

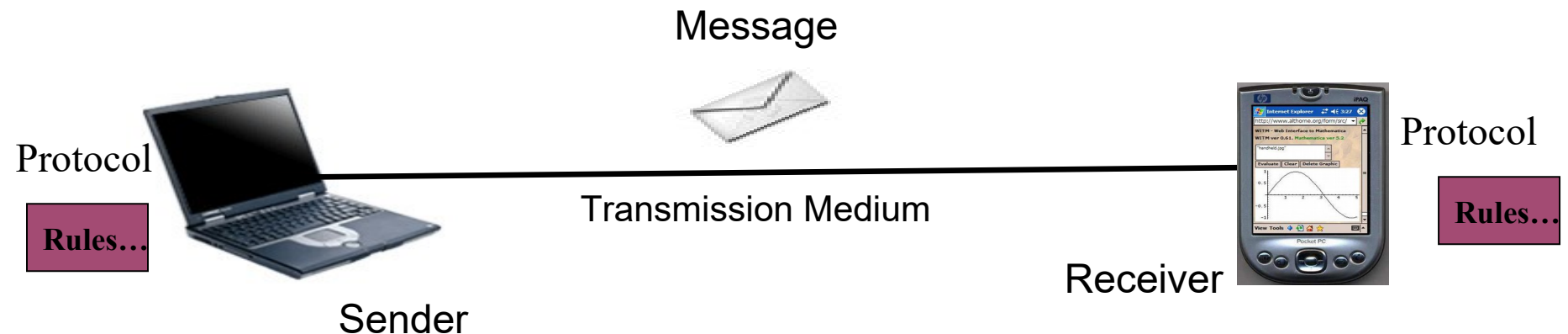
# **Chapter 1: Introduction**

# DATA COMMUNICATION

- **Data Communications** are the exchange of data between two devices via some form of transmission.

# COMPONENTS OF DATA COMMUNICATION

1. **Message:** data.
2. **Sender:** The device that send the message.
3. **Receiver:** The device that receive the message.
4. **Transmission Medium:** The physical path between sender and receiver, the message travel.
5. **Protocol:** Is a set of rules that governs data communication. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but can not communicate.



# DATA COMMUNICATION CHARACTERISTICS

**1. Delivery:** The system must deliver data to the correct destination.

**2. Accuracy:**

- Data delivered accurately.
- Altered data which left uncorrected are unusable.

**3. Timelines:**

- The system must deliver data in timely manner without delay (real-time).

**4. Jitter:**

- Jitter refers to the variation in the packet arrival time. It is the uneven delay in the delivery of audio or video packets.

# Data Representation

- Text
- Numbers
- Images
- Audio
- Video

# DATA FLOW IN COMMUNICATION

- Simplex: one direction only.



Remote Control



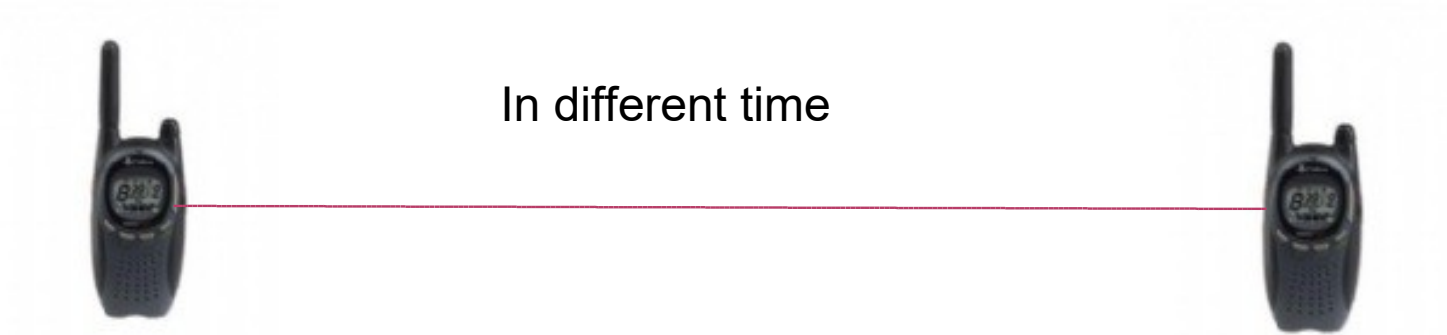
TV

- Always one side sender and another side receiver.

# DATA FLOW IN COMMUNICATION CONT.

- **Half-Duplex:** two-way alternate.

