Heaven's light is our guide"

Rajshahi University of Engineering & Technology
Department of Computer Science & Engineering

Chapter 1
Introduction(Data Communication)
Prepared By Julia Rahman

What is data communication?

- ***Data*** refers to information.
- ***Data communications*** are
  - ✓ the exchange of data between two devices
  - ✓ Focus on transmission medium such as wire cable.

Fundamental characteristics of a data communication system:

- **Delivery** – must deliver data to correct destination.
- **Accuracy** – must deliver the data accurately.
- **Timelines** – must deliver data in a timely manner.
- **Jitter** – refers to the variation in packet arrival time.

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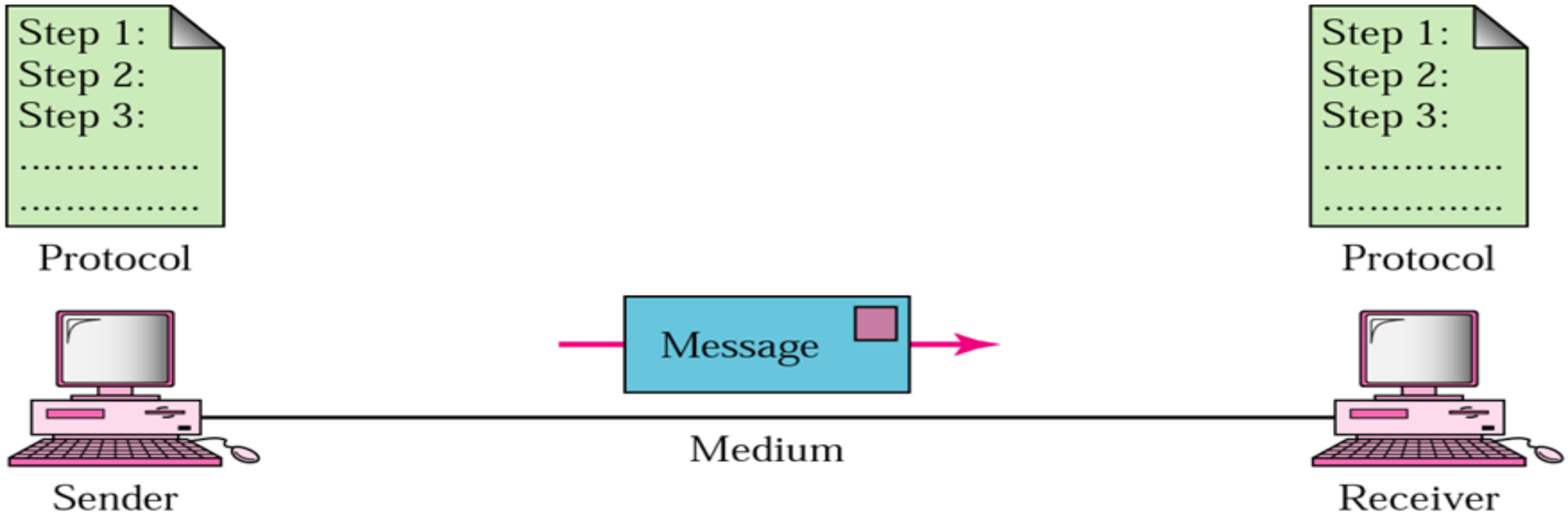
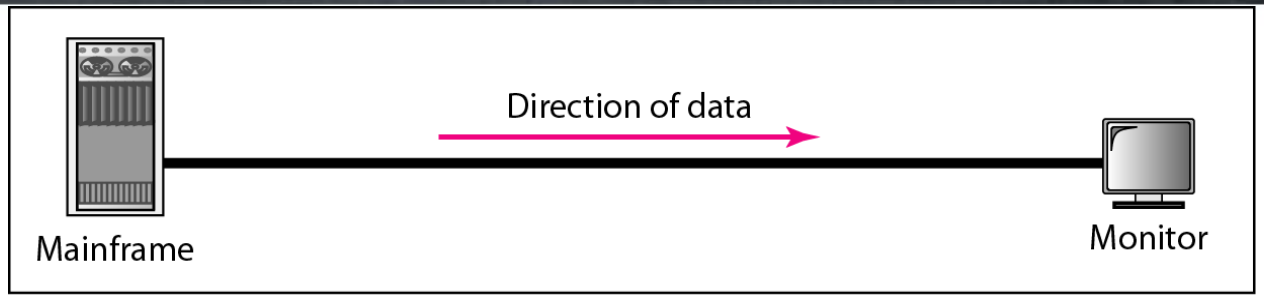
Components of a Data Communication System:

- ✓ **Message –** the information to be communicated.
- ✓ **Sender –** device that sends the message.
- ✓ **Receiver –** device that receives the message.
- ✓ **Transmission medium –** physical path by which a message travels from sender to receiver.
- ✓ **Protocol –**a set of rules that govern data communication.



