

Uses of Computer Networks

☐ Business Applications

- online buying

☐ Home Applications

- mail, chat

☐ Mobile Users

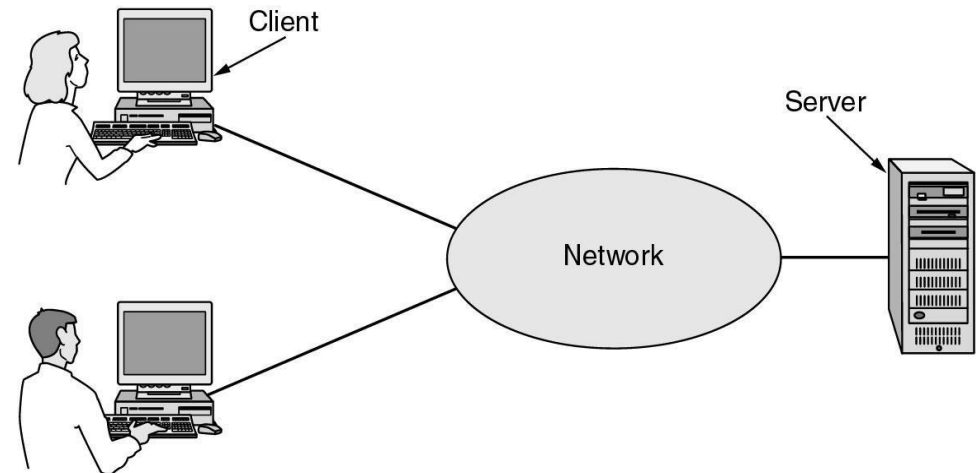
- wireless: laptops, PDA, mobile

☐ Social Issues

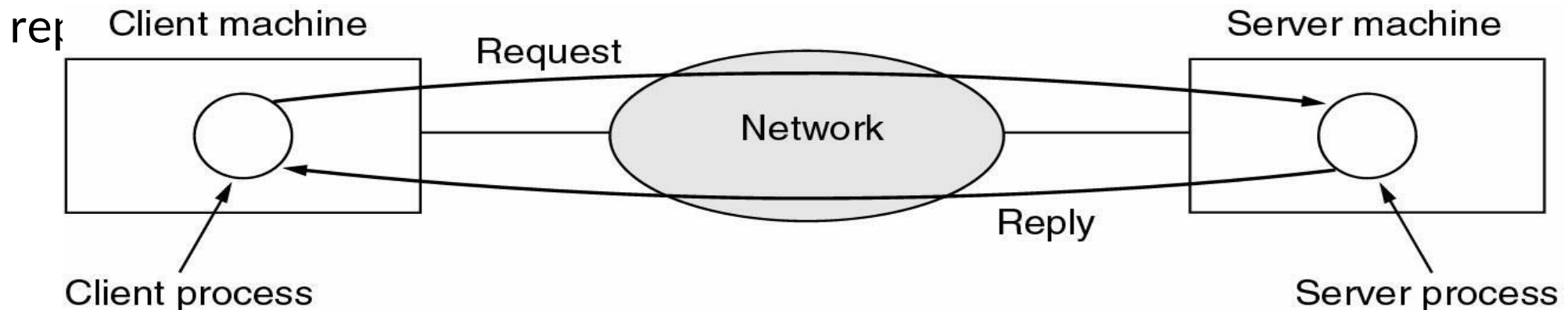
Business Applications of Networks

❑ A network with **two clients and one server**.

- Check bank account
- Pay bills
- Reserve ticket



❑ The **client-server model** involves requests and



Home Network Applications

☐ Access to remote information

- Learning online, downloading

☐ Person-to-person communication

- chat, phone

☐ Interactive entertainment

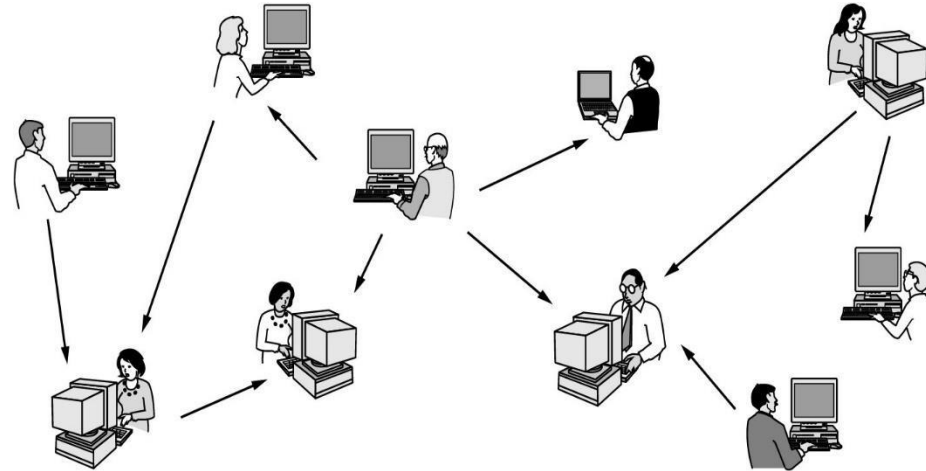
- games, movies, ...

☐ Electronic commerce

Home Network Applications (2)

☐ Peer-to-peer (P2P)

- BitTorrent, ForstWire

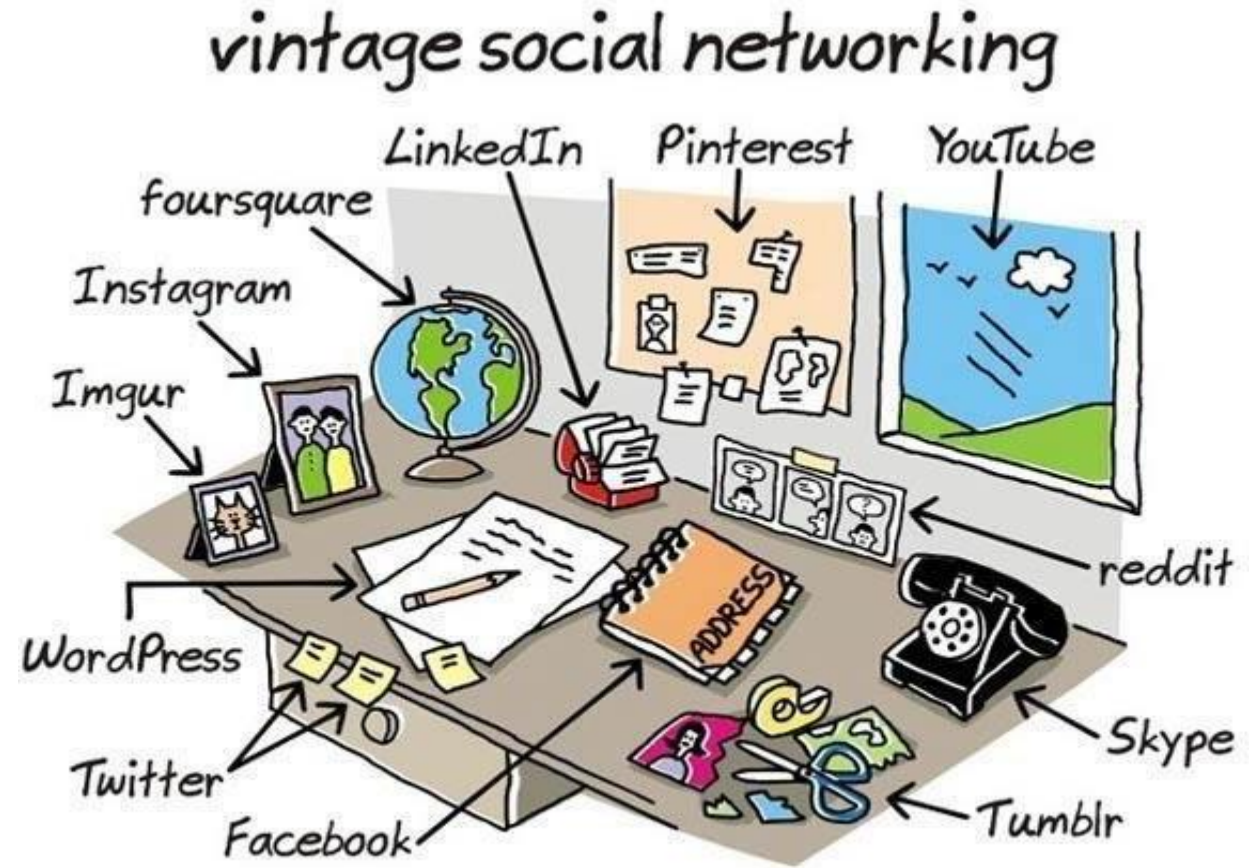


☐ E-commerce

Full name	Example
Business-to-consumer	Ordering books on-line
Business-to-business	Car manufacturer ordering tires from supplier
Government-to-consumer	Government distributing tax forms electronically
Consumer-to-consumer	Auctioning second-hand products on-line
Peer-to-peer	File sharing

