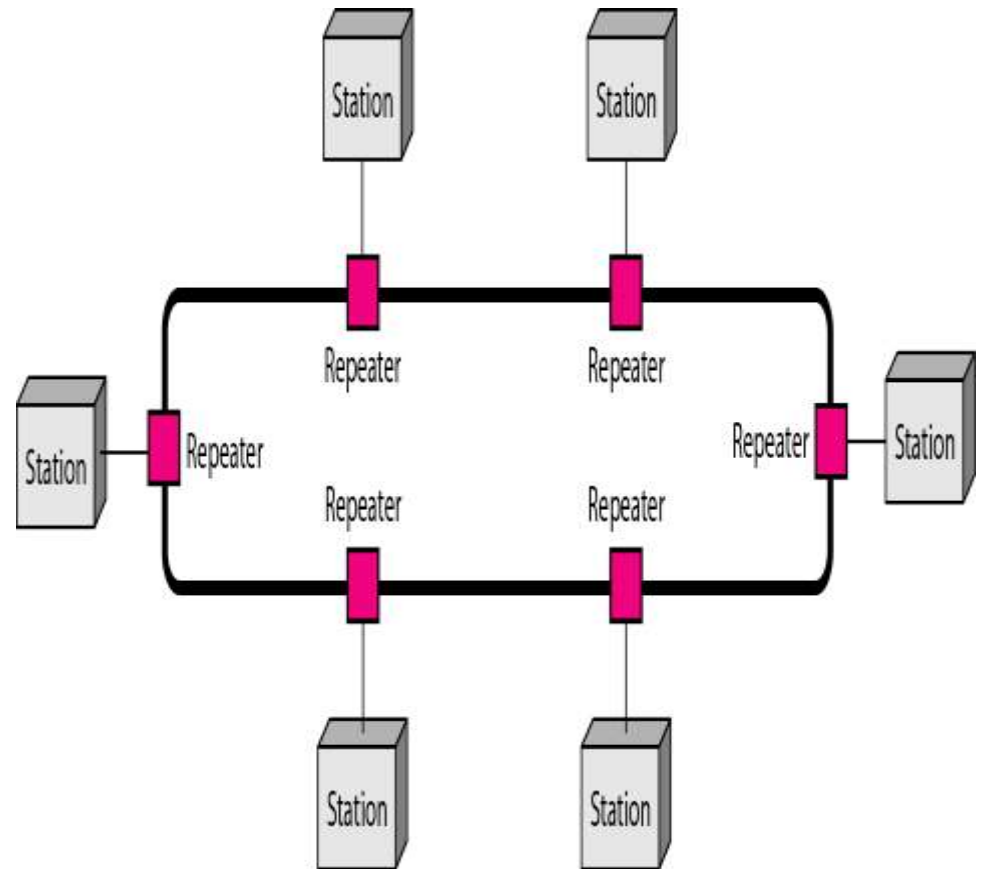
A ring topology connecting six stations

In ring topology a signal is passed along the ring which incorporates a **repeater.**

ADVANTAGES:-

1.Easy to install & reconfigure. Each device is linked to its immediate neighbors.