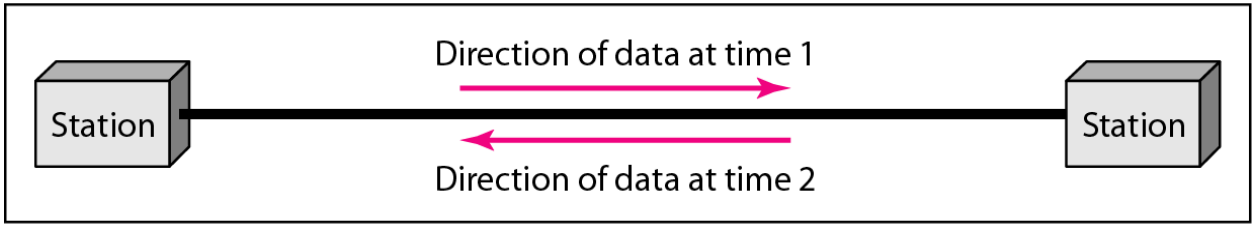
Data Flow *(simplex, half-duplex, and full-duplex)*

- **Simplex:**
  keyboard and monitor.



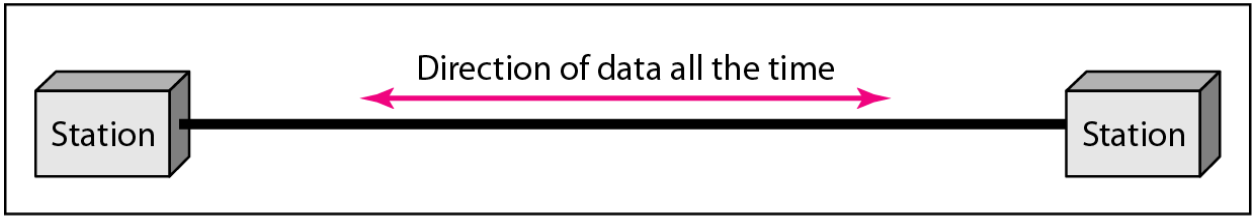
a. Simplex

- **Half- duplex:**
  Walkie- talkies



b. Half-duplex

- **Full- duplex:**
  Telephone line



c. Full-duplex

NETWORKS

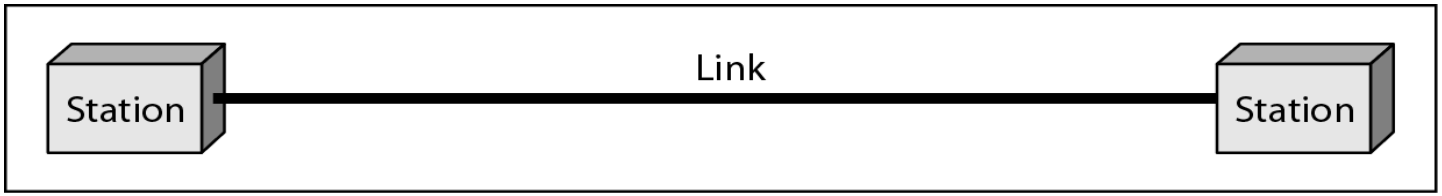
- A **network** is a set of devices (often referred to as nodes) connected by communication links.
- A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.
- A link can be a cable, air, optical fiber, or any medium which can transport a signal carrying information.

Network Criteria:

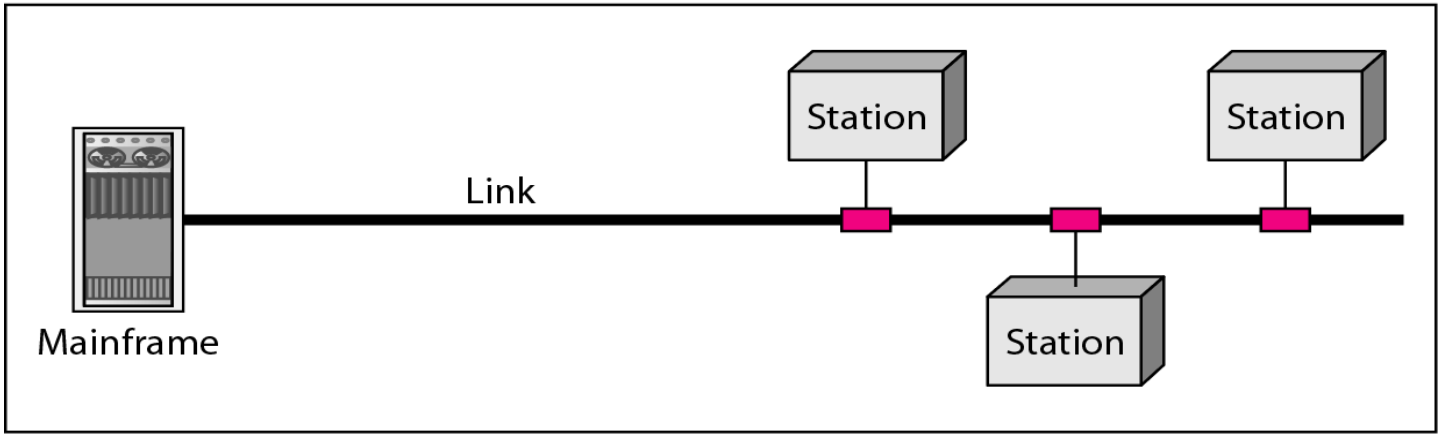
- **Performance**
  - ✓ Depends on Network Elements
  - ✓ Measured in terms of Delay and Throughput
- **Reliability**
  - ✓ Failure rate of network components
  - ✓ Measured in terms of availability/robustness
- **Security**
  - ✓ Data protection against corruption/loss of data due to:
    - Errors
    - Malicious users

Physical Structures

- ***Type of Connection***
  - ✓ **Point to Point –** provide a dedicated link between two devices(single transmitter and receiver).
  - ✓ **Multipoint -** multiple recipients of single transmission.
    share a single link.



a. Point-to-point



b. Multipoint

Physical Topology

- ***Physical Topology***
  - ✓ The way of in which a network is laid out physically.
  - ✓ Connection of devices
  - ✓ Type of transmission - unicast, mulitcast, broadcast

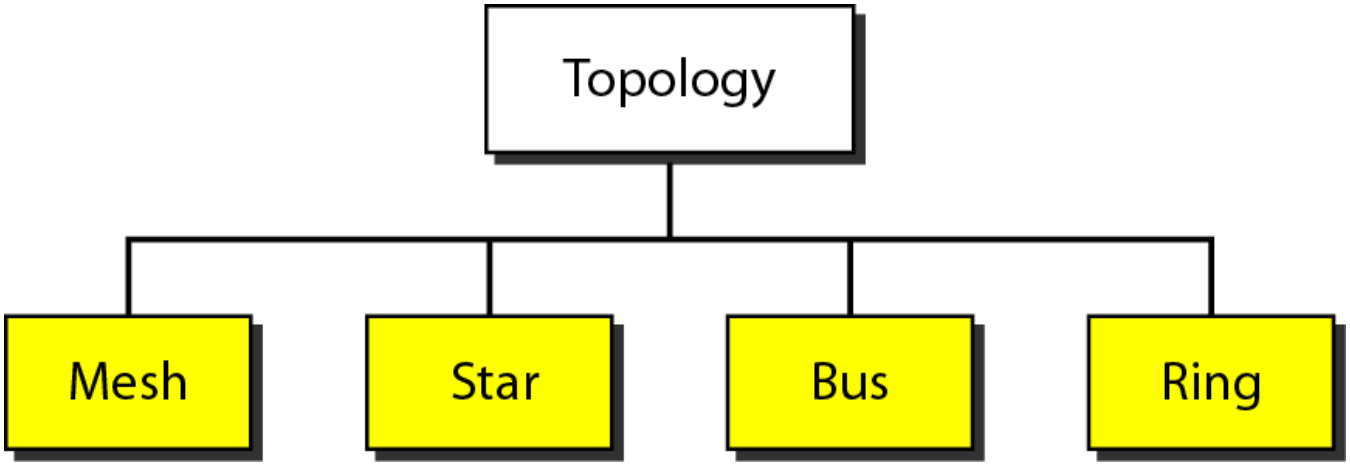


Figure- *Categories of topology*

Physical Topology

❑ Mesh topology:

- ✓ Point to point connection.
- ✓ Fully connected.
- ✓ Every device connect to other devices.
- ✓ Advantages:
  - ➢ Guarantees that each connection carry its own data load.
  - ➢ Robust.
  - ➢ Advantage of privacy and security.
  - ➢ Easy to fault identification and false isolation.
- ✓ Disadvantages:

  Large amount of cabling and I/O ports are needed.
- ✓ Use: telephone regional office.

