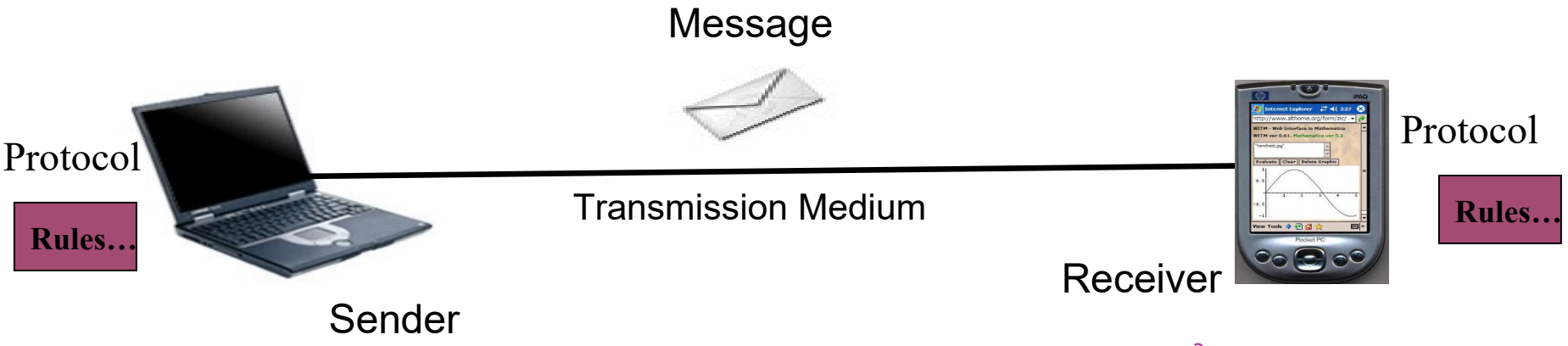
Chapter 1: Introduction

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

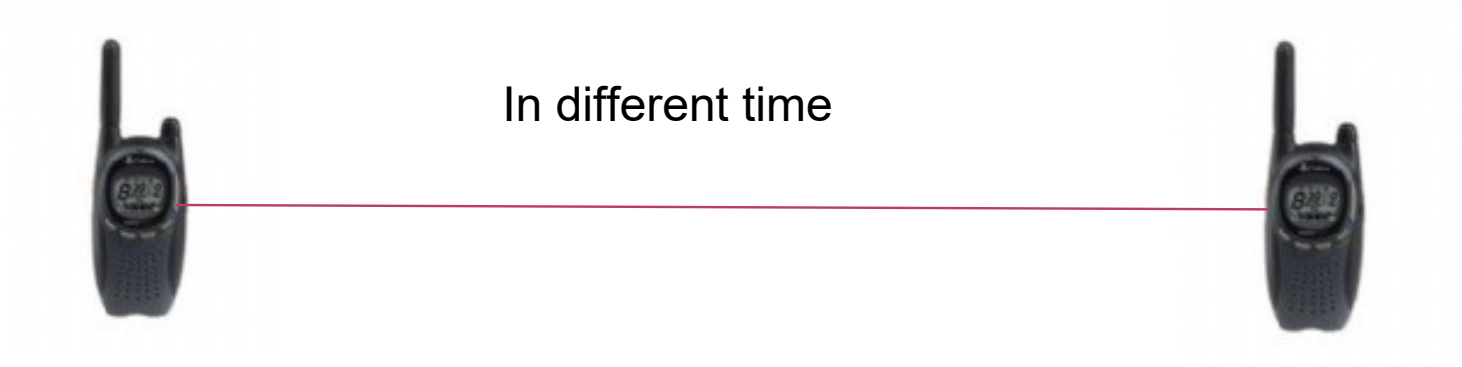
TV

- Always one side sender and another side receiver.

DATA FLOW IN COMMUNICATION CONT.

- Half-Duplex: two-way alternate.

