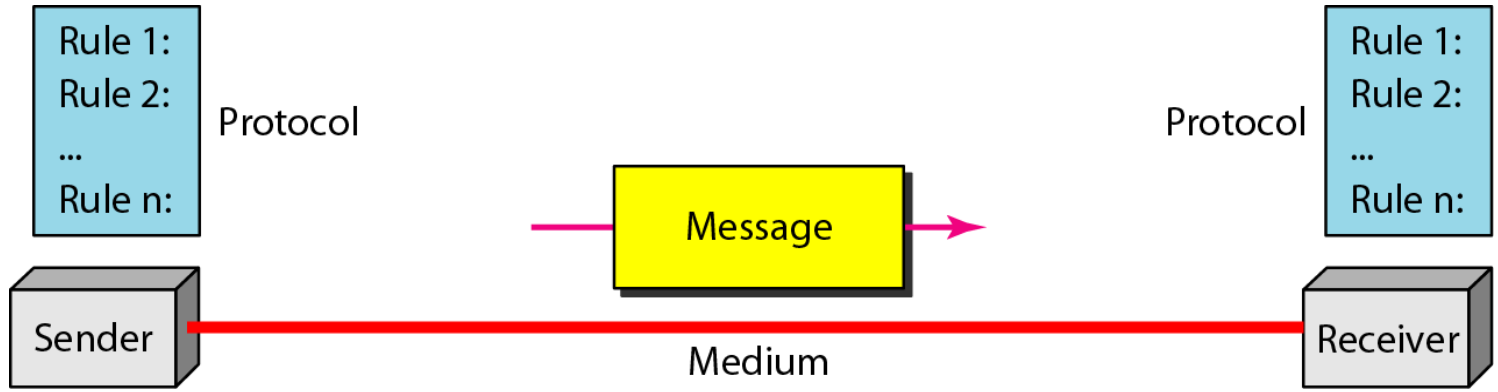
Introduction

1-1 DATA COMMUNICATIONS

- The term **telecommunication** means communication at a distance. The word **data** refers to information presented in whatever form is agreed upon by the parties creating and using the data. **Data communications** are the exchange of data between two devices via some form of transmission medium such as a wire cable.
- **Characteristics of effective data communication:**
  - Delivery
  - Accuracy
  - Timeliness
  - Jitter.

Components of data communication:

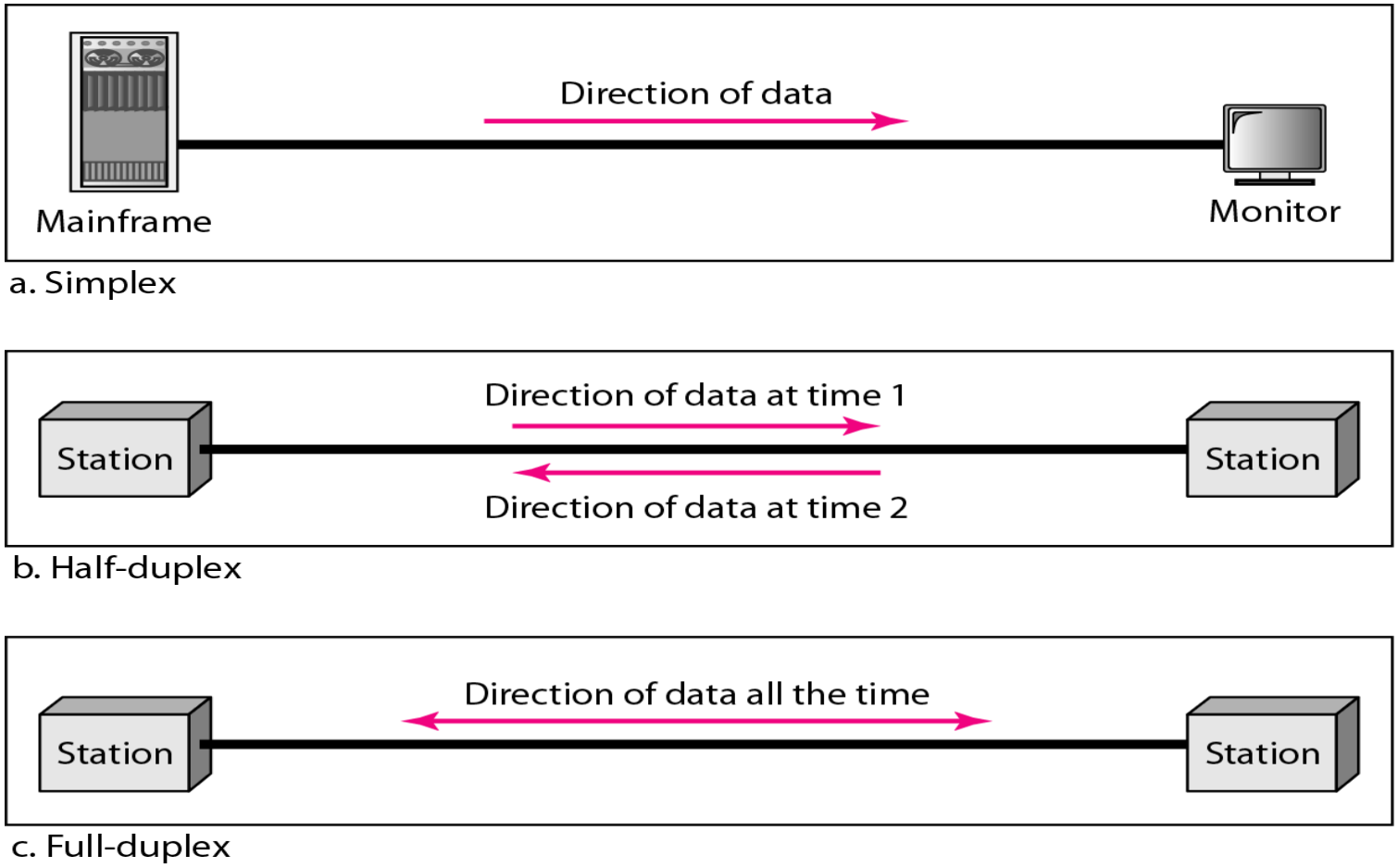
- Message
- Sender
- Receiver
- Transmission medium
- Protocol