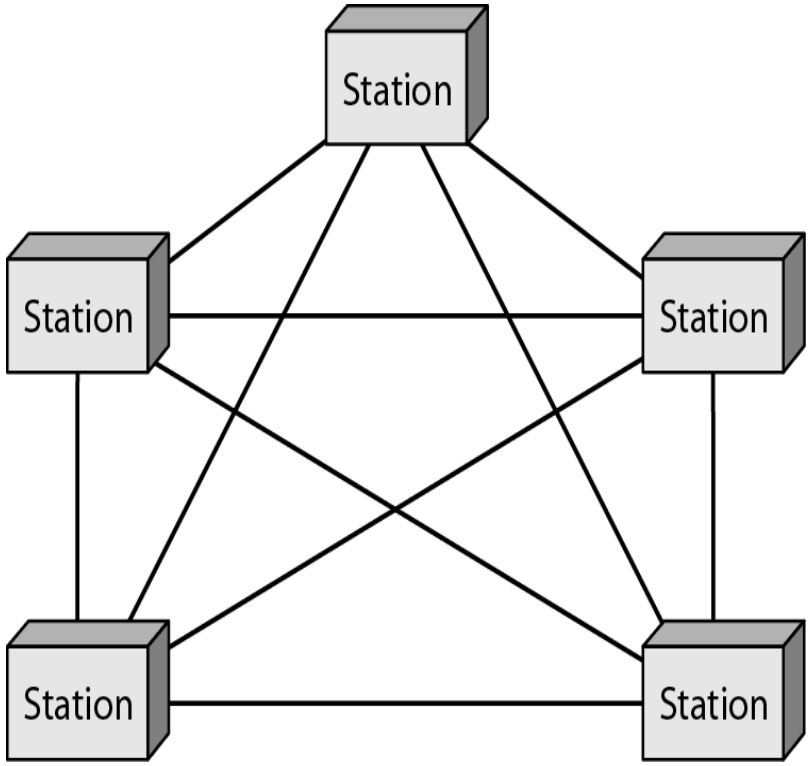


Figure-*A fully mesh topology (five devices)*

Physical Topology

❑ Star topology:

- ✓ Point to point connection.
- ✓ A central controller called **hub**.
- ✓ Devices are not directly connect to one another.
- ✓ Advantages:
  - ➢ Robustness.
  - ➢ Easy to fault identification and false isolation.
  - ➢ Far less cable than a mesh topology.
- ✓ Disadvantages:

  Depends the whole topology on one single point, the hub.
- ✓ Use: LAN.

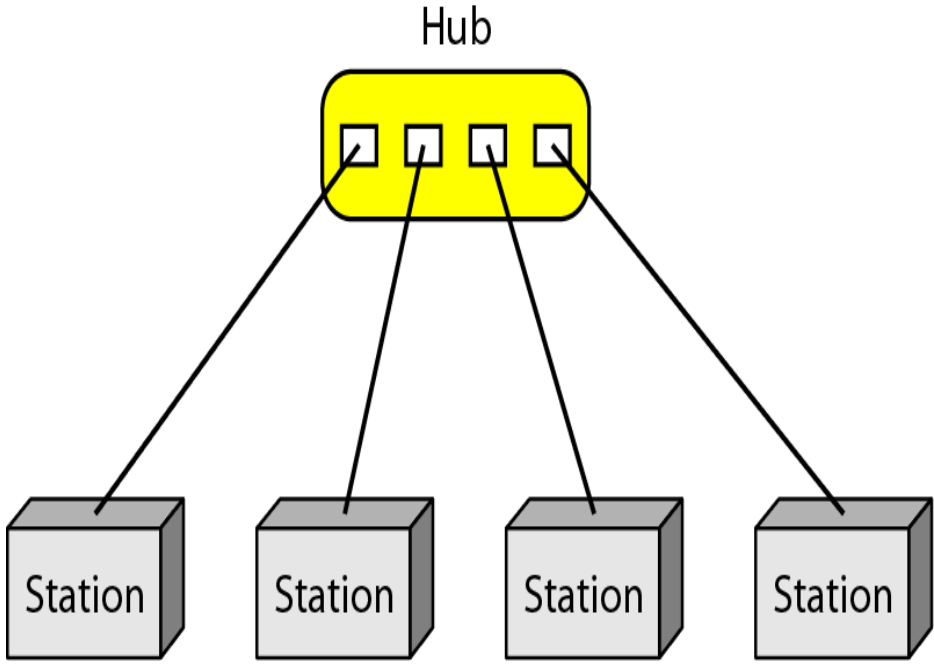


Figure-*A Star topology (four stations)*

Physical Topology

❑ Bus topology:

- ✓ Multipoint connection.
- ✓ One long cable acts as a backbone to link all the devices.
- ✓ Advantages:
  - ➢ Ease of installation.
  - ➢ Backbone cable can be laid along the most efficient path.
  - ➢ A bus uses less cable than a mesh or star topology.
- ✓ Disadvantages:
  - ➢ Difficult reconnection and fault isolation.
  - ➢ A fault or break in the bus cable stops all transmission.
- ✓ Use: Ethernet LAN.

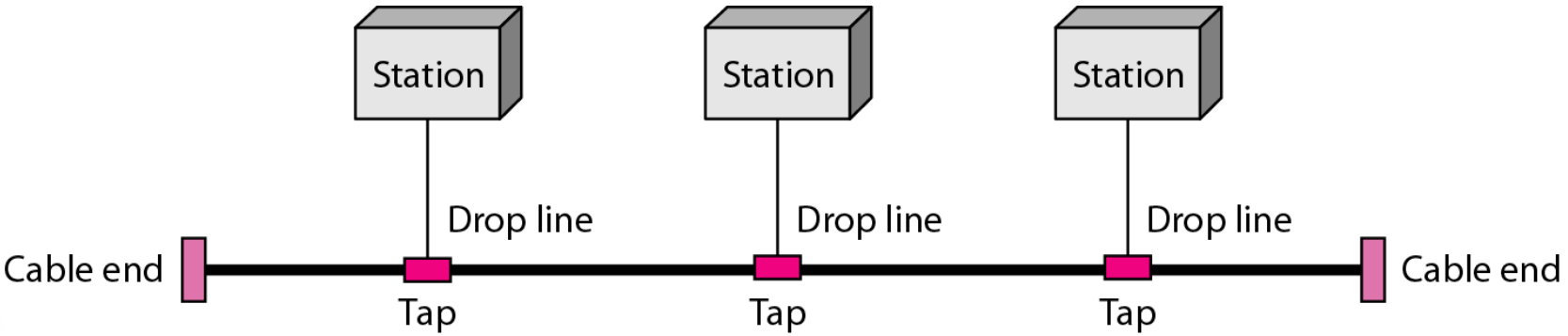


Figure-*A Bus topology (three stations)*

Physical Topology

❑ Ring topology:

- ✓ Point to point connection with only the two devices on either side of it.
- ✓ Advantages:
  - ➢ Relatively easy to install and reconfigure.
  - ➢ To add or delete a device requires changing only two connections.
- ✓ Disadvantages:
  - ➢ Unidirectional traffic.
  - ➢ In a simple ring, a break in the ring can disable the entire network.
- ✓ Use: Token ring network.