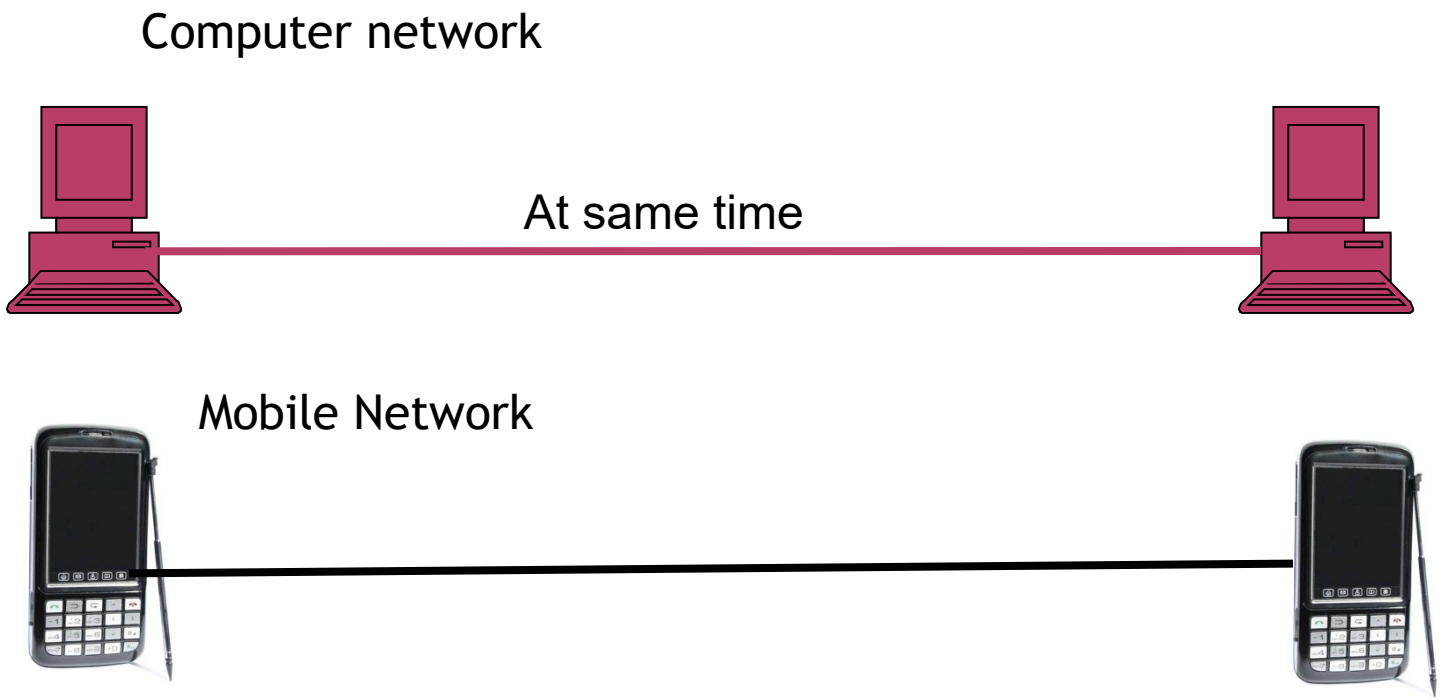
Walki-Talki



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

DATA FLOW IN COMMUNICATION CONT.

- Duplex: two-way concurrent.