Social Issues

- Discussions about
 - **politics,**
 - **technology,**
 - ...
- Hack and robbery



What A Network Includes

- ❑ **Transmission hardware**
- ❑ **Special-purpose hardware devices**
 - interconnect transmission media
 - control transmission
 - run protocol software
- ❑ **Protocol software**
 - encodes and formats data
 - detects and corrects problems

Network Hardware

❑ Transmission technology (2 types)

- Broadcast links
- Point-to-point links

❑ Scale

- Local Area Networks (LAN)
- Metropolitan Area Networks (MAN)
- Wide Area Networks (WAN)
- Wireless Networks
- Home Networks
- Internetworks

❑ Media

- Wire line
- Wireless

Classification by scale

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

CONTENT BEYOND SYLLABUS

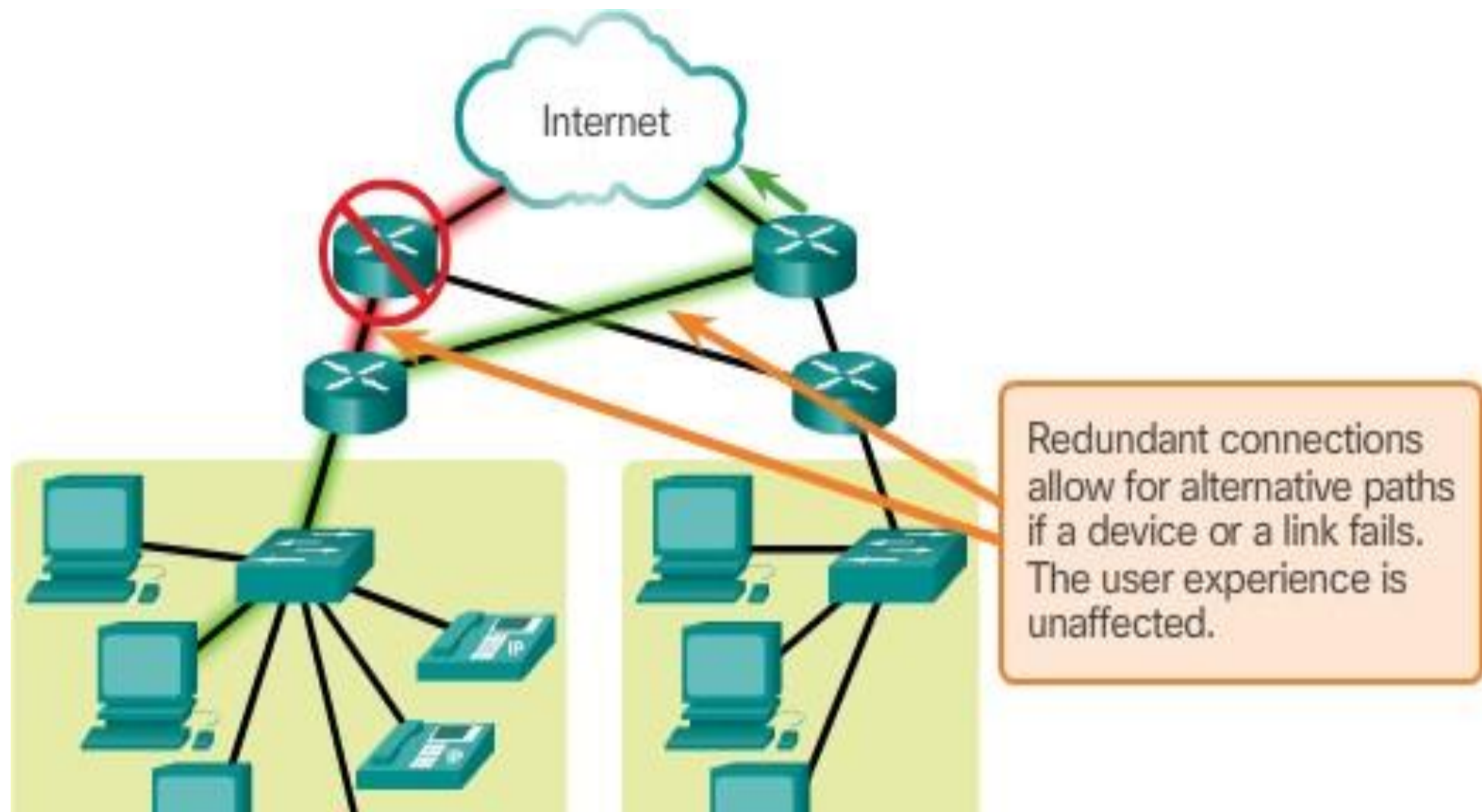
Computer Network (Basic Characteristics)

- ★ Fault Tolerance
- ★ Scalability
- ★ Quality of Service (QoS)
- ★ Security



Fault Tolerance

- The ability of computer network to Continue working despite of failures. Ensure no loss of service.
- Communication is not affected due to alternate route.



Scalability

- Grow based on needs
- Have a good performance after growth.
- Best example is Internet: no impact on performance even though new user gets added.

QoS

QoS is an overall performance measure of the computer network.

The ability to:

Set Priorities(Router will give priority to real time data i.e. VOIP over Email) and manages data traffic to reduce data loss , delay etc.

Security

Ability to prevent:

Unauthorized access to individuals accessing an organization's networks, data, endpoints, applications or devices, without receiving permission.

Misuse:

- **Virus attack:** people use the computer to send virus to another computer in other damage the system..
- **Fraud:** people use the internet to cheat people.
- **Cyberbullying:** some children make use of the internet to bully their friends and enemies
- **Data piracy:** people use the computer to sell things that are not theirs on the internet

Forgery:

Security

Ability to provide:

Confidentiality (use of encryption and decryption mechanism)