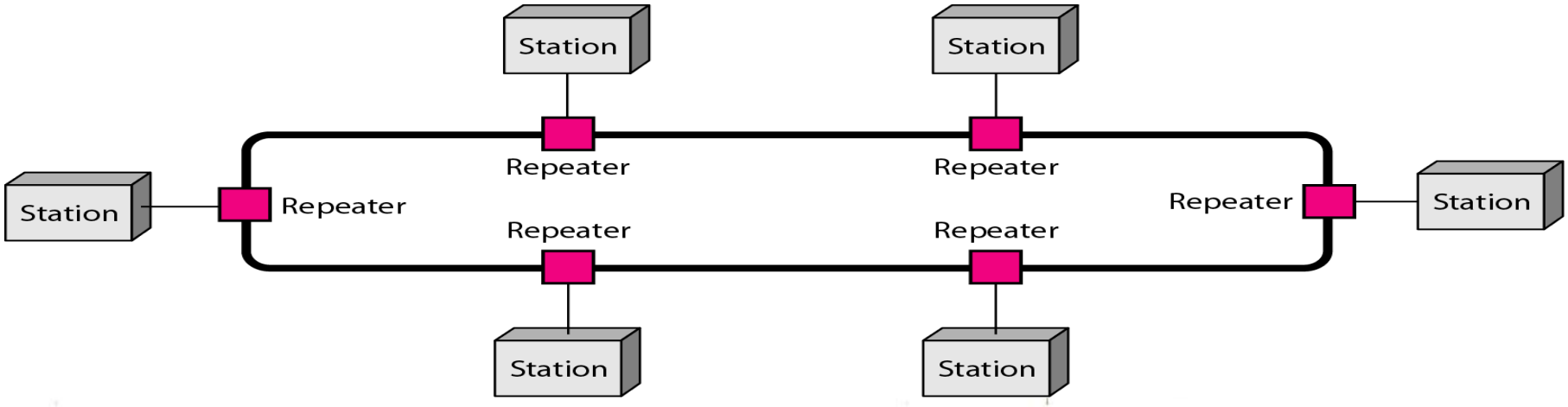


Figure-*A Ring topology (six stations)*

Physical Topology

- **Hybrid topology:**
  - ✓ a star backbone with bus networks.

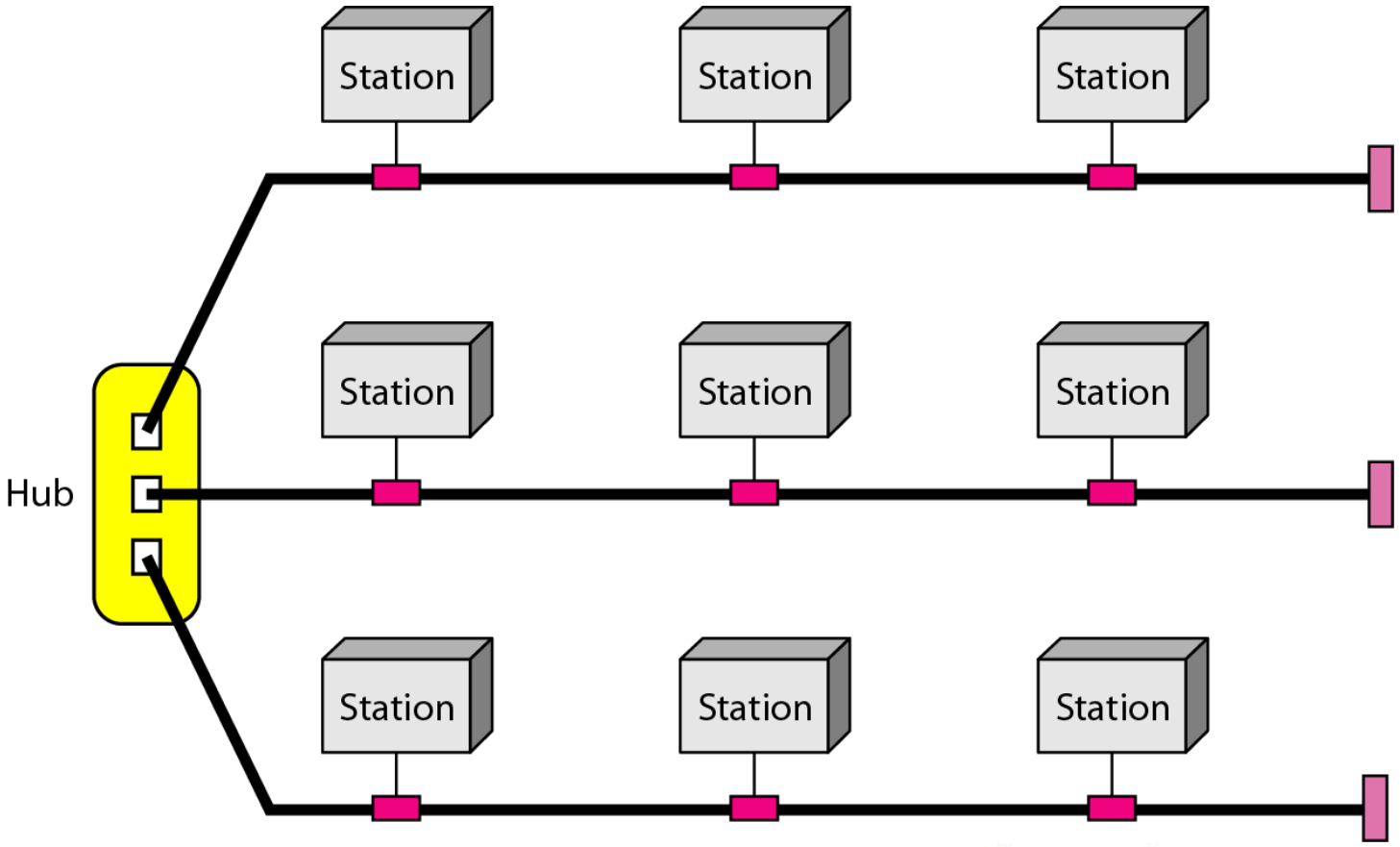


Figure-*A Hybrid topology*

Categories of Networks

❑ Local Area Networks (LANs)

- ✓ Short distances.
- ✓ . Designed to provide local interconnectivity.