## Walki-Talki

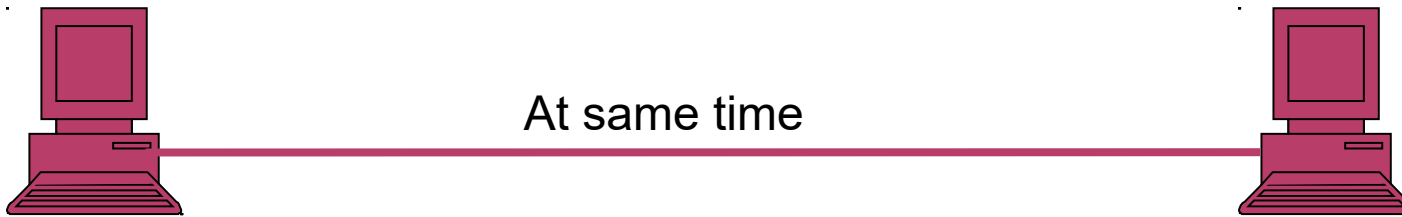


- Each side maybe sender or receiver but not a same time.

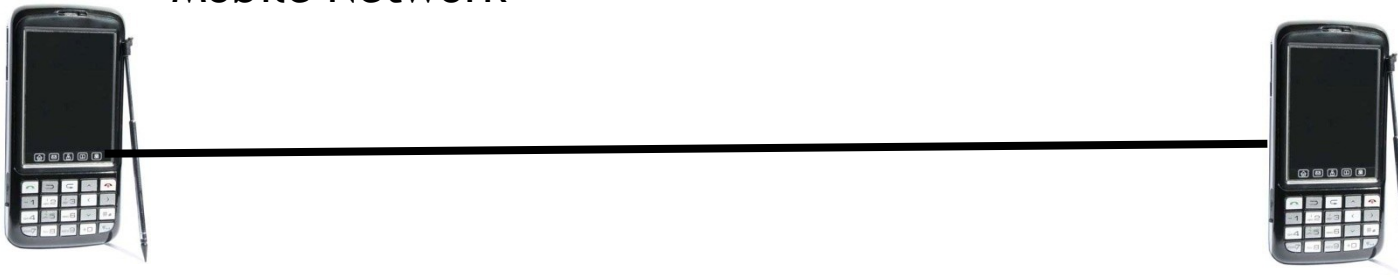
# DATA FLOW IN COMMUNICATION CONT.

- **Duplex:** two-way concurrent.

Computer network



Mobile Network



- Each side sender and receiver at same time.



# NETWORK

- A **Network** is a set of node connect together by communication link to sharing of resources and to transmit information.
- **Node:** Computer, Printer, Scanner etc.
- **Information:** text, voice, picture, etc.

# Why Network ?????

Sharing

# Sharing of What ?????

Resources

# What Resources ?????

Printer, Scanner, Memory, Information  
Network Bandwidth, Internet Services, Data Base,  
etc.

# NETWORK SERVICES

- Sharing (file, printer, application).
- Internet browsing.
- Fax Service.
- Telephony.
- Conferencing.
- Database.
- Backup.
- Etc.....

# NETWORK COMPONENTS

- Transmission media (wired, wireless ).
- Network Operating System (NOS).
- Network Interface Card (NIC).
- Network Hardware:-
  1. Hubs.
  2. Switches.
  3. Routers.
  4. Gateways.
  5. Access Point.
  6. Repeaters.

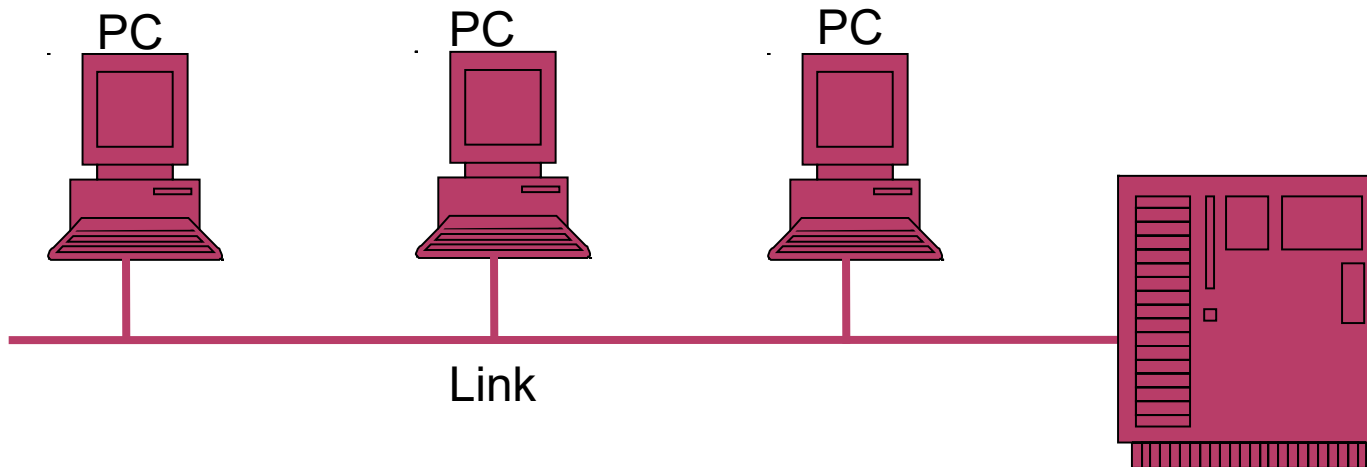
# NETWORK CLASSIFICATION

Upon the transmission medium (type of connection):-

1. **Point-to-point:** A pair of nodes connected together via dedicated link.