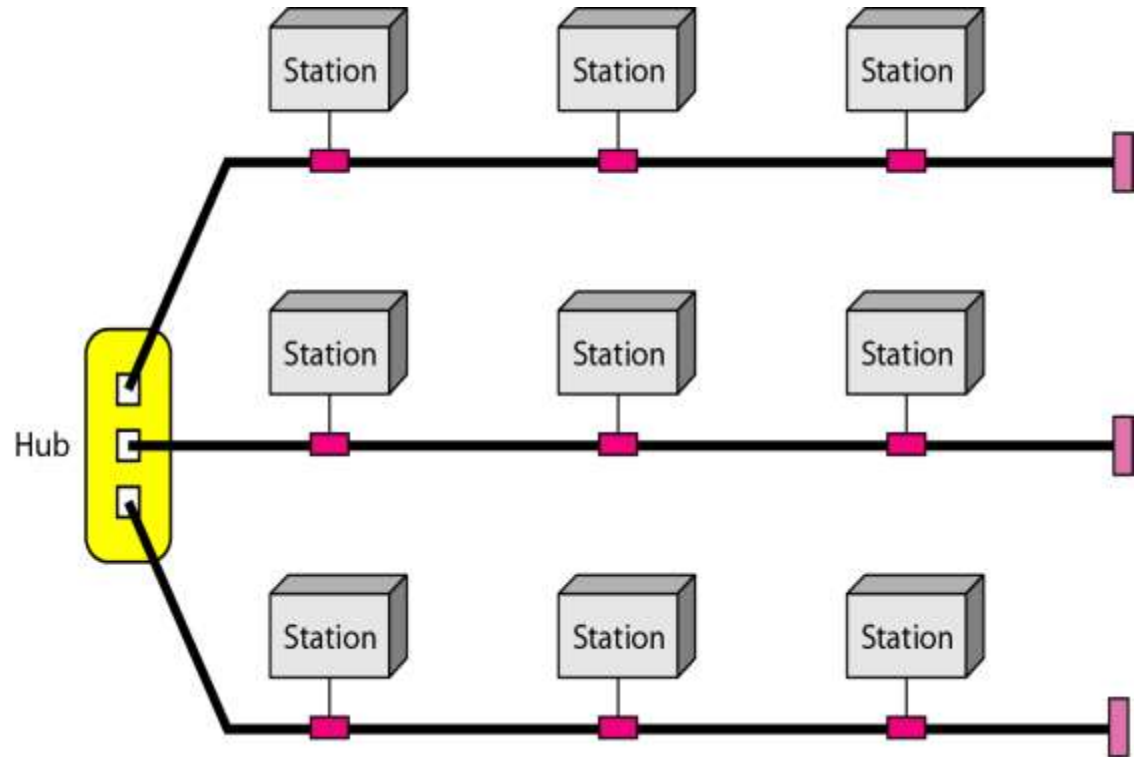**2.Fault isolation is simplified.**

UNIDIRECTIONAL TRAFFIC CAN BE A DISADVANTAGE.

- E.g.:-IBM

A hybrid topology: a star backbone with three bus networks

Combination of

Point –to-point &

Multipoint is

Hybrid topology.

Network Devices: Network devices, also known as networking hardware, are physical devices that allow hardware on a computer network to communicate and interact with one another.

For example, Repeater, Hub, Bridge, Switch, Routers, Gateway, and NIC, etc.

1. Repeater – A repeater operates at the physical layer. Its job is to regenerate the signal over the same network before the signal becomes too weak or corrupted to extend the length to which the signal can be transmitted over the same network. An important point to be noted about repeaters is that they not only amplify the signal but also regenerate it. When the signal becomes weak, they copy it bit by bit and regenerate it at its star topology connectors connecting following the original strength. It is a 2-port device.

2. Hub – A hub is a basically multi-port repeater. A hub connects multiple wires coming from different branches, for example, the connector in star topology which connects different stations. Hubs cannot filter data, so data packets are sent to all connected devices. Also, they do not have the intelligence to find out the best path for data packets which leads to inefficiencies and wastage.

3. Bridge – A bridge operates at the data link layer. A bridge is a repeater, with add on the functionality of filtering content by reading the MAC addresses of the source and destination. It is also used for interconnecting two LANs working on the same protocol. It has a single input and single output port, thus making it a 2-port device.

4. Switch – A switch is a multiport bridge with a buffer and a design that can boost its efficiency (a large number of ports imply less traffic) and performance. A switch is a data link layer device. The switch can perform error checking before forwarding data, which makes it very efficient as it does not forward packets that have errors and forward good packets selectively to the correct port only.