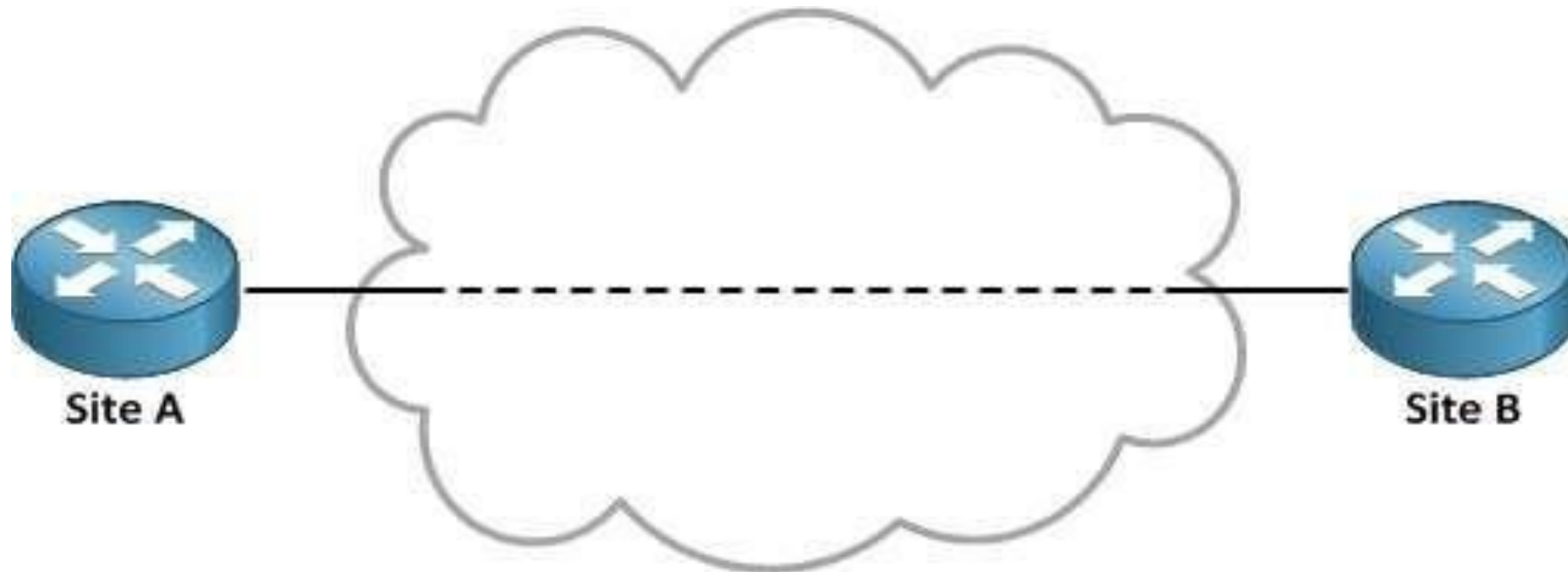
Integrity(no alternation to data)

Availability(available 24x7)

Point -to-Point Connection

It provides a dedicated links between two devices.

For example, a wired system that connects two computers together can be thought of a point-to-point link.



Multi-Point Connection

It is a link between two or more devices. It is also known as Multi- Point configuration. The networks having multipoint configuration are called Broadcast Network.



Transmission Mode

- It refers to the direction of information flow between two devices.
- Data flow is the flow of data between 2 points.

The direction of the data flow can be described as

- Simplex Mode
- Half-Duplex Mode
- Full-Duplex Mode

Data Flow

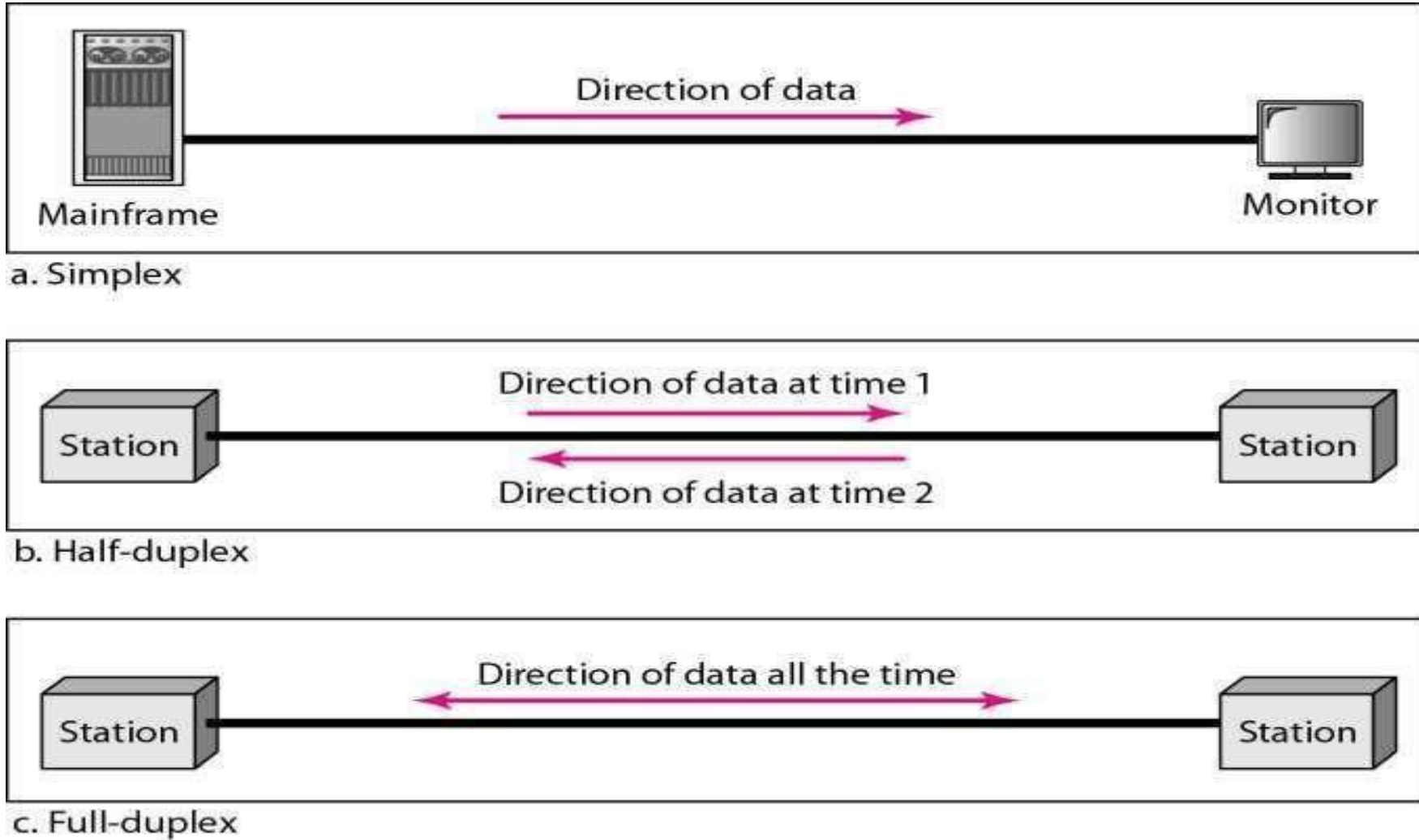


Figure 1.2 *Data flow (simplex, half-duplex, and full-duplex)*

- **Simplex:** Data flows in only one direction on the **data** communication line (medium).

Example: Radio and Television broadcasts.

- **Half-Duplex:** Data flows in both directions but direction **only one** at a time on the data communication line.

Example: Conversation on walkie-talkies.

- **Full-Duplex:** Data flows in both directions simultaneously. Modems are configured to flow data in both directions.

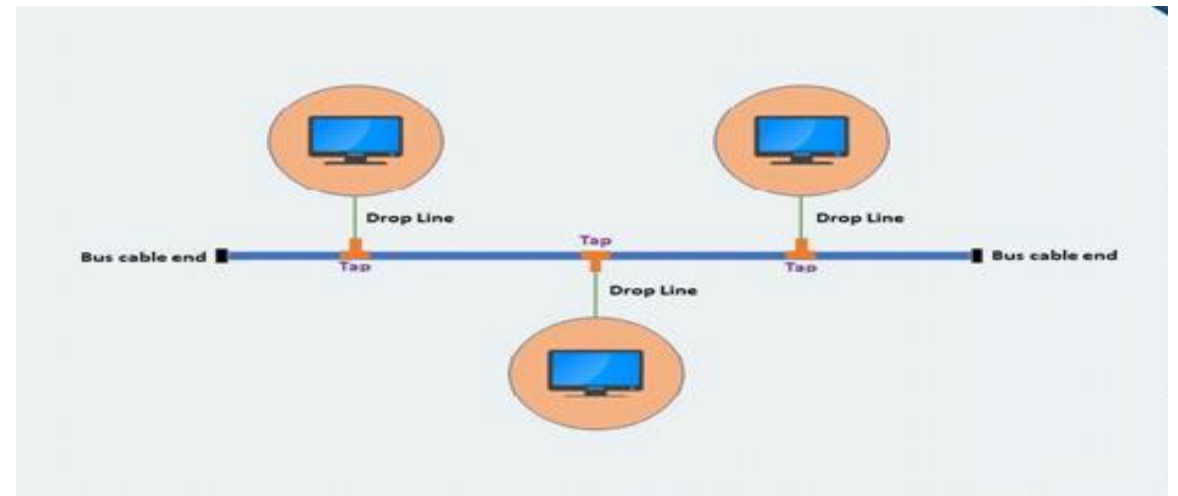
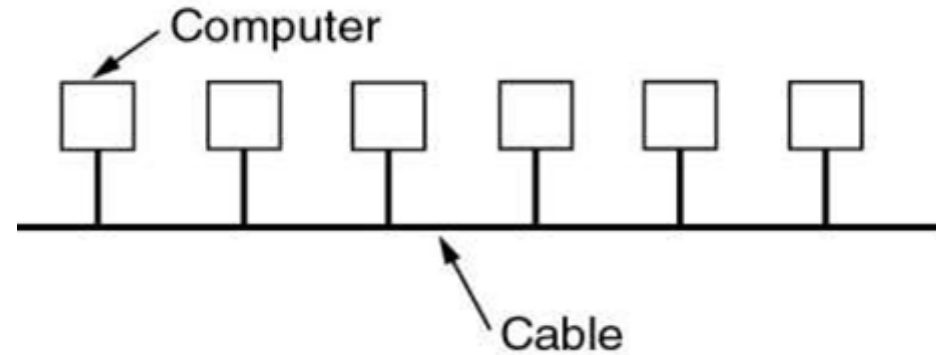
Example: Phone Conversation