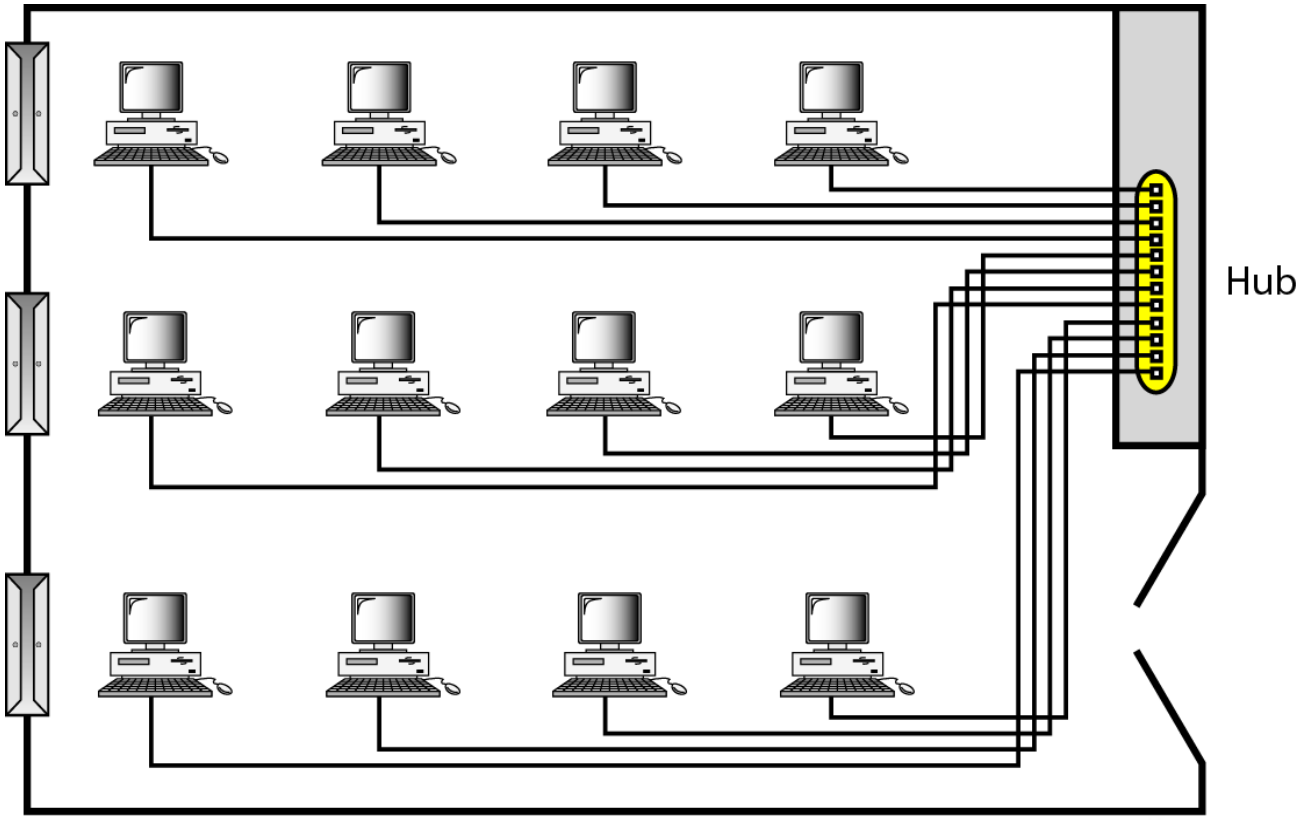
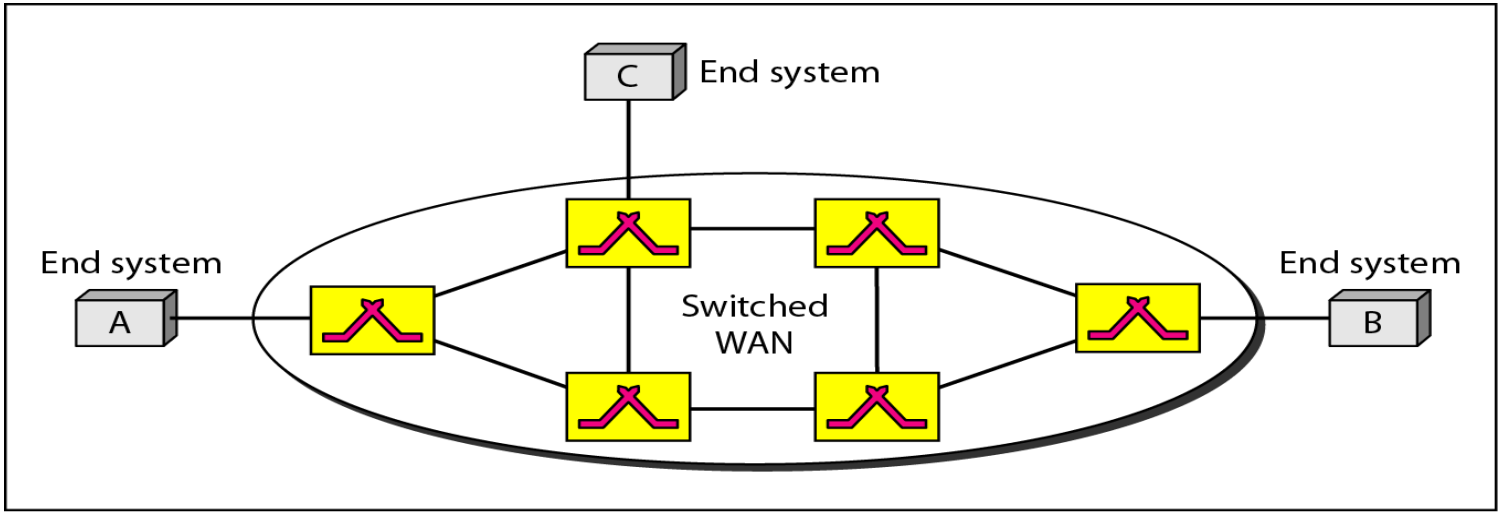