2. **Multipoint:** Number of node connected and share a single link.



# NETWORK CLASSIFICATION

Upon the scale (size):-

1. PAN (Personal Area Network).
2. LAN (Local Area Network).
3. CAN (Campus Area Network).
4. MAN (Metropolitan Area Network).
5. WAN (Wide Area Network).

# PAN (PERSONAL AREA NETWORK)

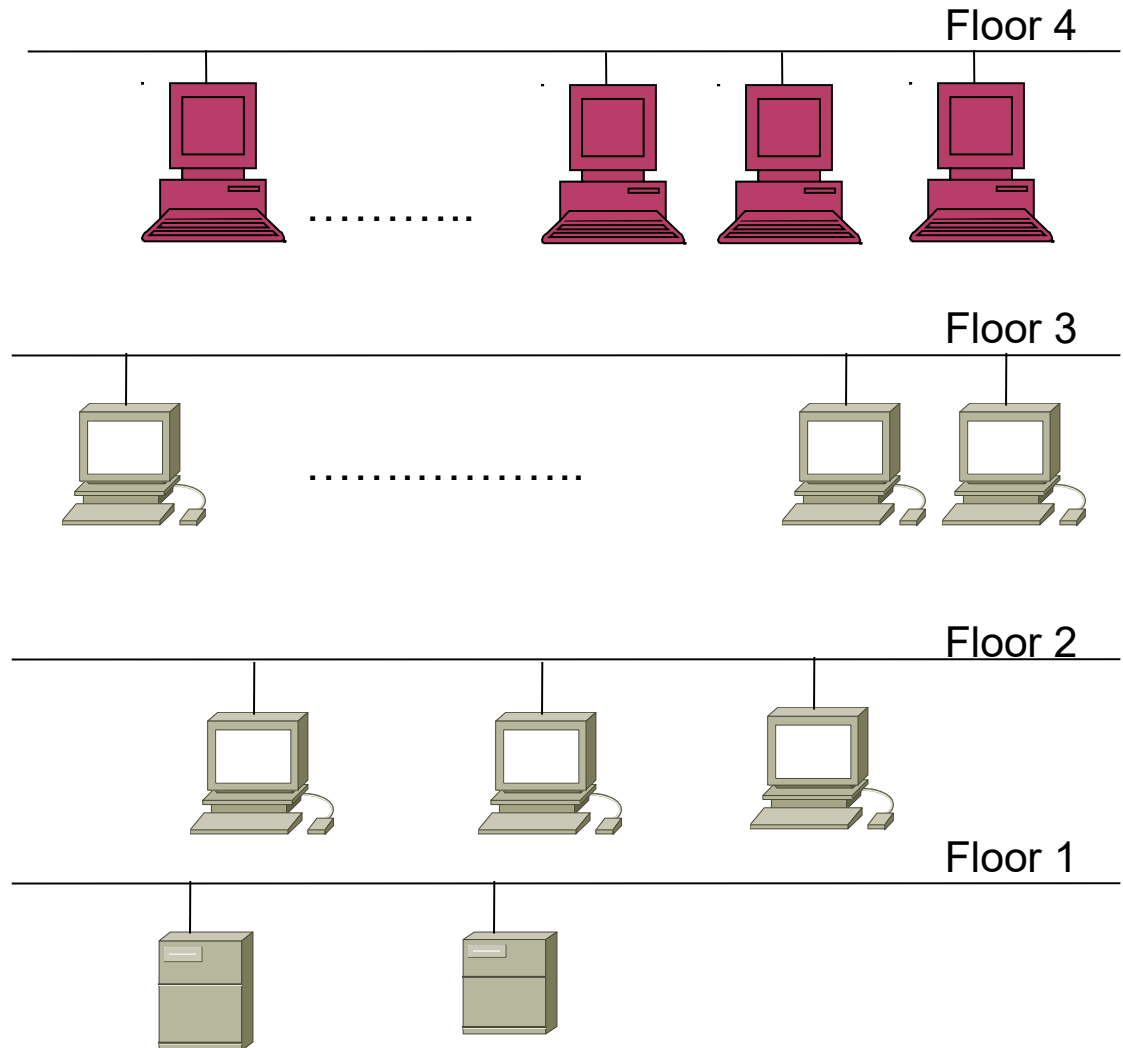
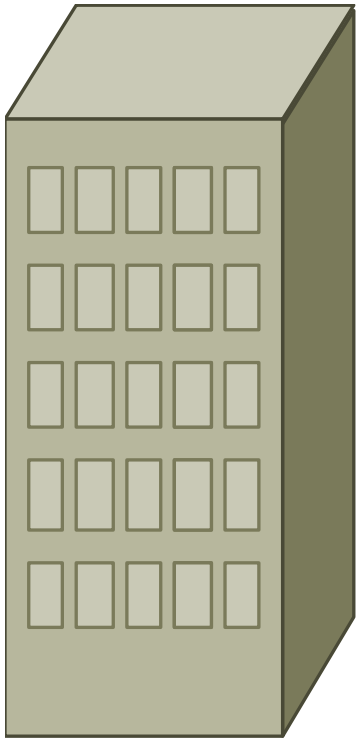
- PAN is a short-distance network design for individual user (person).
- PAN may contain:- printer, mobile, computer, wireless printers etc.
- components of PAN are connected together via Bluetooth , USB cable ,IrDA (infrared), etc.