Topology

- It defines the Physical (or) Logical arrangement of Links in a Network.
- Topology refers to the layout of connected devices in a network.
- The Topology of the Network is Geometric Representation of the relationship between all Communication links.
 1. BusTopology
 2. Star Topology
 3. TreeTopology
 4. Bus Topology
 5. Ring Topology
 6. Hybrid Topology

Bus Topology

- A Bus topology describes the multipoint configuration.
- One long cable act as a backbone to link all the devices in a network.
- Devices are connected in a bus topology with the help of “Drop lines” and “Tapes”.



Bus Topology

Advantages:

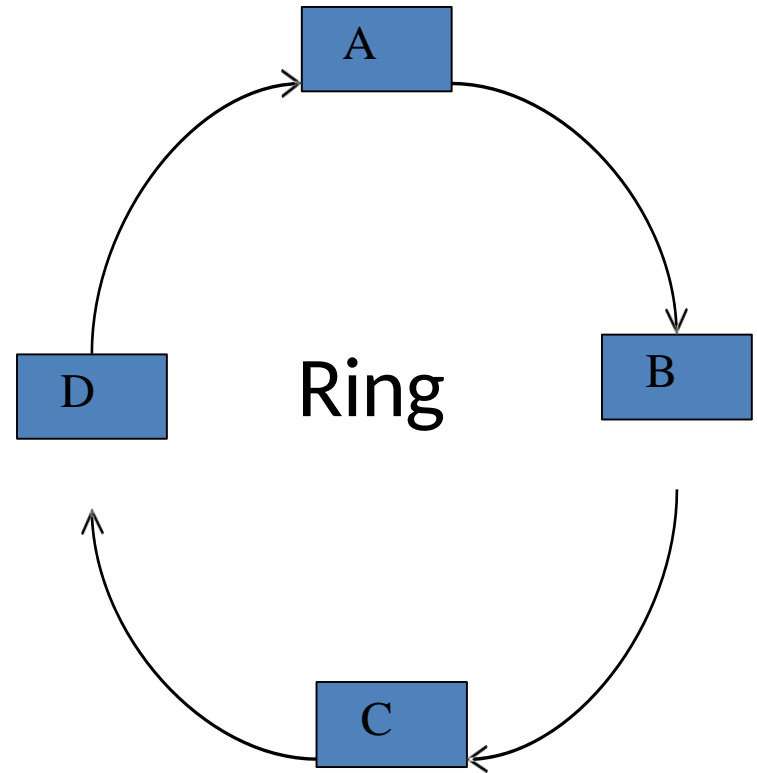
- Less Expensive.
- Suitable for temporary network.
- Node failure does not affect others

Disadvantages:

- Not a fault tolerant.
- Limited cable Length.
- No security

Ring Topology

- A Ring topology is a bus topology in a closed loop.
- Peer-to-peer LAN topology.
- Unidirectional
- Sending and receiving of data takes place with the help of a **Token**.



Ring Topology

Advantages:

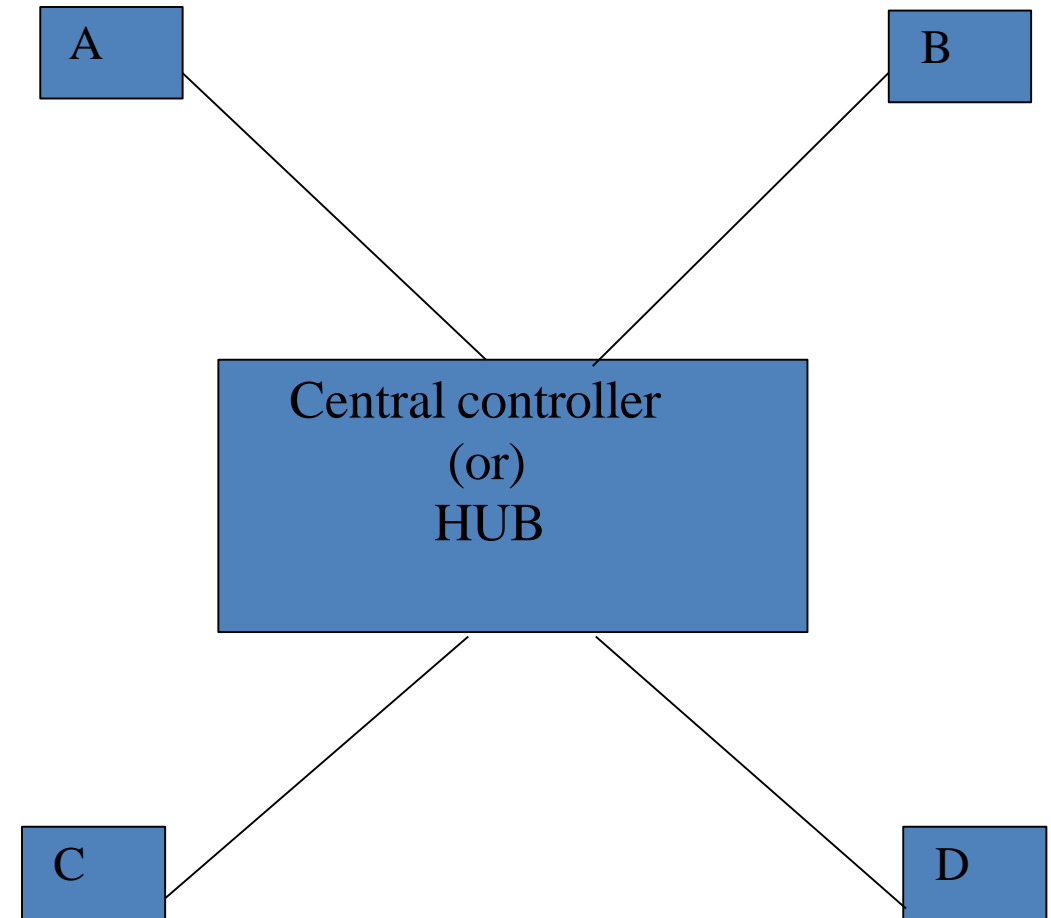
- Easy to install and reconfigure better performance than Bus Topology.
- Can cause bottleneck due to weak link.
- All nodes with equal access.

Disadvantages:

- Unidirectional single point of failure will affect the whole network.
- Increase in load leads to decrease in performance.
- No Security.

Star Topology

- Each device has a dedicated point-to-point link between only a central controller or “HUB” .
- The devices are not directly linked to some other devices.
- If one device wants to send data to another device, it sends to the central controller and the Central controller send to other device.