Figure- An isolated LAN connecting 12 computers to a hub in a closet

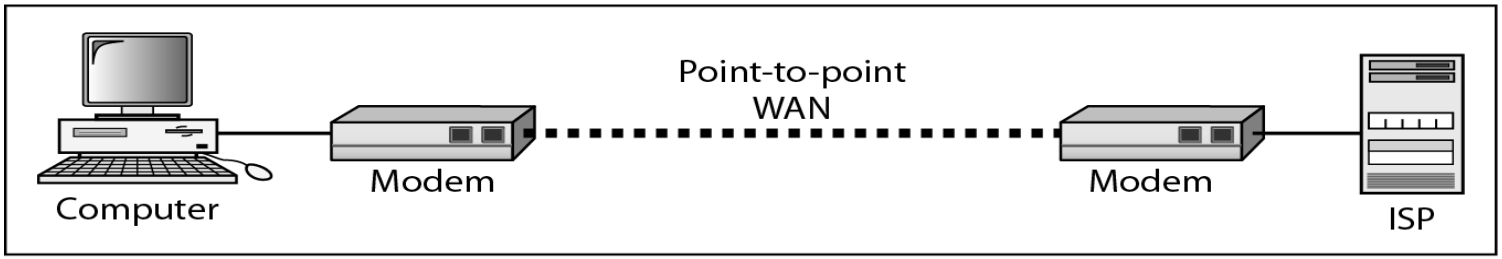
Categories of Networks

❑ Wide Area Networks (WANs)

- ✓ Long distances.
- ✓ Provide connectivity over large areas.



a. Switched WAN



b. Point-to-point WAN

Figure -*WANs*

Categories of Networks

- **Metropolitan Area Networks (MANs)**
  - ✓ Provide connectivity over areas such as a city, a campus.

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THE INTERNET

- ✓ The Internet has revolutionized many aspects of our daily lives.
- ✓ It has affected the way we do business as well as the way we spend our leisure time.
- ✓ The Internet is a communication system that has brought a wealth of information to our fingertips and organized it for our use.

Protocols

- ✓ A ***protocol*** is synonymous with rule.
- ✓ It consists of a set of rules that govern data communications.
- ✓ It determines what is communicated, how it is communicated and when it is communicated.

Elements of a Protocol

- **Syntax**
  - Structure or format of the data.
  - Indicates how to read the bits - field delineation.
- **Semantics**
  - Interprets the meaning of the bits.
  - Knows which fields define what action.
- **Timing**
  - When data should be sent and what.
  - Speed at which data should be sent or speed at which it is being received.

Thank To All …