- **5. Routers** – A router is a device like a switch that routes data packets based on their IP addresses. The router is mainly a Network Layer device. Routers normally connect LANs and WANs and have a dynamically updating routing table based on which they make decisions on routing the data packets. The router divides the broadcast domains of hosts connected through it.
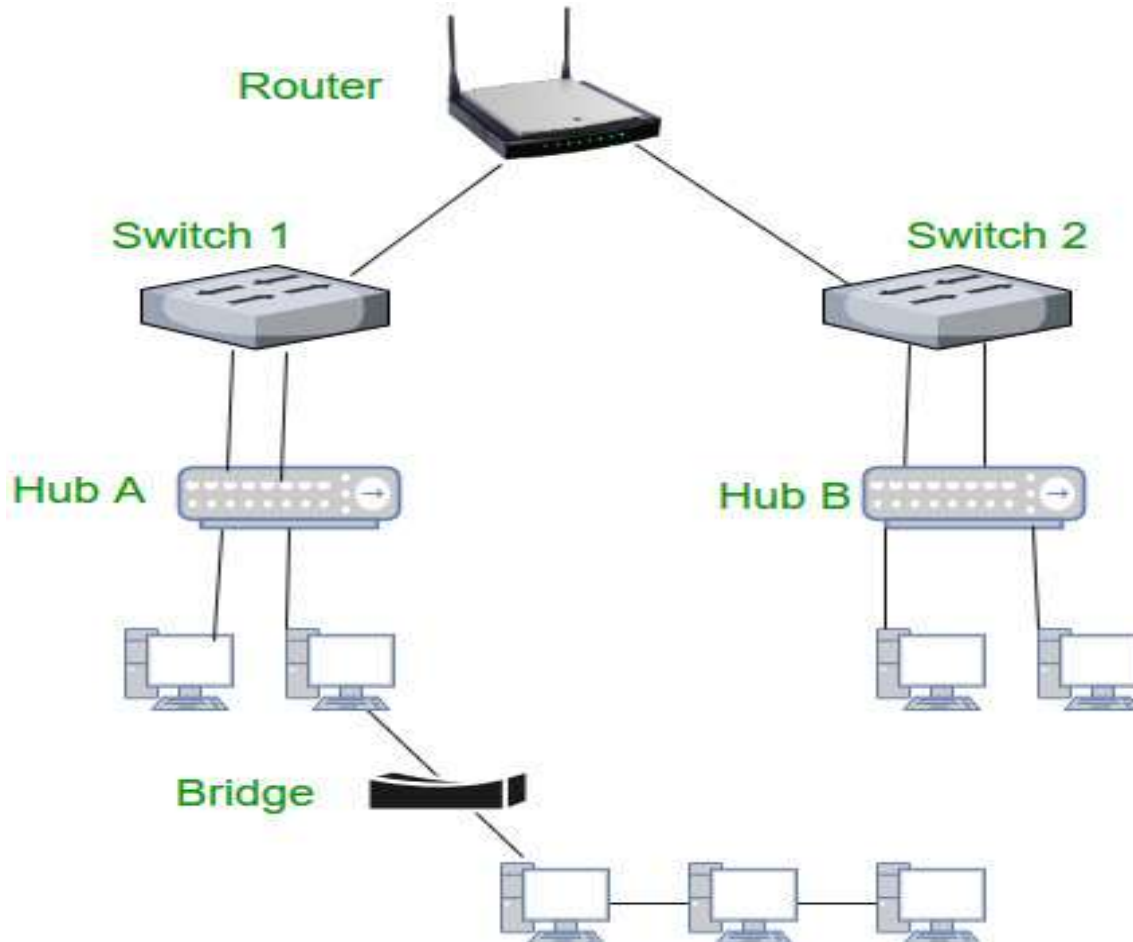
6. Gateway – A gateway, as the name suggests, is a passage to connect two networks that may work upon different networking models. They work as messenger agents that take data from one system, interpret it, and transfer it to another system. Gateways are also called protocol converters and can operate at any network layer. Gateways are generally more complex than switches or routers. A gateway is also called a protocol converter.

7. NIC – NIC or network interface card is a network adapter that is used to connect the computer to the network. It is installed in the computer to establish a LAN. It has a unique id that is written on the chip, and it has a connector to connect the cable to it. The cable acts as an interface between the computer and the router or modem. NIC card is a layer 2 device which means that it works on both the physical and data link layers of the network model.