Data Representation:

- Text
- Numbers
- Images
- Audio
- Video

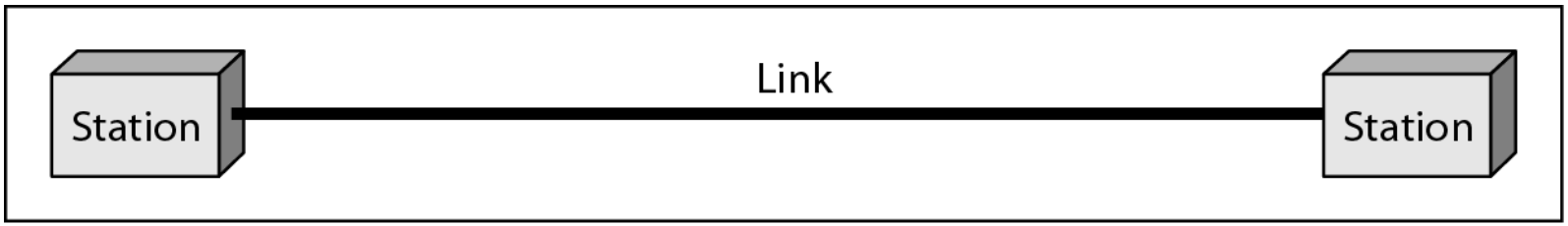
Figure 1.2 *Data flow (simplex, half-duplex, and full-duplex)*