Star Topology

Advantages :

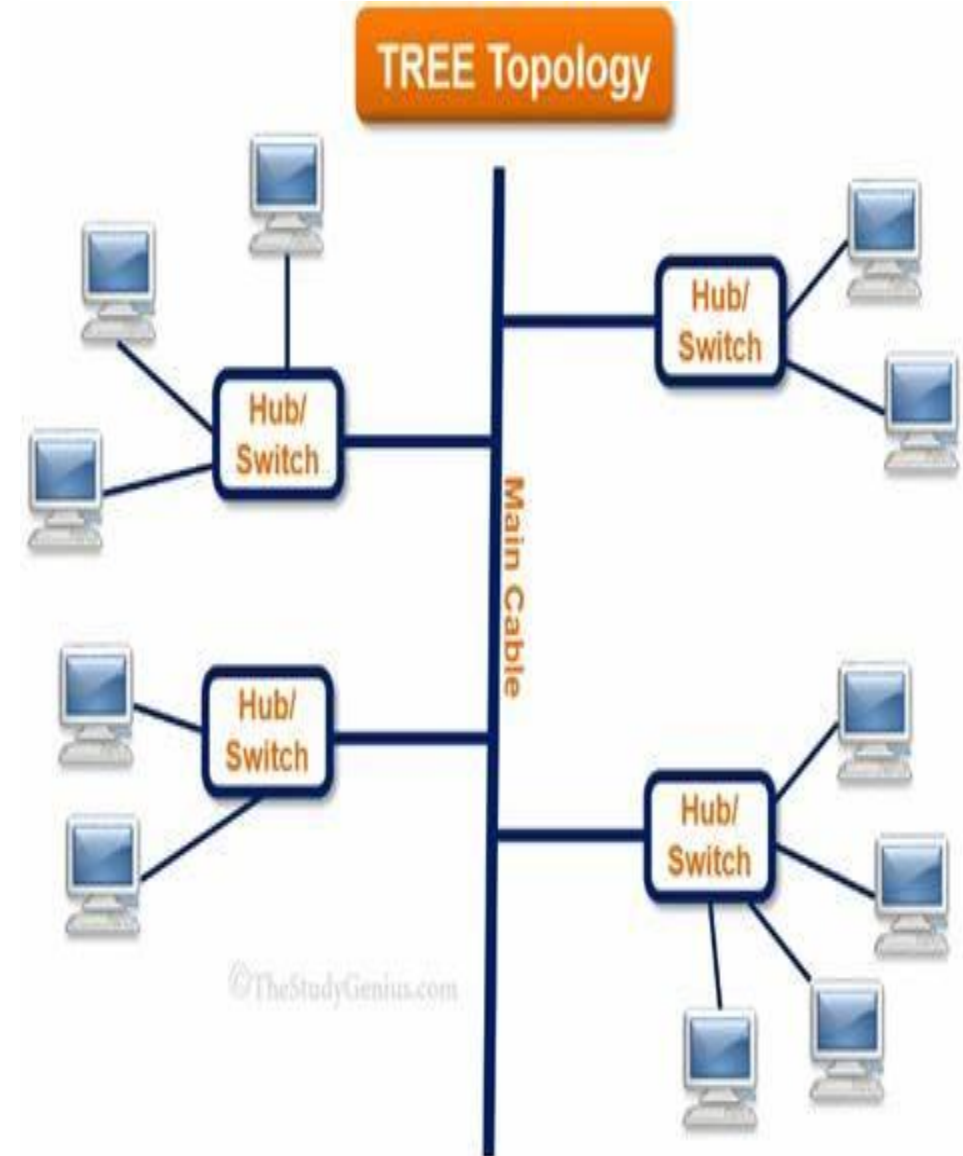
- Easy to design and implement.
- Centralized Administration.
- Scalable.

Disadvantages:

- Each device must connected to controller.
- Bottleneck due overloaded Switch and Hub.
- If central controller failure means network collapse.

Tree Topology

- Tree topology has some variation from star topology.
- The nodes in the tree are linked to central controller.
- The primary HUB in the tree is represented by “Active Hub”.
- The secondary HUB in the tree is represented by “Passive Hub”.



Tree Topology

Advantages :

- It allows more devices to be attached in a single central controller.
- It allows the network to prioritize the communication.

Disadvantages:

- Each device must be linked to controller.
- It require more installation processes.
- If central controller failure means system should fail down.

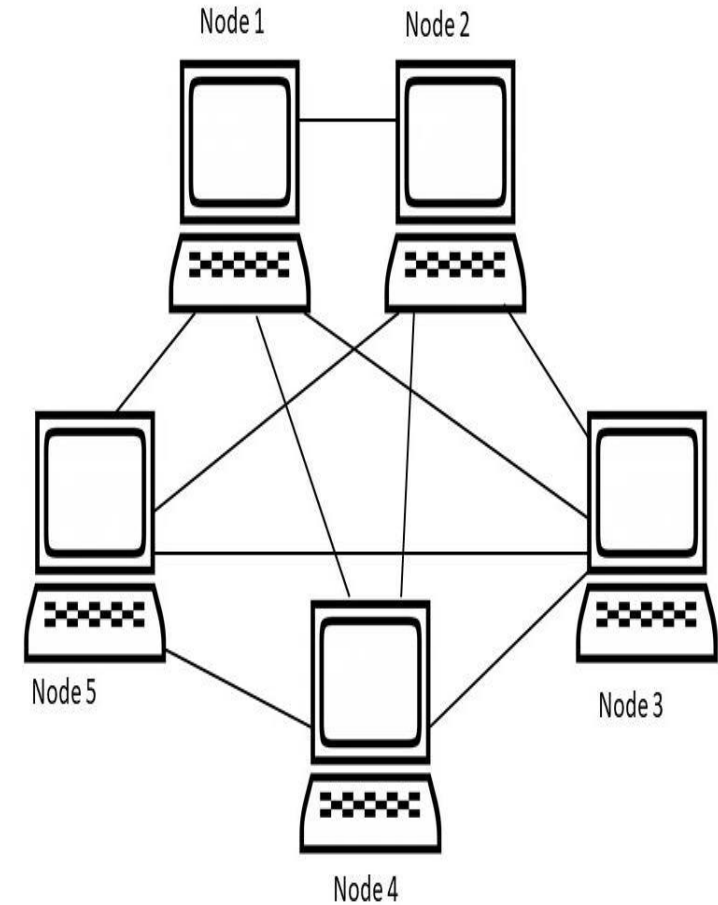
Mesh Topology

- Here every device has a direct point to point link between every other device.
- A fully connected mesh can have $n(n-1)/2$ physical channels to link n devices.

if $n=5$ (Number of Nodes)

then $5(5-1)/2 = 10$ (Communication Links)

5 Nodes are Connected by using 10 Communication Links



Mesh Topology

Advantages :