Network Types

- Define the Internet
  - The internet is defined as a global mesh of interconnected networks
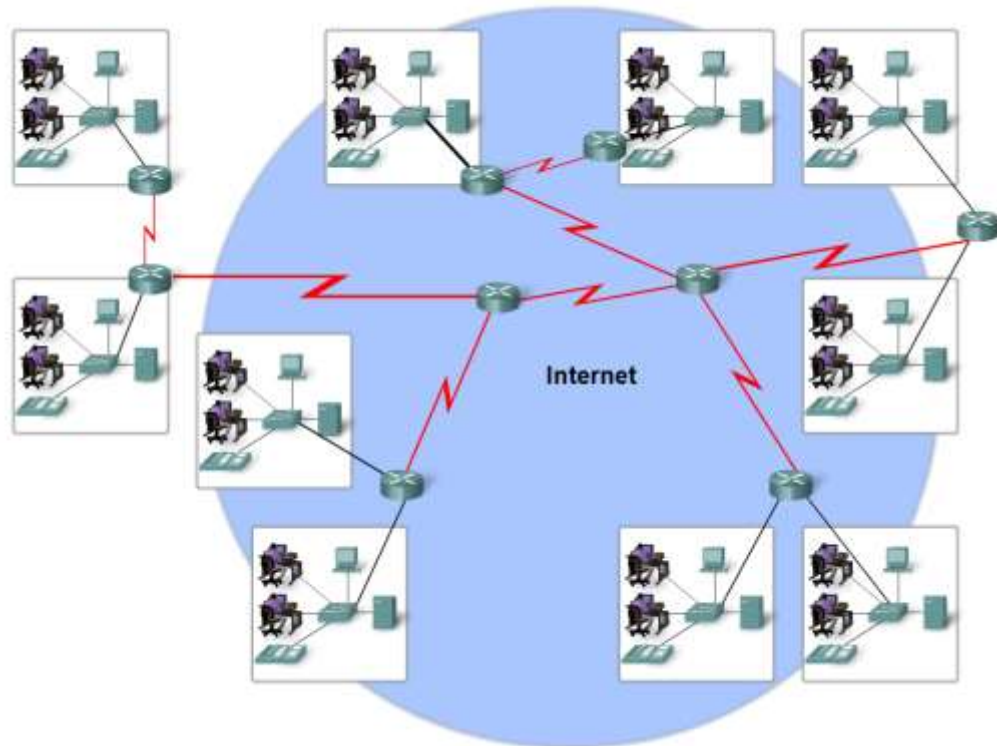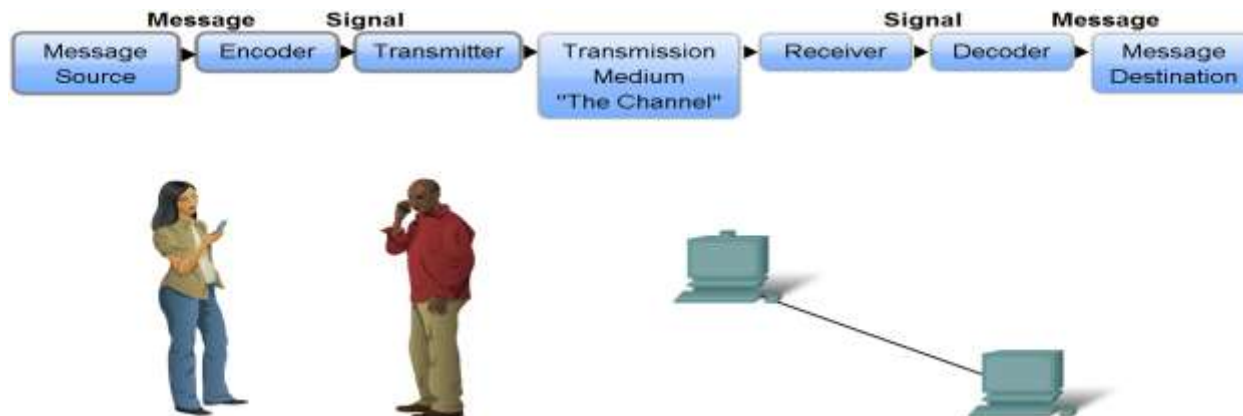
INTERNET

1.Internet means a network of networks.

2.Concieved in USA in 1969 as the ARPA

NET(Advance Research Project Agency
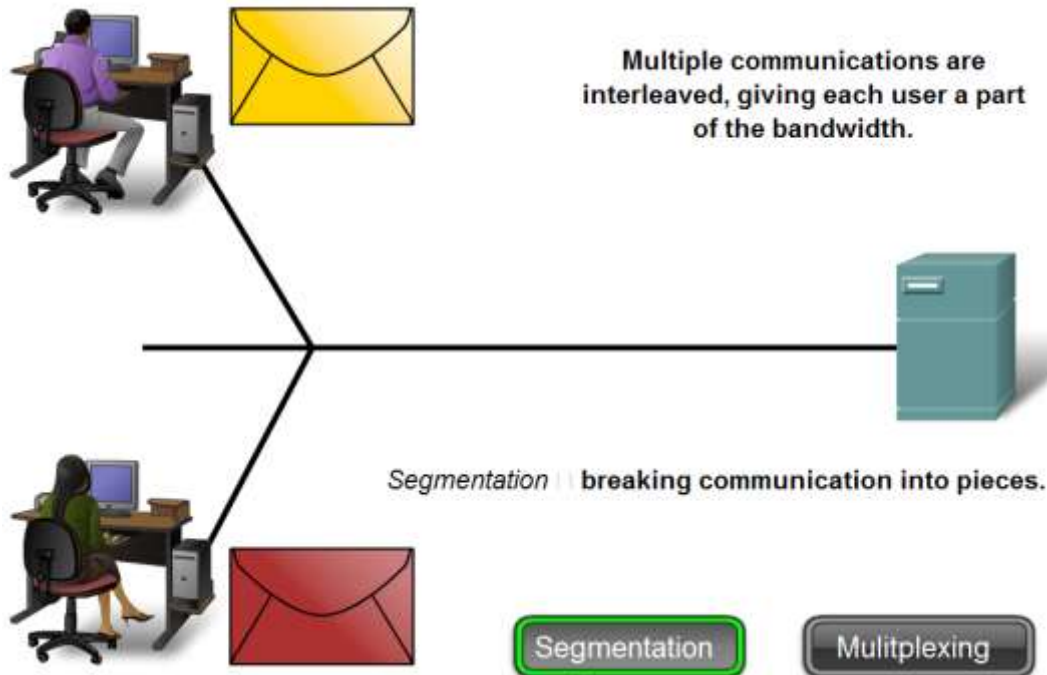 Network)by the Defence Department of USA.