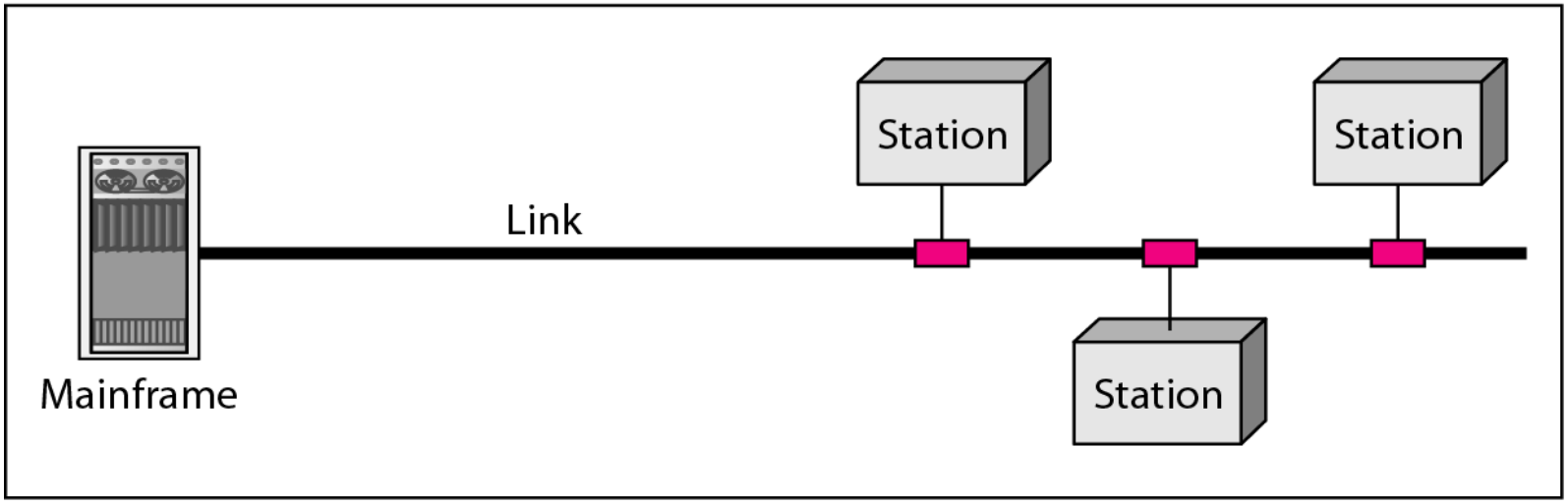
1-2 NETWORKS

- 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.
- **Network Criteria:**
  - Performance (Transition Time, Response Time, Throughput, Delay)
  - Reliability
  - Security

Figure 1.3 Types of connections: point-to-point and multipoint



a. Point-to-point



b. Multipoint

Physical Topology:

- The term **physical topology** refers to the way in which a network is laid out physically.

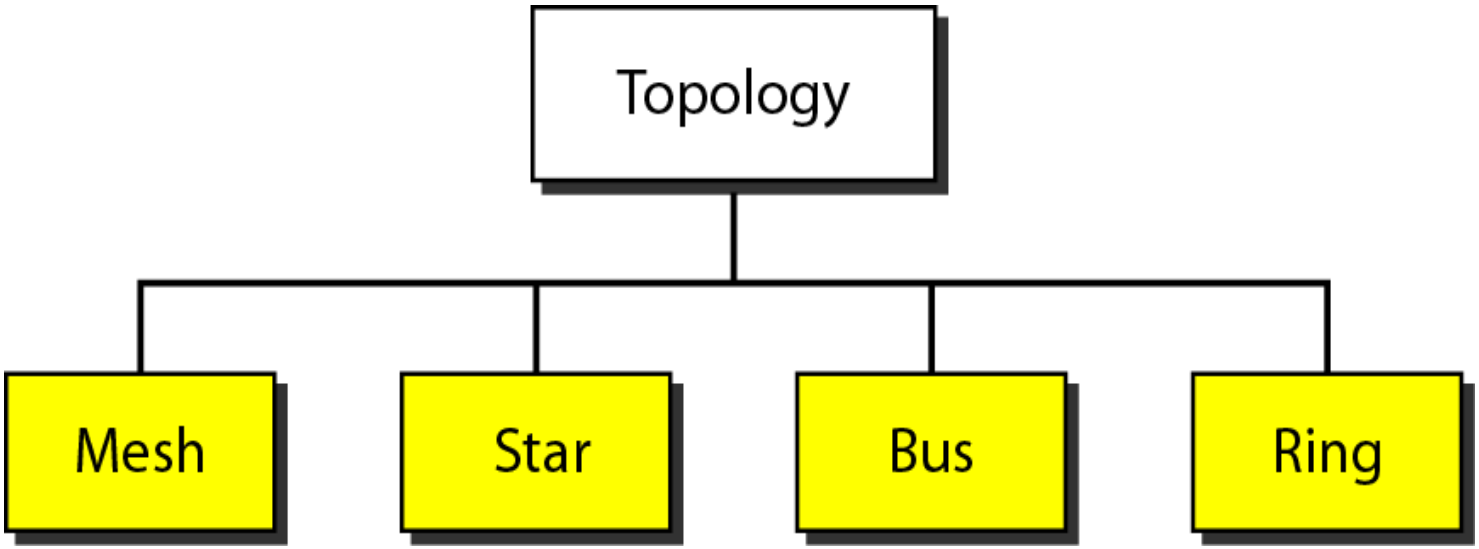
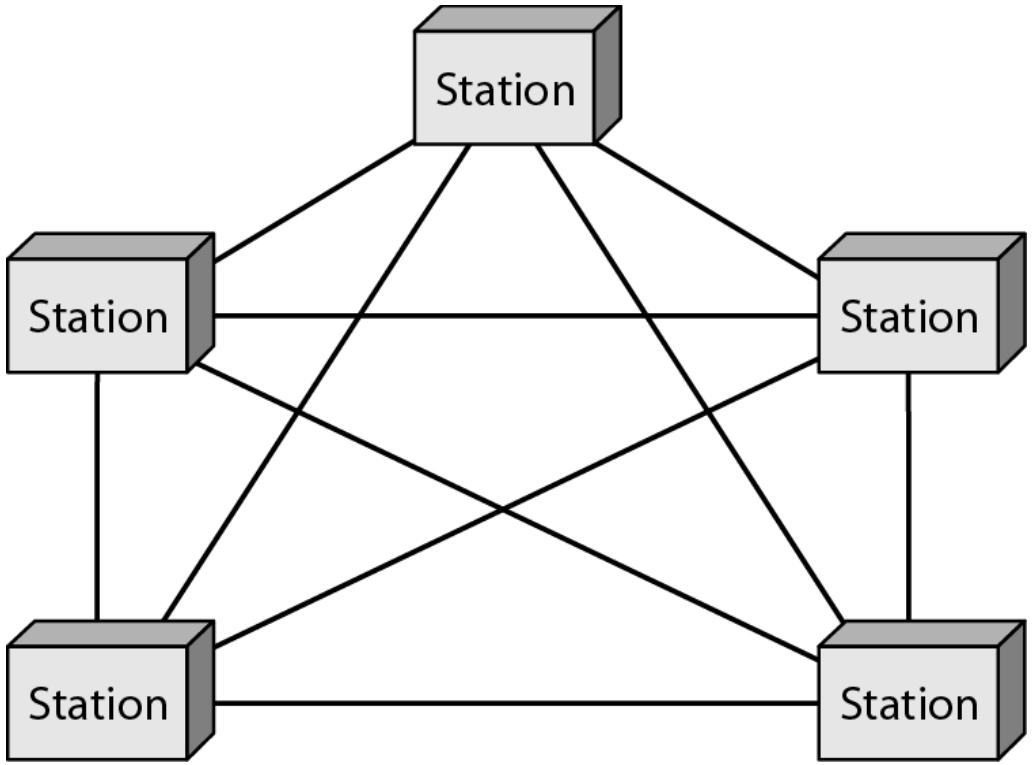