# LAN (LOCAL AREA NETWORK)

- A LAN is a group of nodes connected together in a small specific area.
- LAN may contain workstations, computers, scanner, printers, servers, etc.



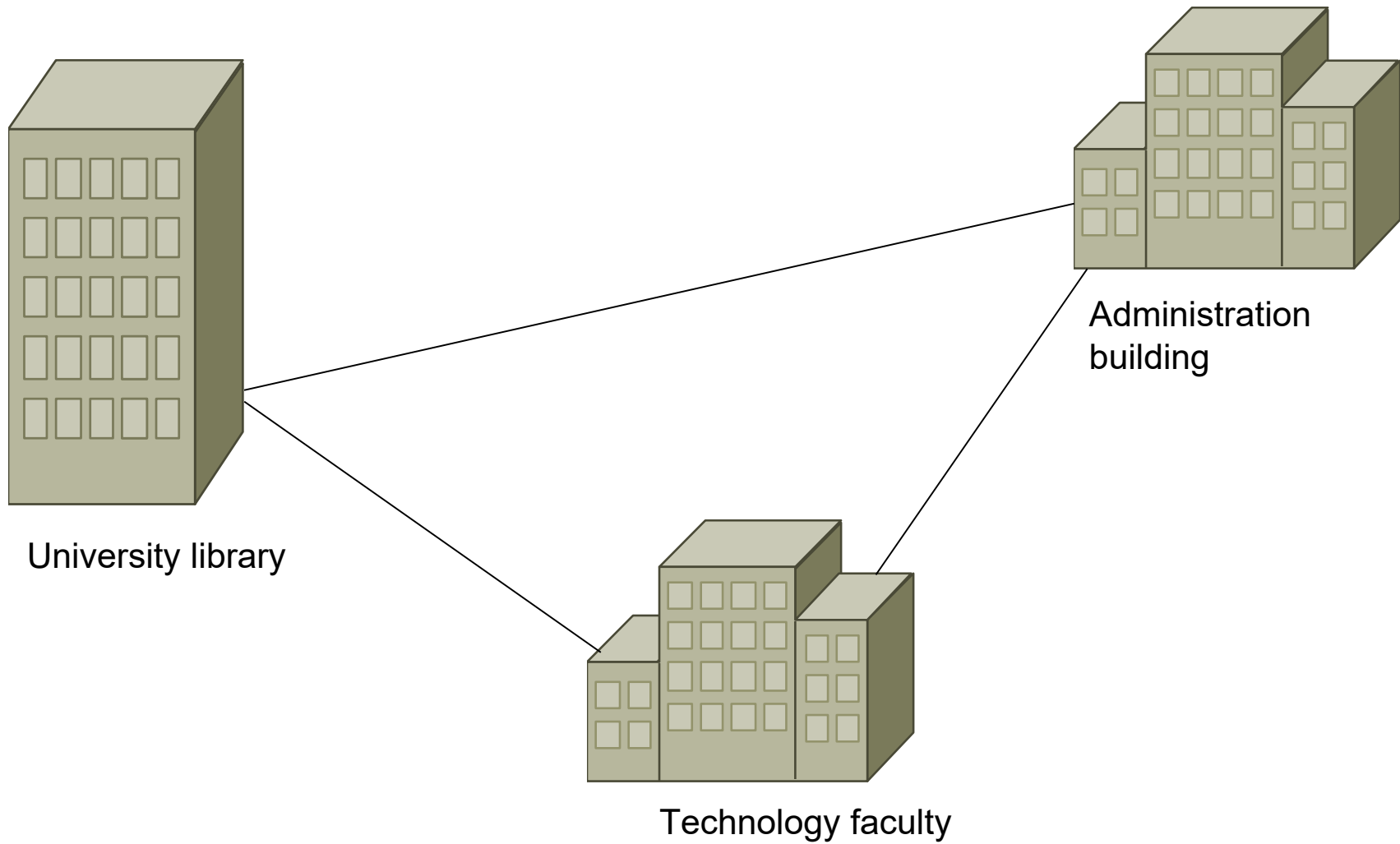
# LAN CONT.