Network Structure

- Define a network

  – Data or information networks capable of carrying many different types of communications
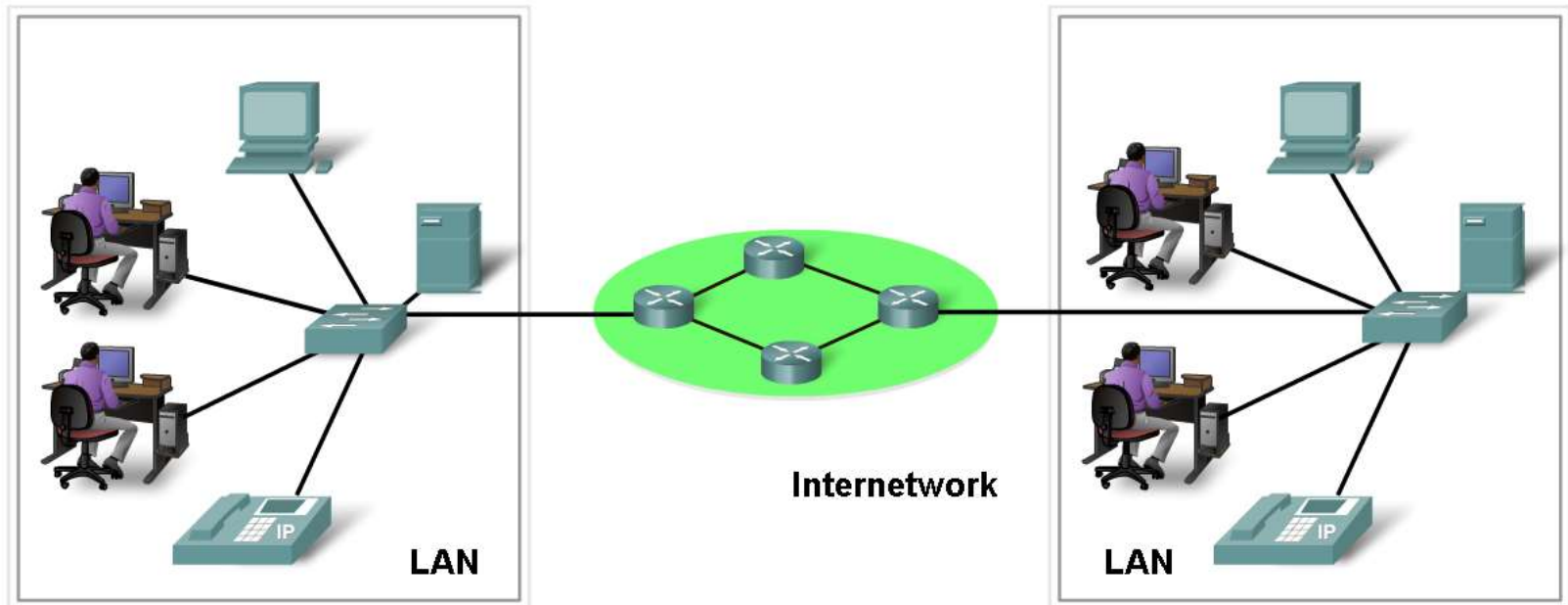
Network Structure

- Describe how messages are communicated
  - Data is sent across a network in small "chunks" called segments

Multiple communications are interleaved, giving each user a part of the bandwidth.