- 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:-

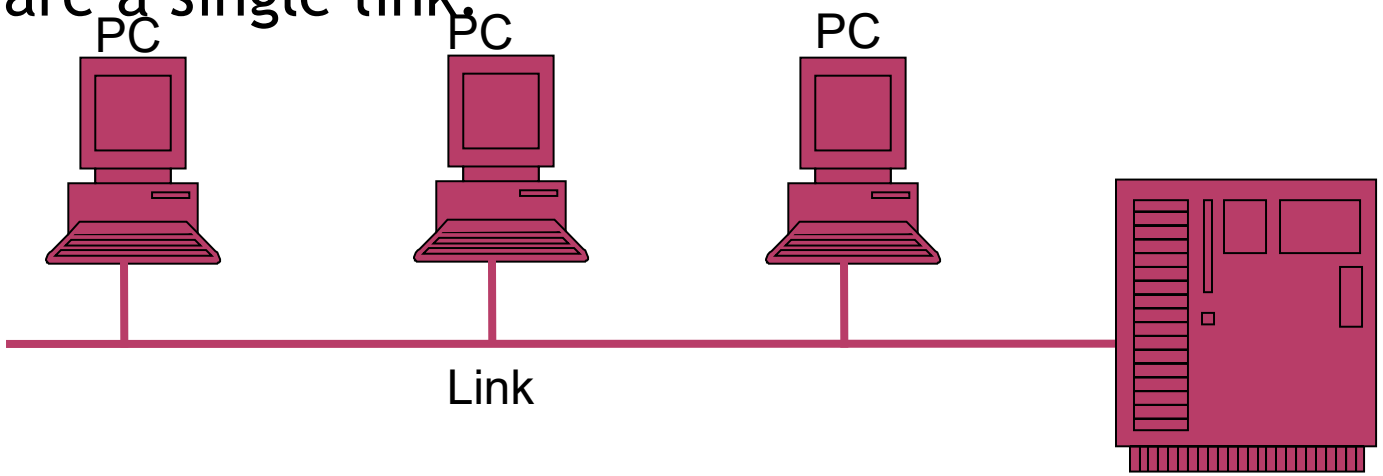
1. Hubs.
2. Switches.
3. Routers.
4. Gateways.
5. Access Point.
6. Repeaters.

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)

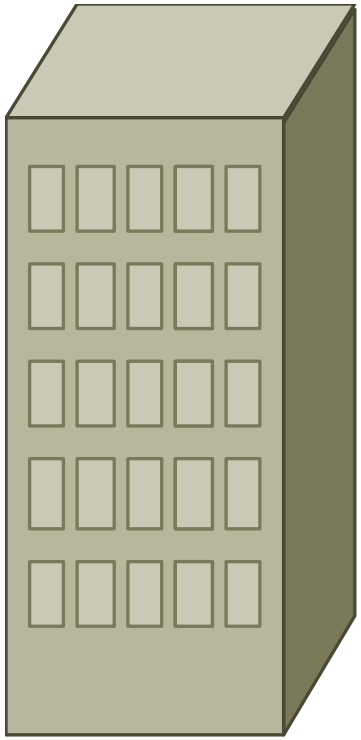
- PAN is a short-distance network design for individual user (person).
- PAN may be contain:- printer, mobile, computer, wireless printers etc.
- components of PAN connected together via Bluetooth , USB cable ,IrDA (infrared), etc.