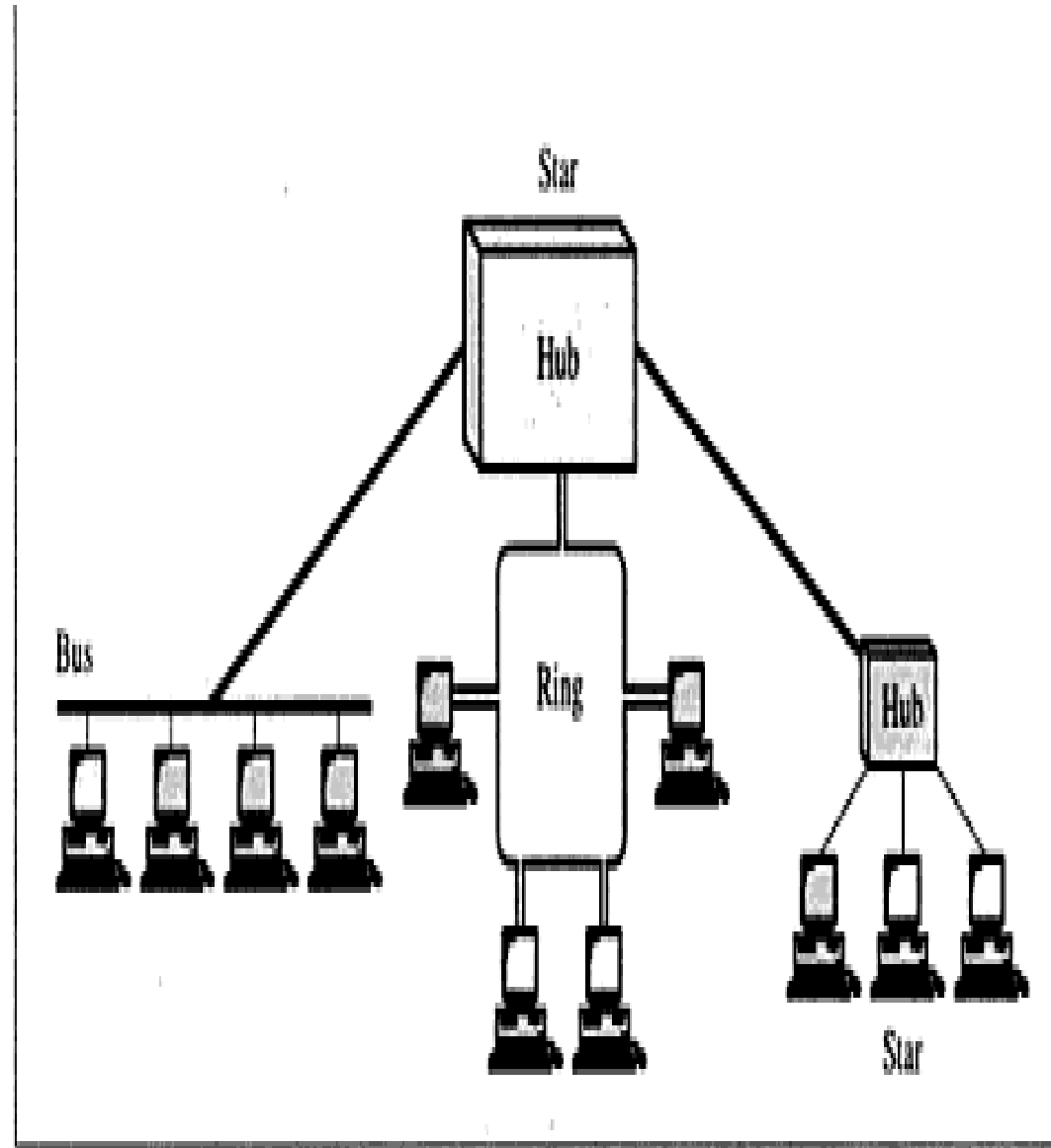
- It eliminate the traffic problem.
- It is robustness.
- It has privacy and security.
- Fault can be easily found.

Disadvantages:

- More number of cables to be used.
- Every devices must be connected to some other devices. So installation process is very difficult.

Hybrid Topology

- Combination of all topology is called hybrid topology.



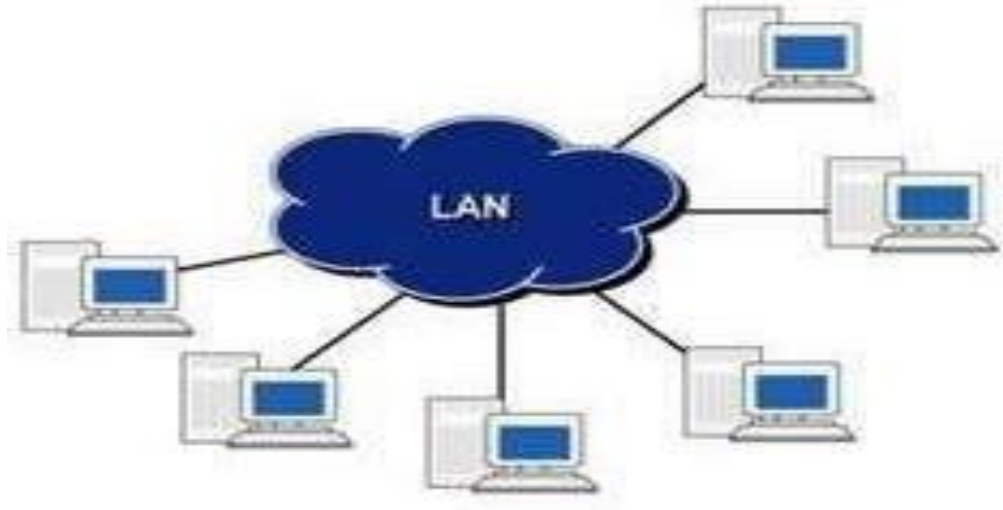
Categories or Types of Network

There are Three Types:

- 1. LAN - Local Area Network**
- 2. MAN - Metropolitan Area Network**
- 3. WAN – Wide Area Network**

LAN - Local Area Network

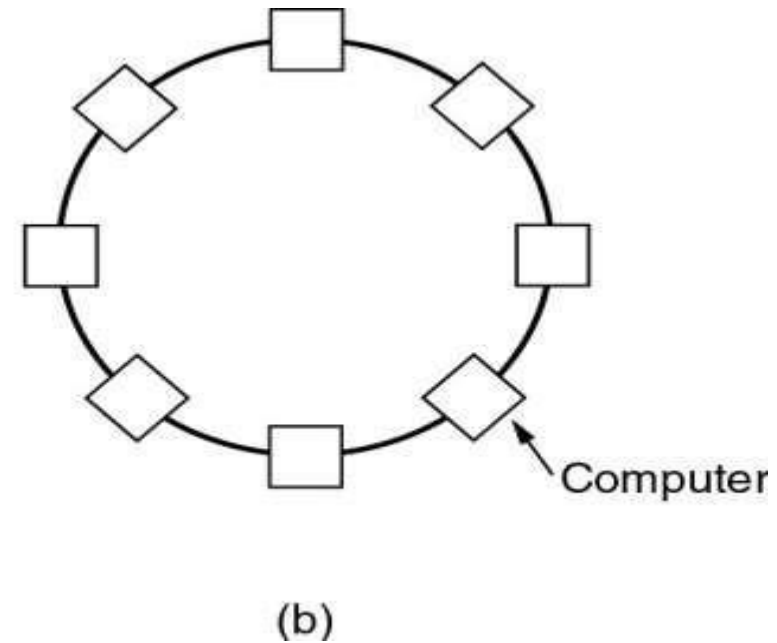
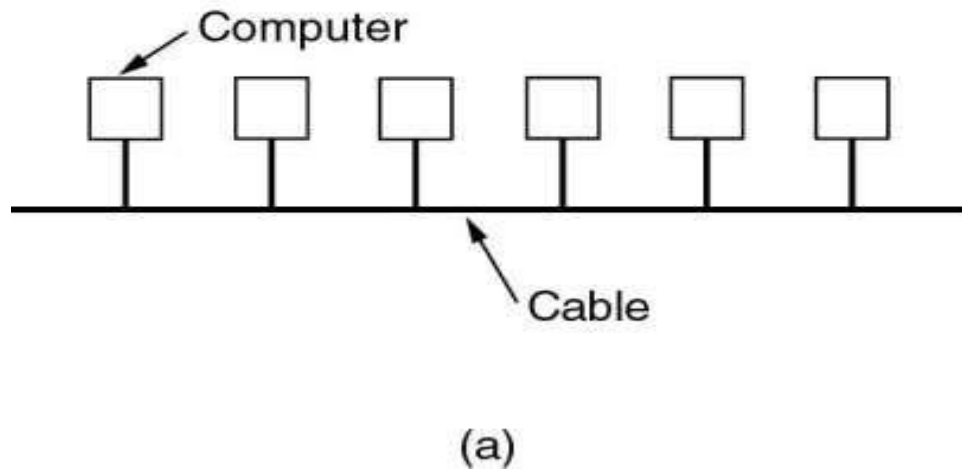
- LANS are privately-owned networks within a single building or campus of up to few kilometers in size
- **A LAN is Designed by Local Area Connections such as:**
 - i) within Building
 - ii) within office
 - iii) within Campus



LAN - Local Area Network

- LANS are distinguished based on
 - Their size
 - Their transmission technology
 - Their topology
- LANS are restricted in **size**
- LANS use a **transmission technology** consisting of a single cable to which all machines are attached like telephone company lines once used in rural areas
- LANS run at speeds of 10 to 100 Mbps, have low delay and make very few errors