Segmentation — breaking communication into pieces.
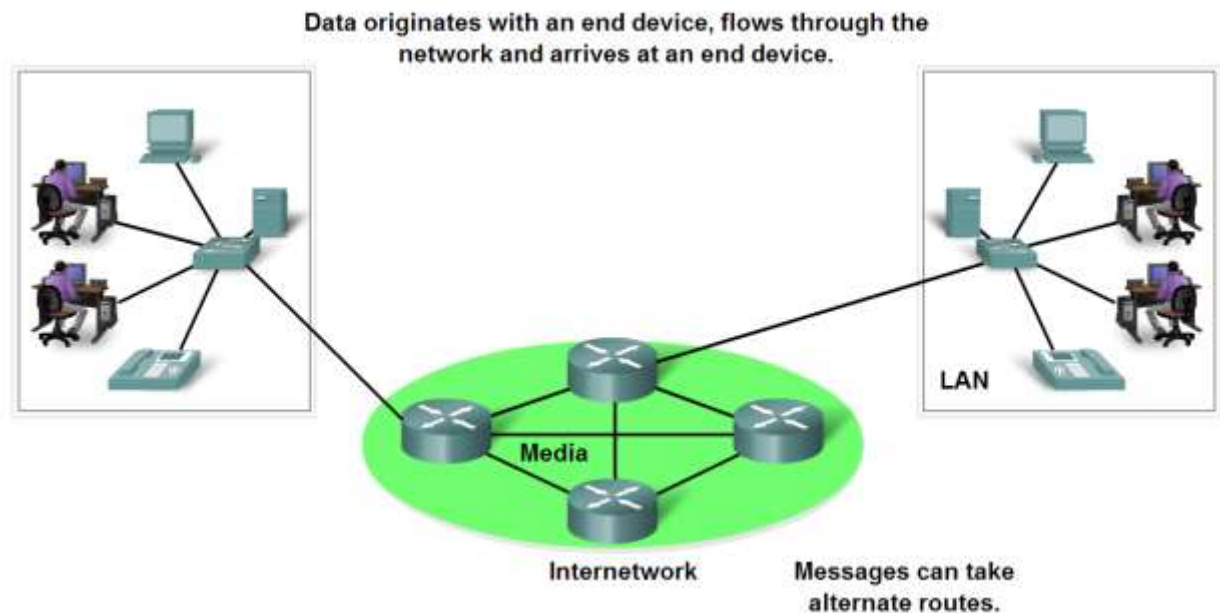
Segmentation   Mulitplexing

Network Structure

- Define the components of a network
  - Network components
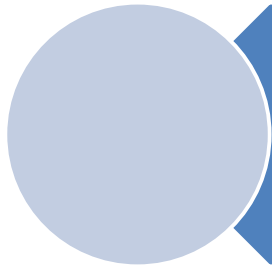   - Hardware
    - Software
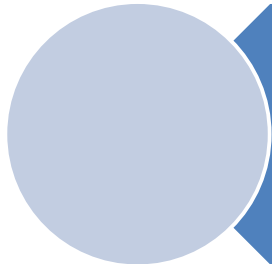
Network Structure

- End Devices and their Role in the Network
  - End devices form interface with human network & communications network
  - Role of end devices:
    - Client
    - Server

Data originates with an end device, flows through the network and arrives at an end device.

LAN

Media

Internetwork

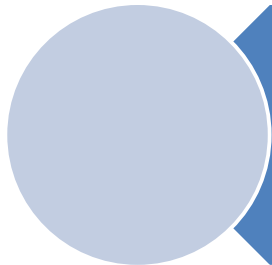Messages can take alternate routes.

CATEGORIES OF NETWORKS

LAN(Local Area Network)