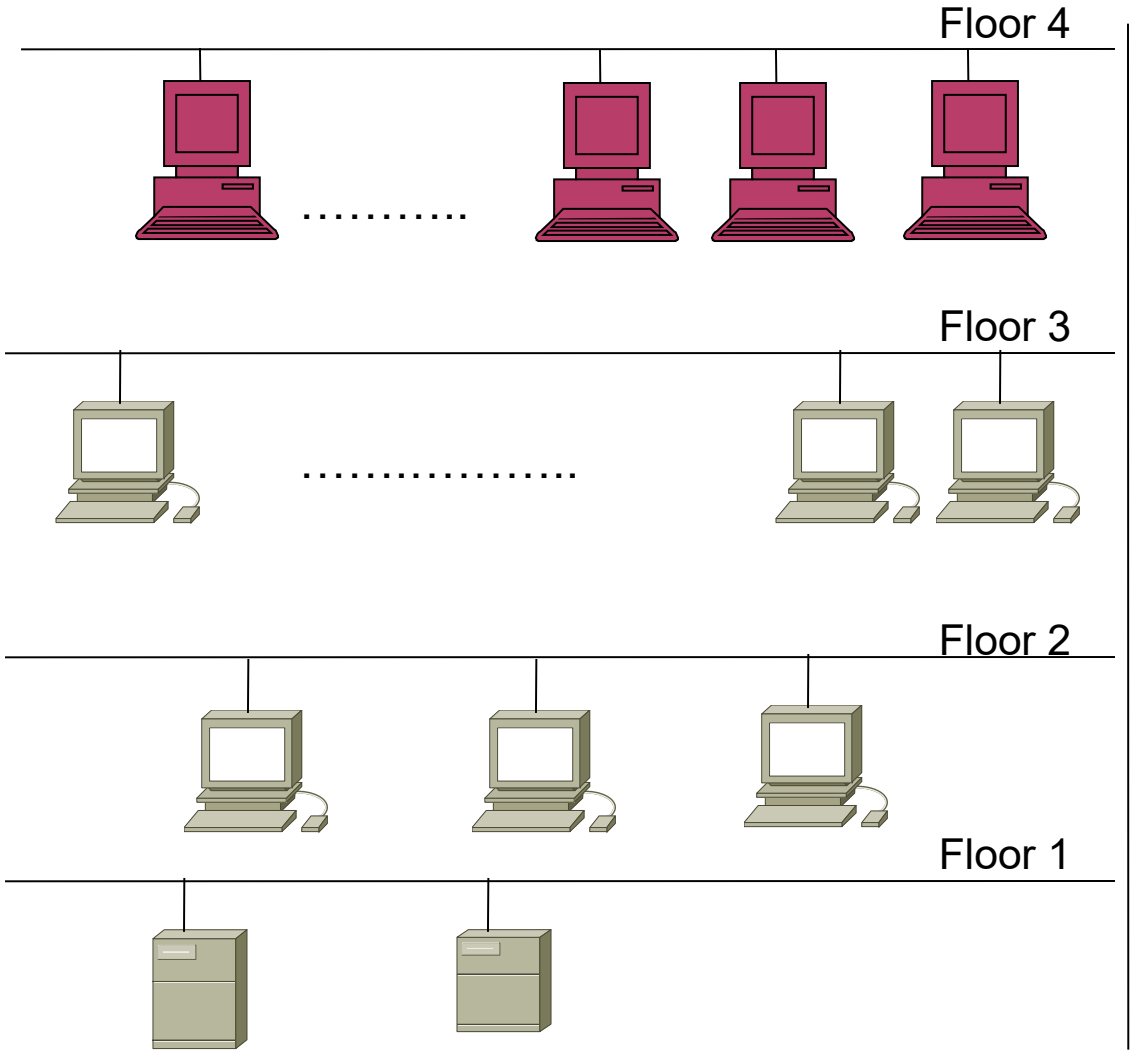
LAN (LOCAL AREA NETWORK)

- A LAN is a group of node connected together in a small specific area.

- LAN may be contain workstations, computers, scanner, printers, servers, etc.

LAN CONT.