# CAN (CAMPUS AREA NETWORK)

- A CAN is a group of interconnection LAN within limited geographical area.
- A CAN using in school campus, military base, university campus ,etc.

# CAN CONT.



# MAN (METROPOLITAN AREA NETWORK)

- A MAN is a large computer network used to connect between LAN in different locations (cities).
- A MAN is a group of nodes connected together over a city.

# WAN (WIDE AREA NETWORK)

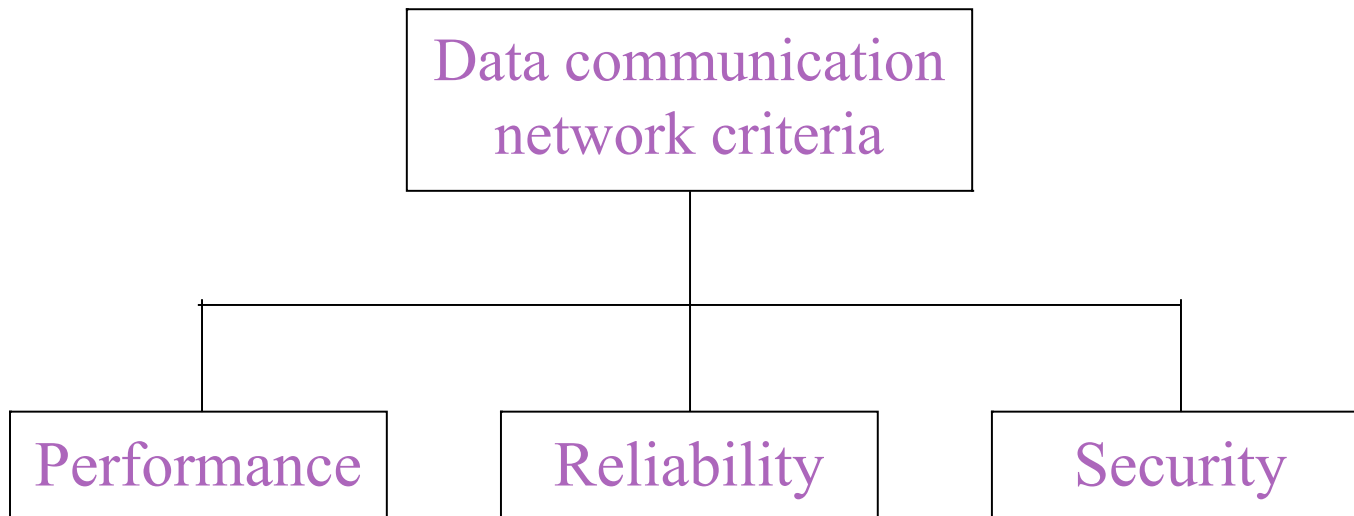
- A WAN is a computer network that covers large geographical area.
- WANs are used to connect types of networks together.

# WAN CONT.



# NETWORK CRITERIA

- A network must be able to meet a certain number of criteria. The most important of these are Performance, Reliability, and Security



# NETWORK CRITERIA

- **Performance:**

- The performance of network depends on a number of factors:
  - ✓ Number of users
  - ✓ Type of transmission medium
  - ✓ Hardware
  - ✓ Software.
- ❖ The performance is evaluated by two networking metric :  
Throughput and Delay.
- ❖ Performance can be measured in many ways, including transit time and response time.

- **Reliability:**

Network reliability is measured by

- Accuracy of delivery
- Frequency of failure
- Recovery time of a network after a failure



# NETWORK CRITERIA CONT.

- **Security:**

Network security include

- protecting data from unauthorized access
- protecting data from damage, and
- write policies and implementing it for security issues.