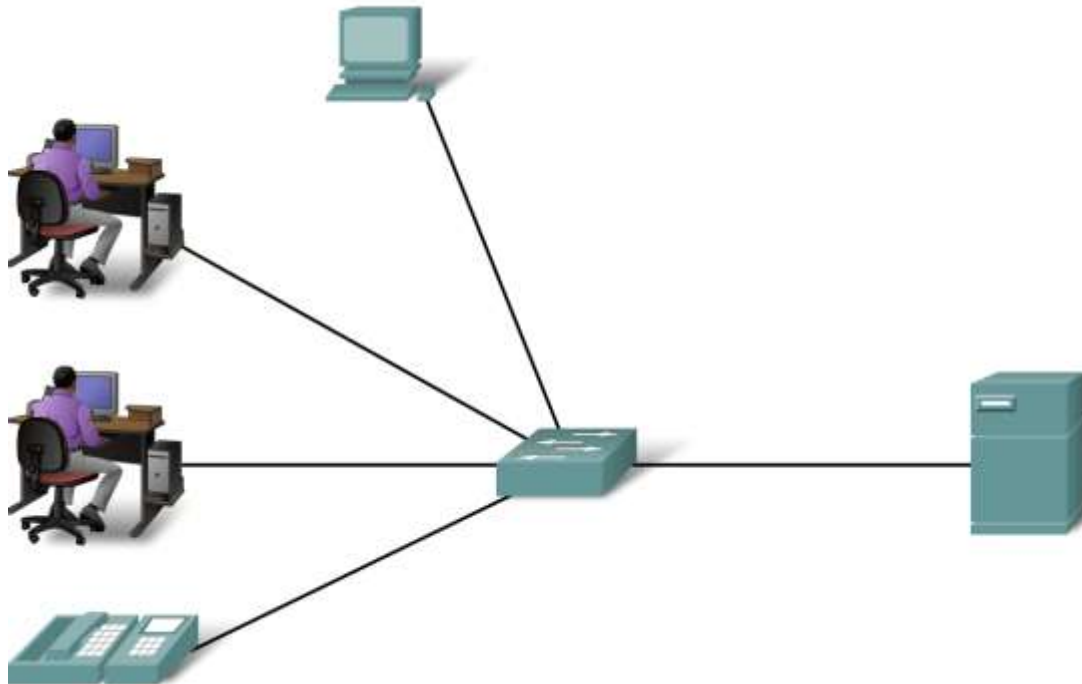Covering a confined region area.

MAN(Metropolitan Area Network)

Lies in between MAN & WAN

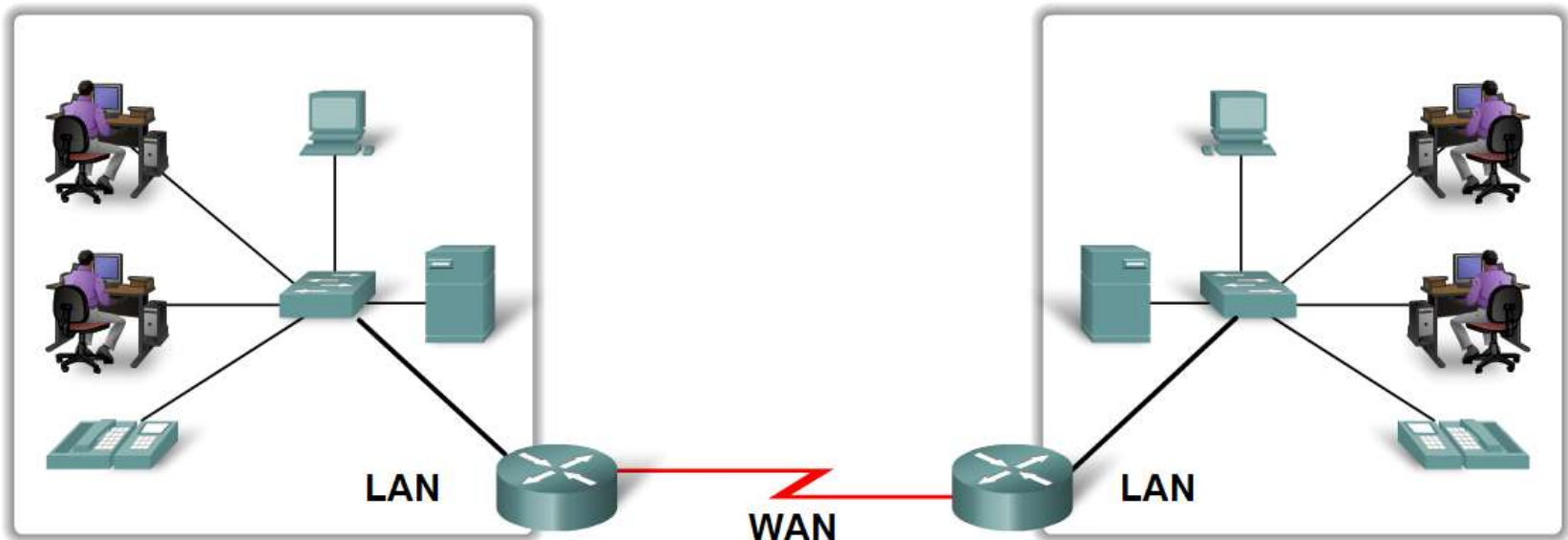WAN(Wide Area Network)

Covering a whole world.