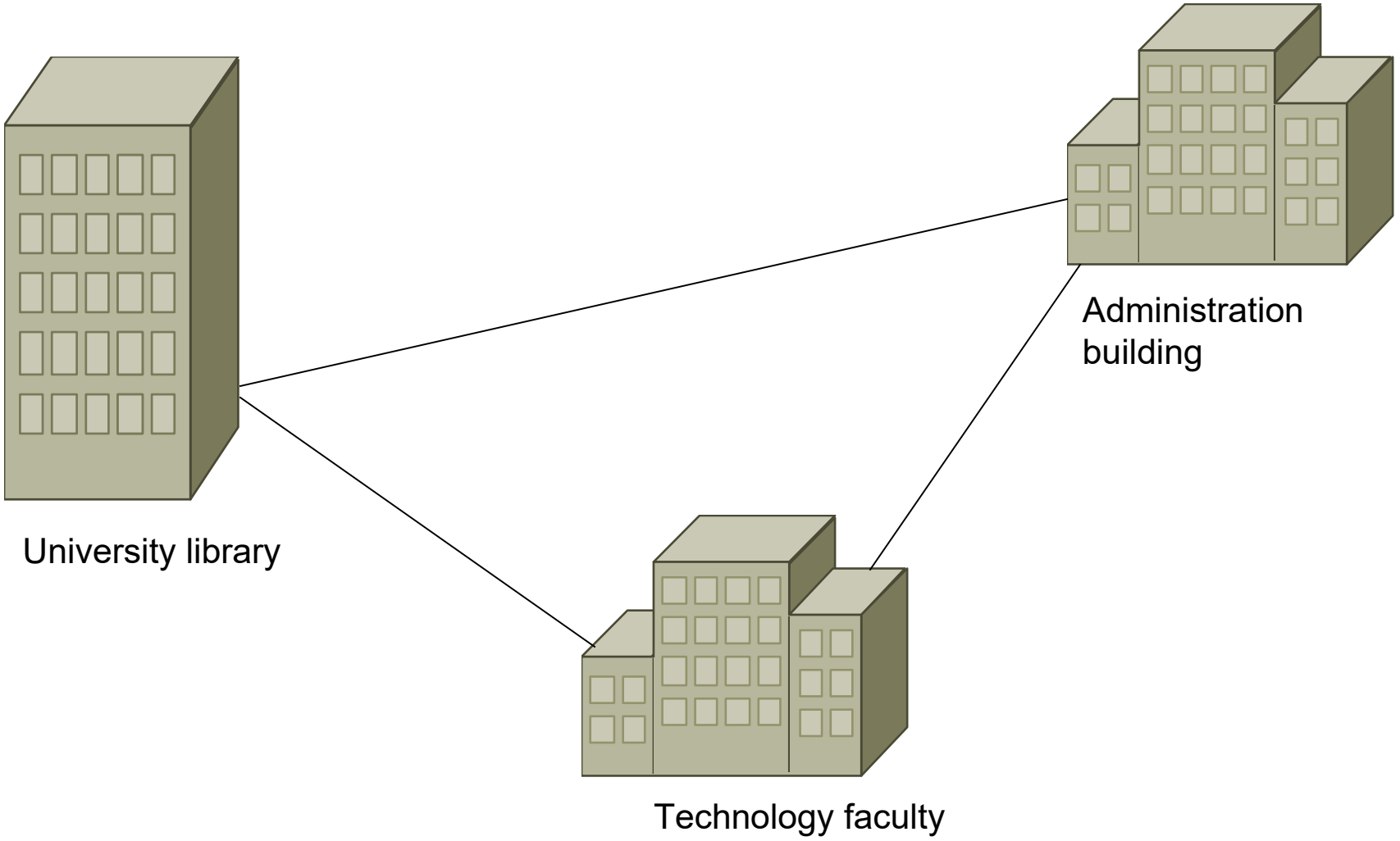


CAN (CAMPUS AREA NETWORK)

- 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.


Administration building
University library
Technology faculty

MAN (METROPOLITAN AREA NETWORK)

- A MAN is a large computer network uses to connect between LAN in different location (cities).

- A MAN is a group of node connect together over city.

WAN (WIDE AREA NETWORK)

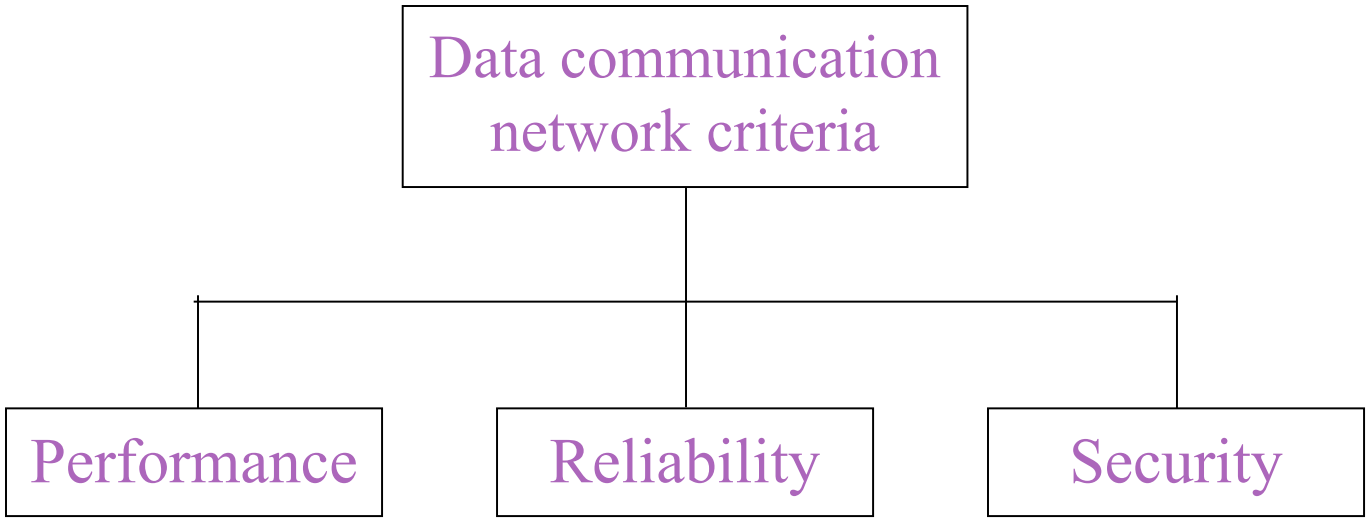
- A WAN is a computer network that covers large geographical area.