# NETWORK MODES

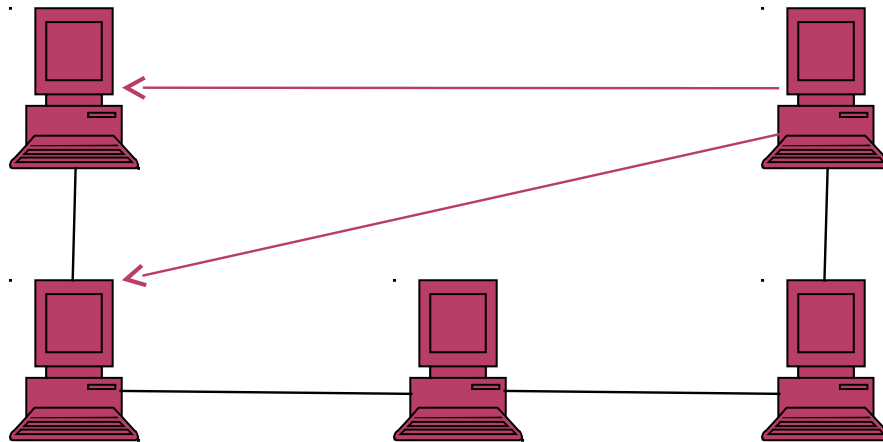
- **Unicast Mode:**  
Single source send to single node.



# NETWORK MODES CONT.

- **Multicast Mode :**

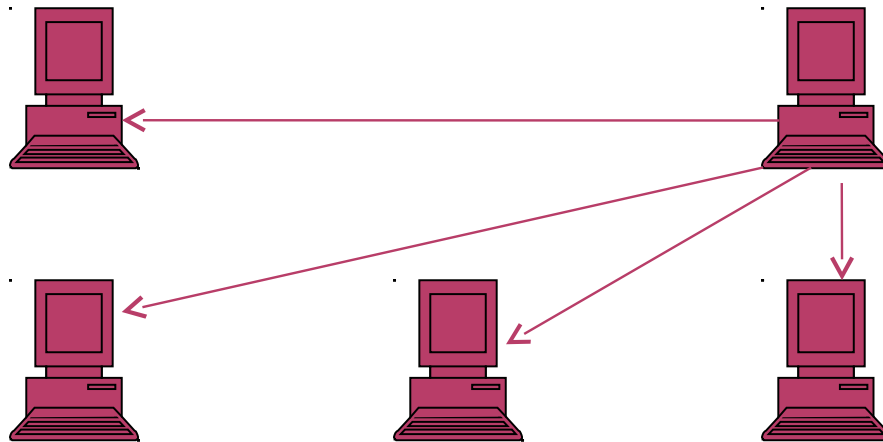
Single source send to specific nodes (group) that are connected to same Network.



**one-to-many**

# NETWORK MODES CONT.

- **Broadcast Mode:**
  - Single source send to all other nodes that are connected to same Network

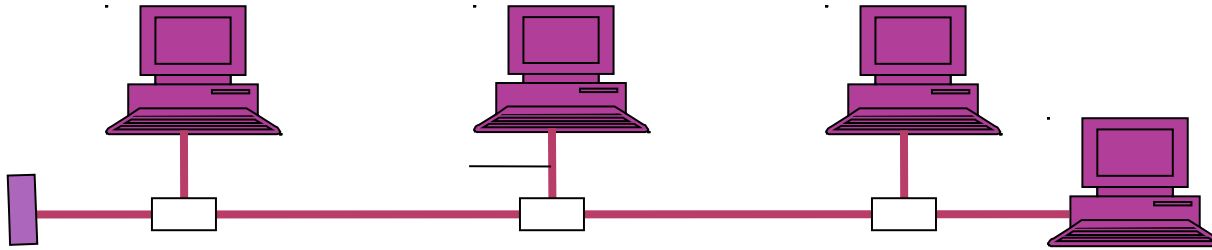


**one-to-all**

# PHYSICAL TOPOLOGY

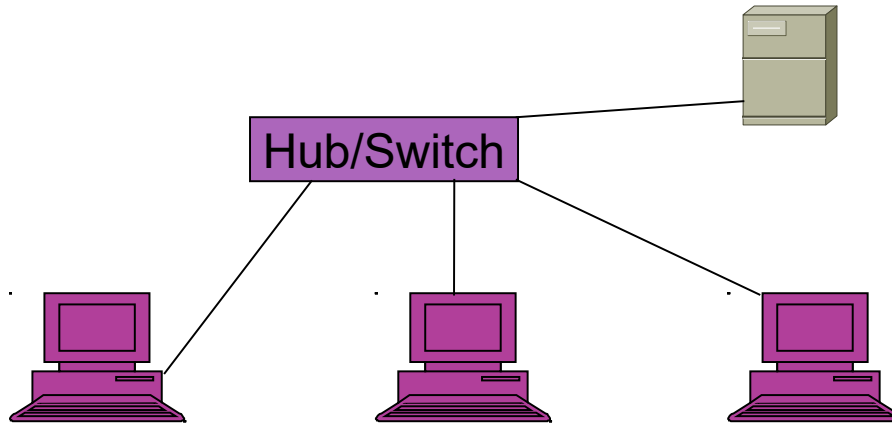
- Determines how the network nodes are connected together.
  - Bus Topology
  - Star Topology
  - Ring Topology
  - Mesh Topology
  - Tree Topology
  - Hybrid Topology

# BUS TOPOLOGY



- Multipoint.
- One long cable (backbone) ,connect all nodes in network.
- Access method : Broadcast.
- All computer have a copy from a message but only the receiver (sent to) can open the message.
- If the cables was cutoff or failure, all network is down.
- This topology uses less cabling.