Network Types

- Define Local Area Networks (LANs)
  - A network serving a home, building or campus is considered a Local Area Network (LAN)
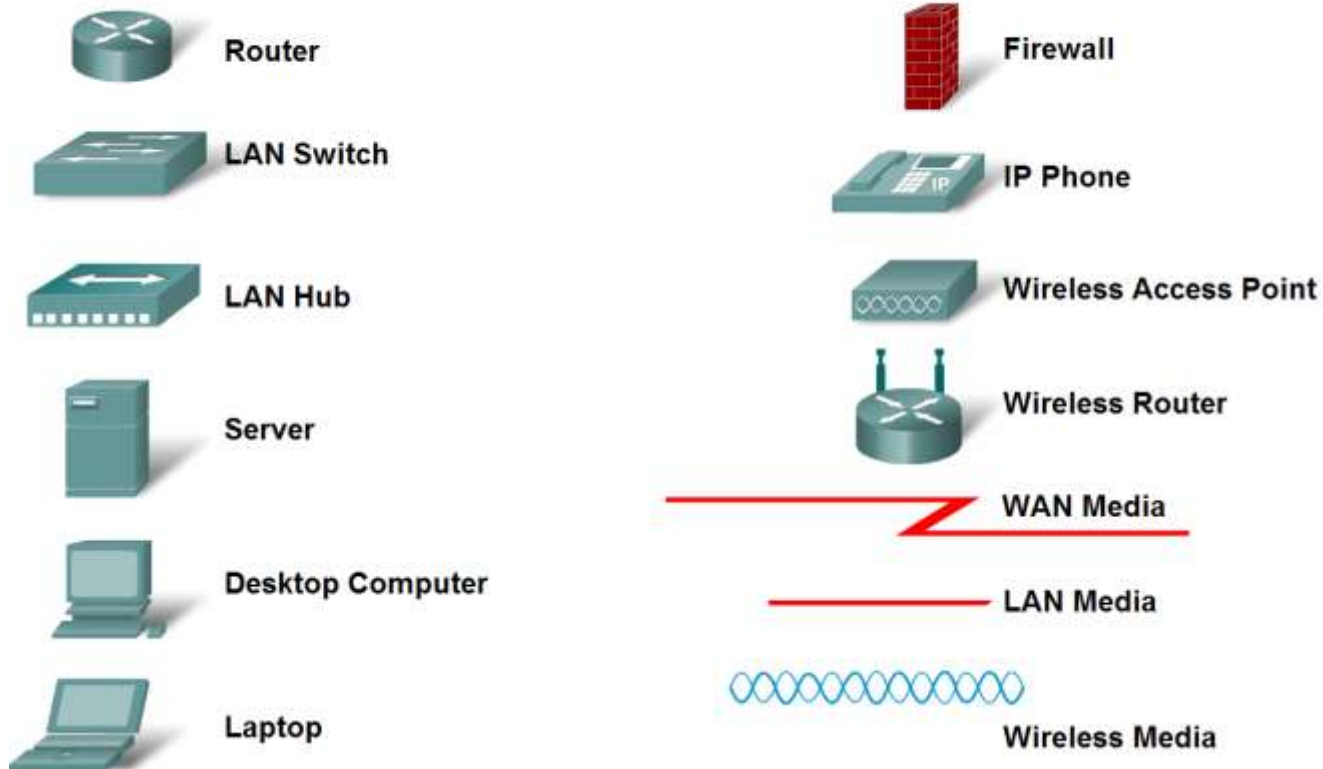
Network Types

- Define Wide Area Networks (WANs)
  - LANs separated by geographic distance are connected by a network known as a Wide Area Network (WAN)

Network Types

Describe network representations

Common Data Network Symbols

PROTOCOLS AND STANDARDS

we define two widely used terms: protocols and standards.
First, we define protocol, which is governs with rule.

Protocols:-set of rules that governs data communication.

Syntax:Structures or format of the data,meaning order in which data can be represented.

Semantics:meaning of each section of bits.

Timing:Data should be sent in time.

Standards represents agreed -upon rules.

Its having two categories:-de jure& de facto.

De jure:-by law/organisation/committee.

De facto:-by fact,by law.

Some of the standards organisation are:-

ISO:-International Oragnization for Standardisation.

ITU-T:-International Telecommunication Unit for Tele Standards.

ANSI:-American National Standards   Institute

IEEE:-Institute of Electrical& Electronics
        Engineers.
EIA:-Electronics Industries Association.