- 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

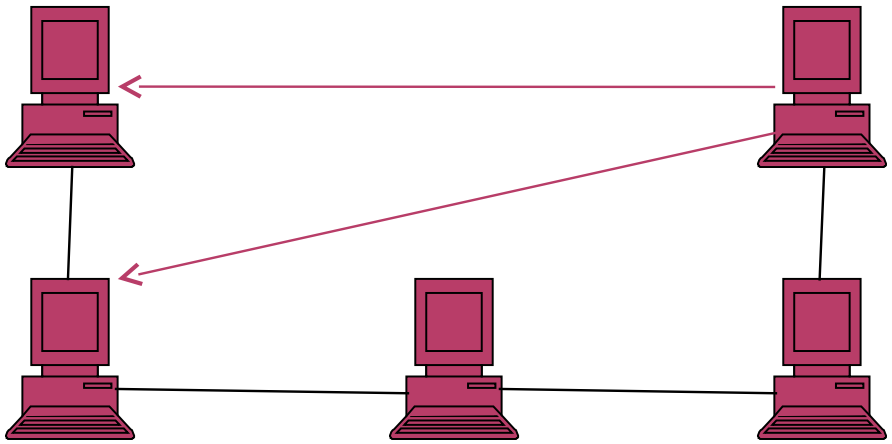
- Unicast Mode:

  Single source send to single node.

NETWORK MODES CONT.

- Multicast Mode :

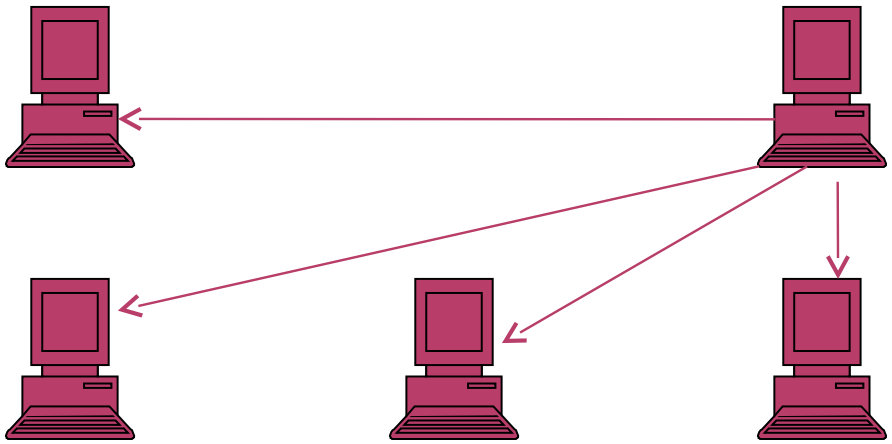
Single source send to specific nodes (group) that are connected to same Network.



one-to-many

NETWORK MODES CONT.

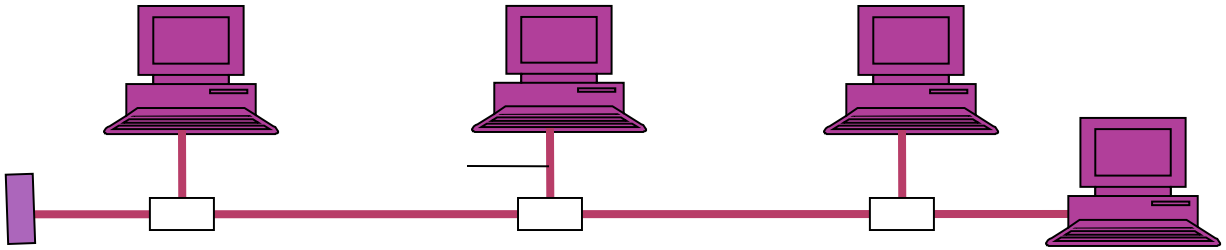
- Broadcast Mode:
- Single source send to <u>all</u> other nodes that are connected to same Network