LAN - Local Area Network



Topology used here is Bus and Ring

Advantages

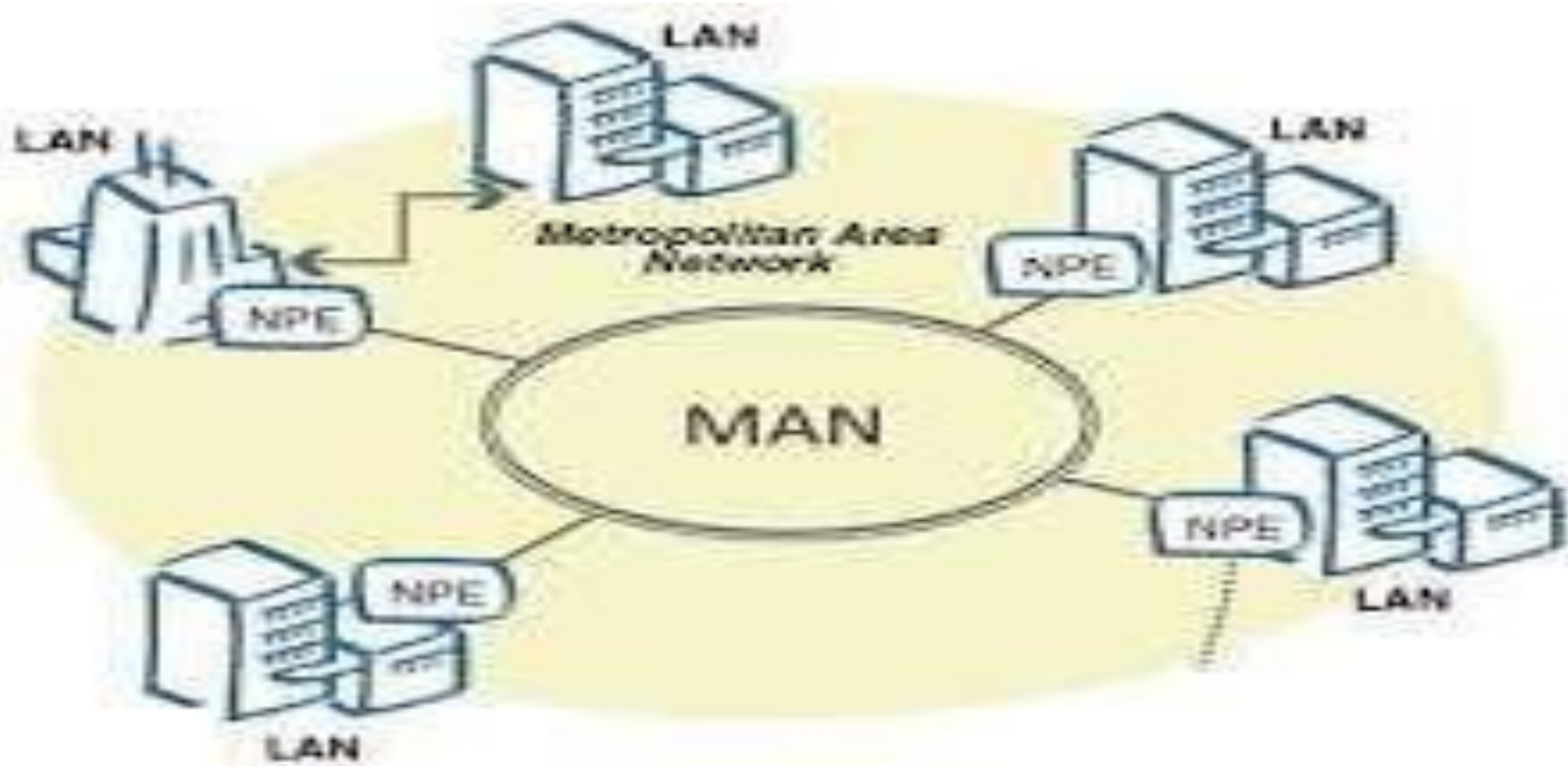
- 1)Sharing of Files.**
- 2)Sharing of Programs.**
- 3)Communication Exchange**

Disadvantages

- 1)Reliability**
- 2)Capacity**
- 3)High Cost**

MAN - Metropolitan Area Network

- Interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN).
- MAN supports up to 150 Kilometers Distance.
- It uses the standard DQDB (distributed queue dual bus, 802.6)
- **Example:**
 - Telephone
 - Network Cable TV

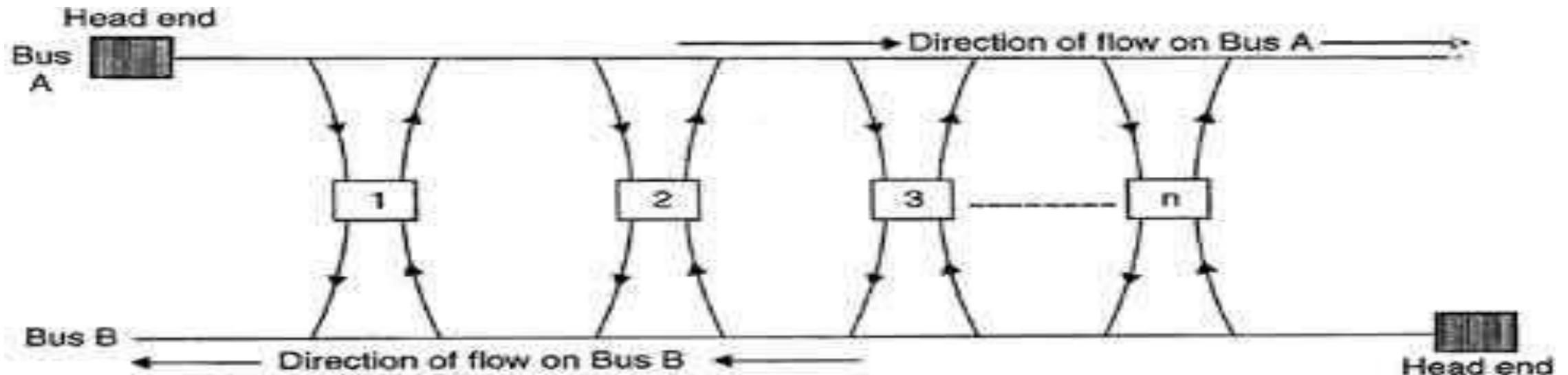


DQDB consists of two unidirectional buses to which all computers are connected . Each bus has **head end** which initiates transmission activity. The key aspect of MAN is a broadcast medium to which all computers are attached.