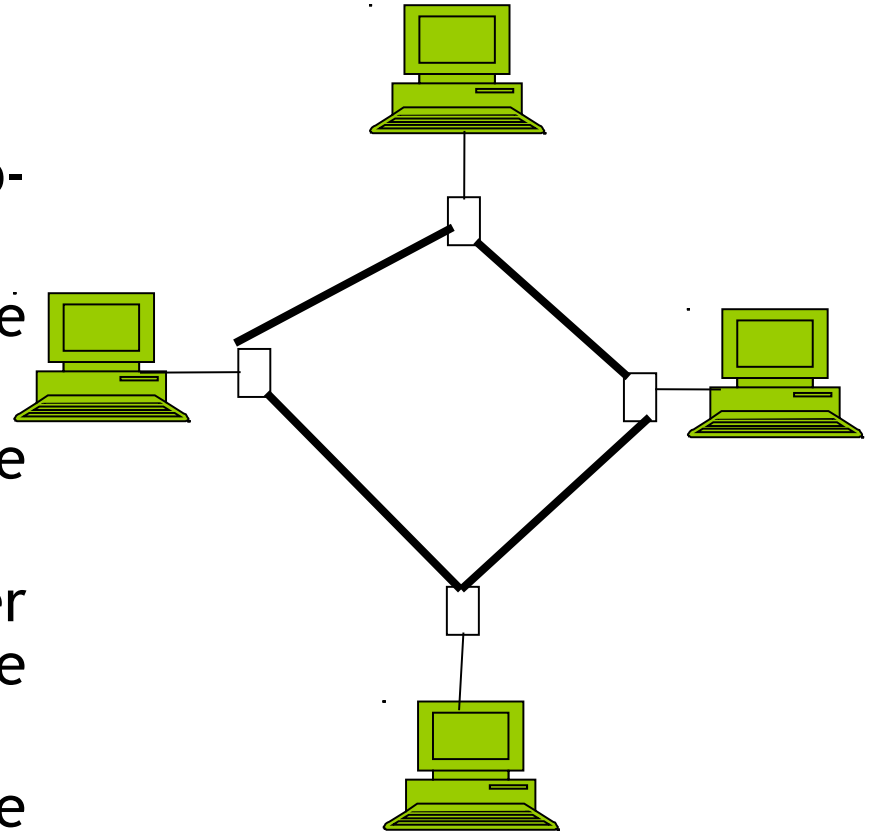
# STAR TOPOLOGY



- All nodes in network connected point-to-point link with central controller (hub/switch).
- In star topology, each node need one link and one port to connect with network.
- All network depend on the hub, if the hub goes down, all network is dead.

# RING TOPOLOGY

- Every node connected point-to-point with two node.
- The signal is passed on one direction.
- Not all node have the same copy of the message.
- The message sent by the sender and the message turns to give destination
- To speed up the network we add another ring.
- When a ring break , all network is dead
- Unidirectional traffic





# MESH TOPOLOGY

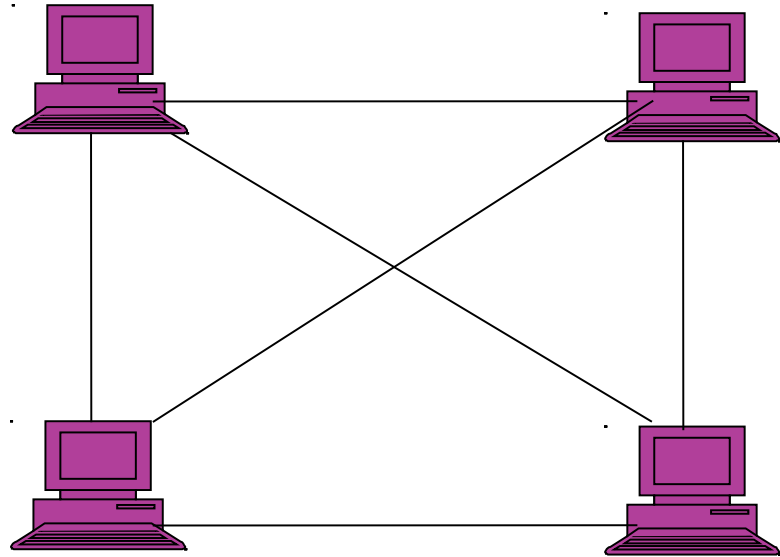
- Every node has dedicated point-to-point link with all node in network.
- Every node must have n-1 port.