PHYSICAL TOPOLOGY

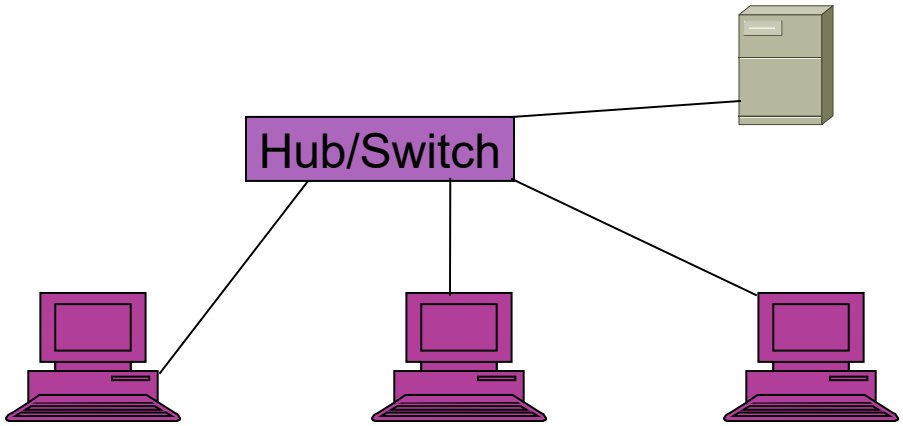
- Determines how the network nodes are connected together.
  - Bus Topology
  - Star Topology
  - Ring Topology
  - Mesh Topology

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.