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Architecture of DQDB

Advantages

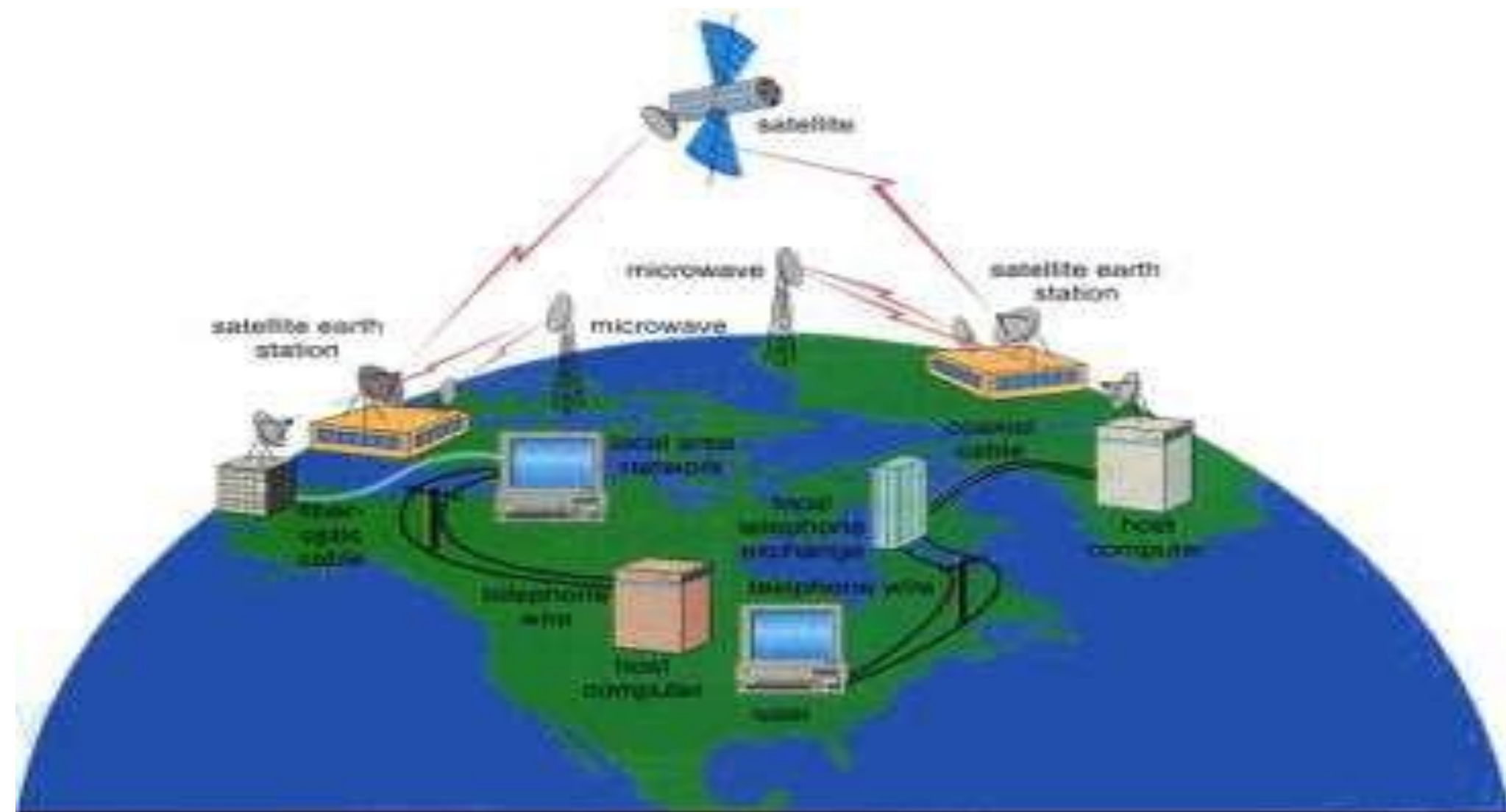
- 1) High Bandwidth**
- 2) It support Large number of Clients**
- 3) Reduce the Errors.**

Disadvantages

- 1) Large Space Requirements**
- 2) Slower Data Access**
- 3) High Cost**

WAN - Wide Area Network

- WANs spans a large geographical area, often a country or continent.
- It contains collection of machines for running user applications, called **hosts** or **end user**.
- The hosts are connected by communication subnet or **subnet**. The subnet carries message from host to host.
- For communication aspect – subnet application aspect - hosts

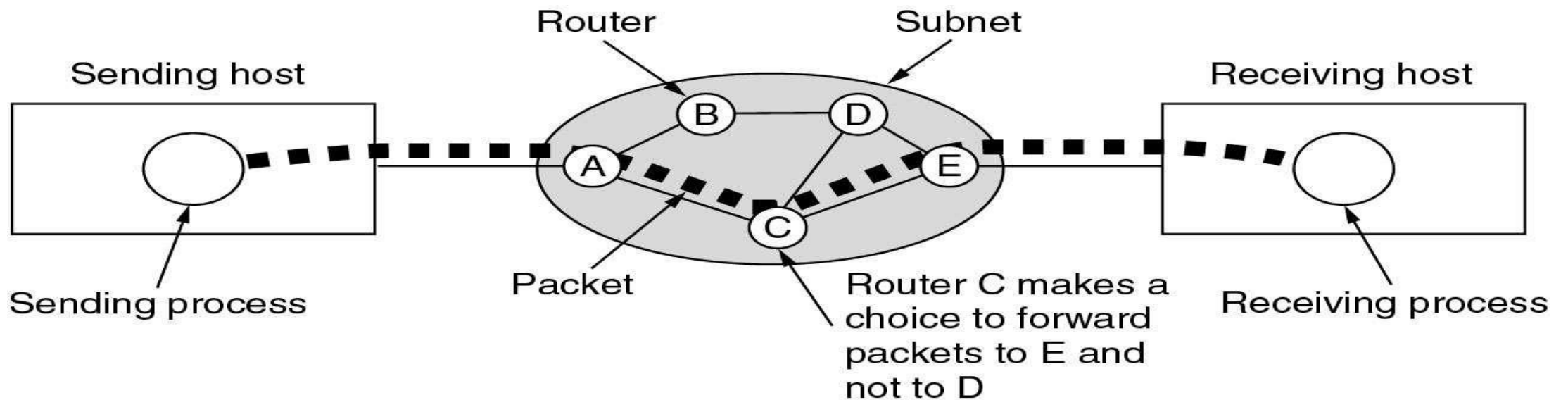


WAN - Wide Area Network

- In WAN the subnets consists of two distinct components: transmission lines and switching elements.
- Transmission lines are circuits or channels
- Switching elements are specialized computers used to connect two or more transmission lines. These are called **routers**
- Each host is connected to LAN on which a router is present, or in some cases host can be connected directly to router.
- **The collection of communication lines and routers form the subnet.**

WAN - Wide Area Network

- When the packet is send from one router to another via one or more intermediate routers , the packet is received at each router and stores until required output line is free and then forward.
- A subnet uses this principle and it is called as point-to-point , store- and-forward, or packet-switching subnet.



Protocol Architecture

- Each layer of protocol architecture provides some set of rules
- There are 2 widely used protocol architecture
 - ✓ TCP/IP Architecture
 - ✓ OSI Model

Protocol

- Protocol is a set of rules that govern data communication
- It represents **what** is communicated, **when** it is communicated and **how** it is communicated.
- There are 3 key elements
 - ✓ Syntax
 - ✓ Semantics
 - ✓ Timing

Syntax

- It represents **structure**, Format of data the order in which it is presented

Data may contain:

- First 8 bit -> SenderAddress
- Second 8 bit -> ReceiverAddress
- Remaining bits-> message stream

SEMANTICS

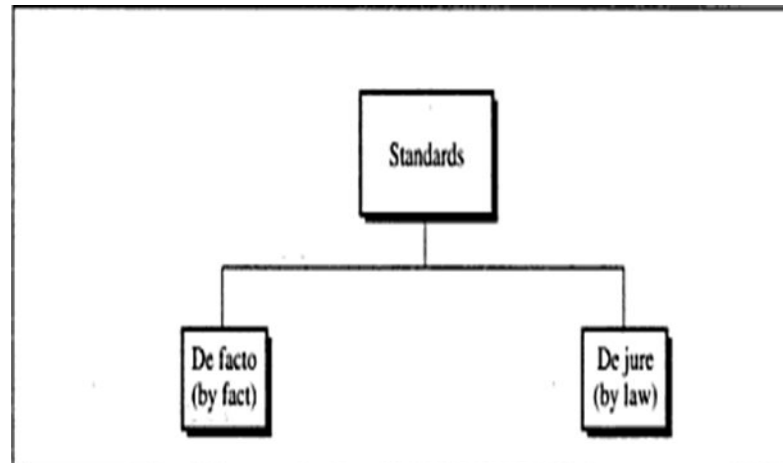
- It refers the **meaning** of each section of bit

TIMING

- It refers when data sent and how fast it is sent (Says Characteristics)
- Ex: 100Mbps

Protocol Standard

- It provides **model for the development** of product regardless of individual manufacturer
- It falls in 2 categories



De Facto standard

- Not officially adopted but usedwidespread
- It has 2 categories
- **Proprietary**->Wholly owned by company
- **Non-Proprietary**->Group or communiy developed for public

De Jure Standard

- A Standard Legislated by an officially recognized body
- Standard Organizations:
 - International Standard Organization
 - ANSI
 - IEEE