N: no. of nodes in network

- No. of link in any mesh network =

$$N(N-1)/2$$

- Mesh topology service security and privacy.
- More expensive.



# TREE TOPOLOGY

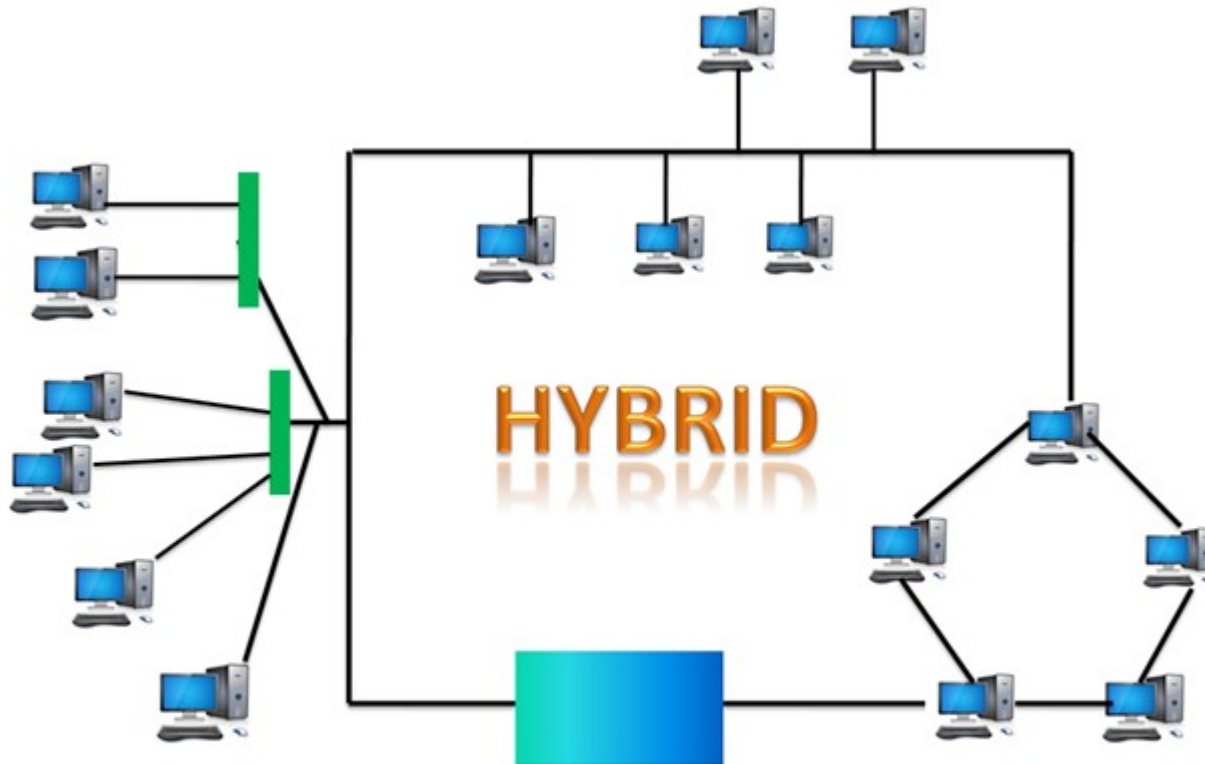
- Tree topology combines the characteristics of bus topology and star topology.
- A tree topology is a type of structure in which all the computers are connected with each other in hierarchical fashion.
- The top-most node in tree topology is known as a root node, and all other nodes are the descendants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



# HYBRID TOPOLOGY

- The combination of various different topologies is known as **Hybrid topology**.
- A Hybrid topology is a connection between different links and nodes to transfer the data.
- 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.
- For 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.

# HYBRID TOPOLOGY



# What is a Protocol?

- A Protocol is a set of rule that governs data communication.
- For two entities to communicate successfully, they must “speak the same language”.
- What is communicated, how it is communicated, and when it is communicated must confirm.
- These conventions are referred to as a protocol.

# Key Elements of a Protocol

- **Syntax**
  - Data formats
  - Signal levels
- **Semantics**
  - Control information for coordination( meaning of each section).
  - Error handling
- **Timing**
  - When data should be send.
  - How fast they can be sent

# Standards Organizations

- Standard maintenance is required to allow for interoperability between equipment.
- ISO( International Organization for Standardization ).
- ANSI( American National Standards Institute ).
- IEEE( Institute of Electrical and Electronics Engineers).
- ITU-T( International Telecommunication Union - Telecommunication Standards).