Figure 1.4 *Categories of topology*

Figure 1.5 *A fully connected mesh topology (five devices)*



- in a mesh topology, we need **n (n – 1) / 2** duplex-mode links.

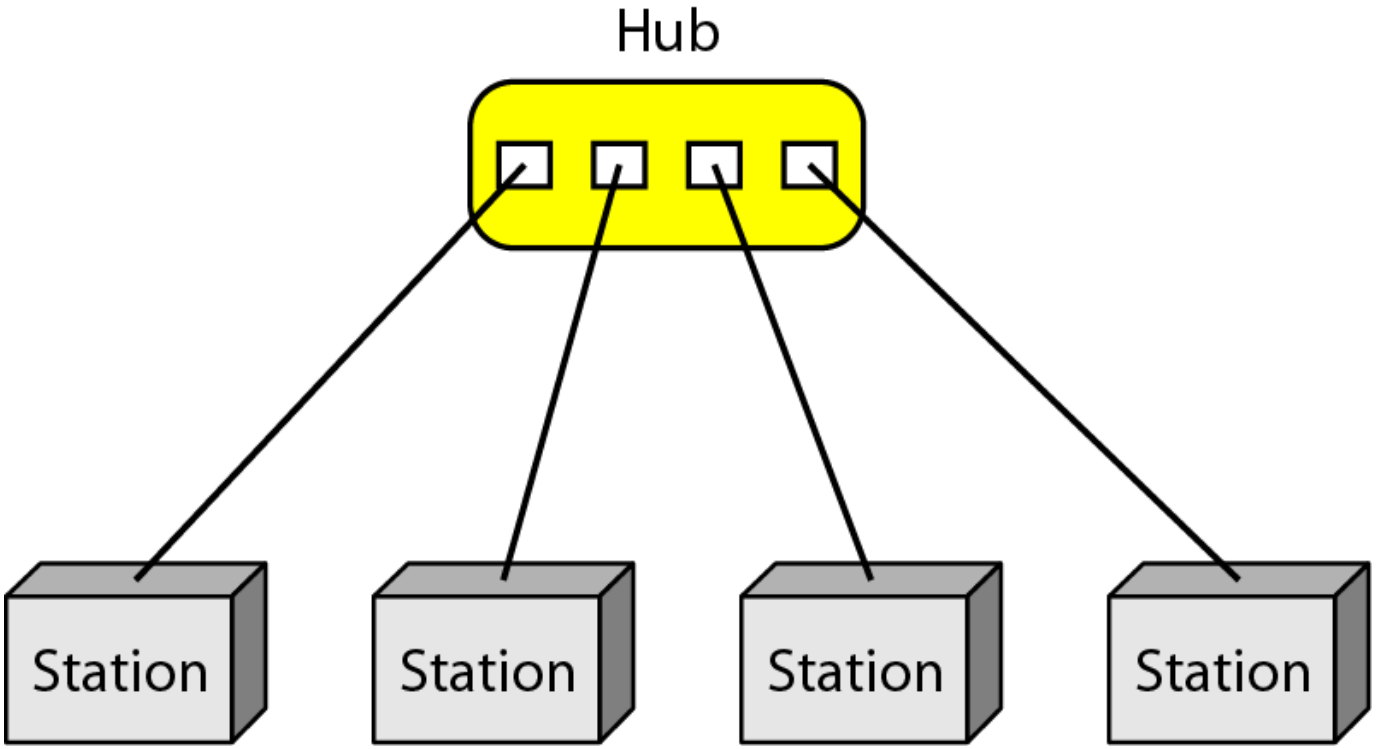
Advantages:

- Each connection carry its own data load, thus eliminating the traffic problems.
- A mesh topology is robust.
- Privacy or security.
- Make fault identification and fault isolation easy.

Disadvantages:

- Amount of cabling and the number of I/O ports required.
- Installation and reconnection are difficult.
- The sheer bulk of the wiring can be greater than the available space.
- The hardware required to connect each link can be prohibitively expensive.

Figure 1.6 *A star topology connecting four stations*



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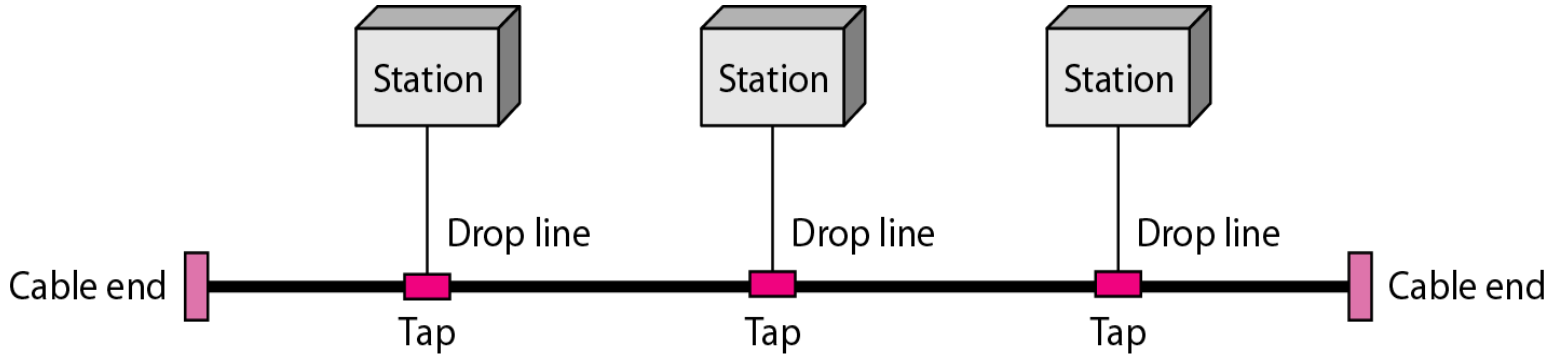
Advantages:

- Easy to install and reconfigure.
- Far less cabling needs to be housed.
- It is robust.
- Make fault identification and fault isolation easy.

Disadvantages:

- If the hub goes down, the whole system is dead.
- more cabling is required in a star than in some other topologies (such as ring or bus).

Figure 1.7 *A bus topology connecting three stations*



- A **bus topology**, is multipoint. One long cable acts as a **backbone** to link all the devices in a network. Nodes are connected to the bus cable by drop lines and taps. A **drop line** is a connection running between the device and the main cable. A **tap** is a connector that either splices into the main cable or punctures the sheathing of a cable to create a contact with the metallic core.