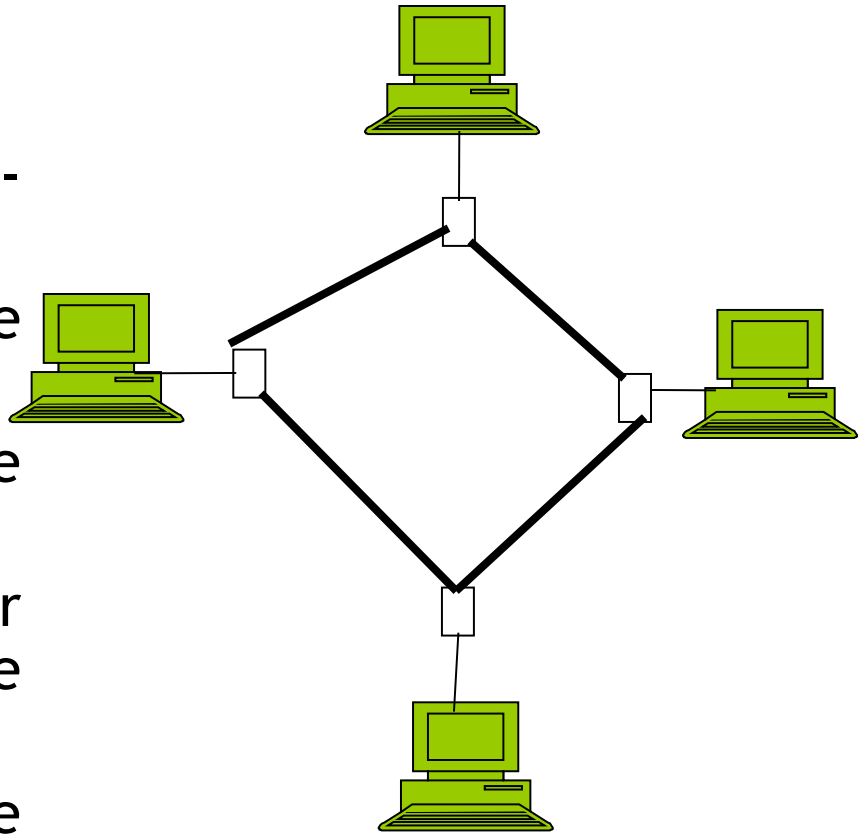
STAR TOPOLOGY



- 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

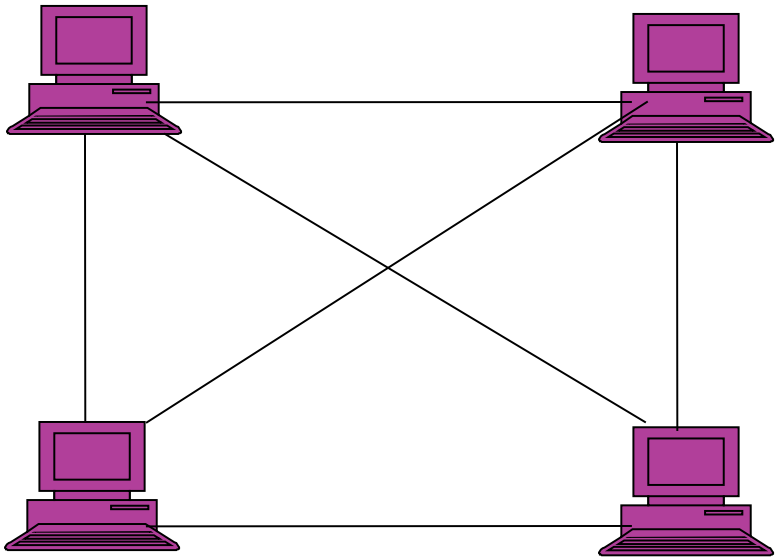


MESH TOPOLOGY

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

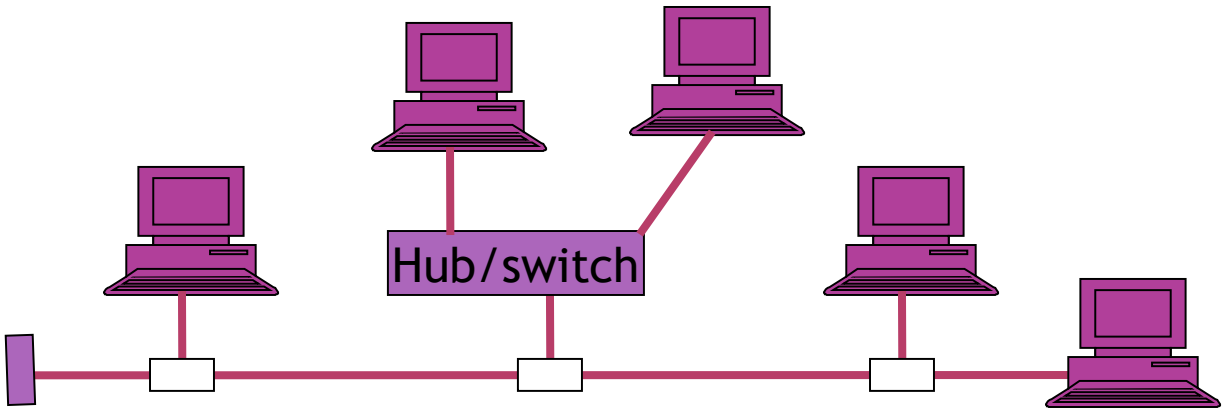
  N: no. of nodes in network
- No. of link in any mesh network =

  N(N-1)/2
- Mesh topology service security and privacy.
- More expensive.



HYBRID TOPOLOGY

- A network can be hybrid.



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 : a simple protocol might expect the

first 8 bits of data to be the address of the sender, the second 8 bits to be the address of the receiver, and the rest of the stream to be the message itself

Semantics

refers to the meaning of each section of bits.

Control information for coordination(meaning of each section).

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).
- The ISO is active in developing cooperation in the realms of scientific, technological, and economic activity.
- ANSI(American National Standards Institute).
  - completely private, nonprofit corporation not affiliated with the U.S. federal government. However, all ANSI activities are undertaken with the welfare of the United States and its citizens occupying primary importance.

- IEEE(Institute of Electrical and Electronics Engineers).
- ITU-T(International Telecommunication Union –Telecommunication Standards).