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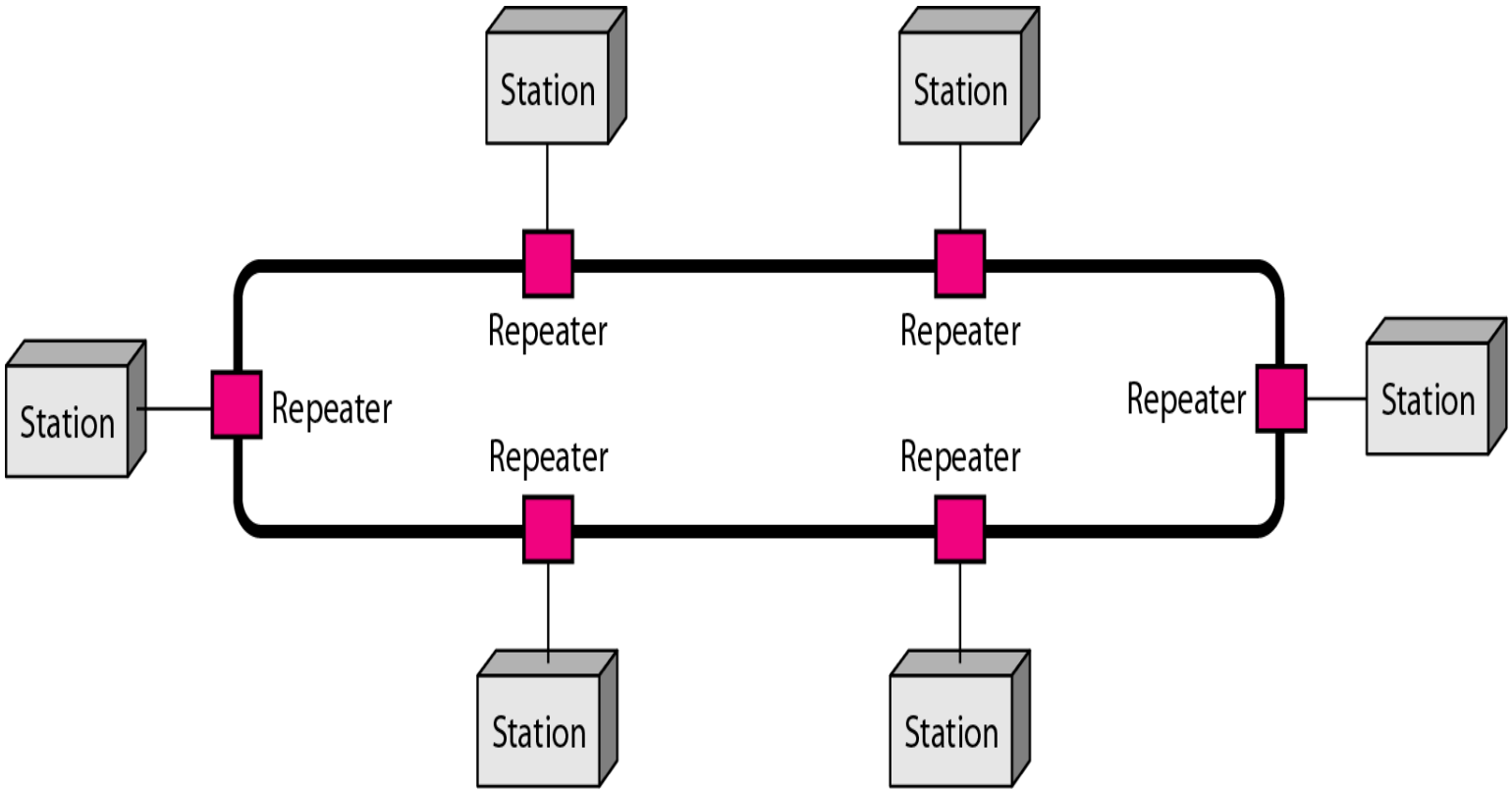
Advantages:

- Ease of installation.
- Bus uses less cabling than mesh or star topologies.

Disadvantages:

- difficult reconnection and fault isolation.
- Signal reflection at the taps can cause degradation in quality.
- a fault or break in the bus cable stops all transmission
- The damaged area reflects signals back in the direction of origin, creating noise in both directions.

Figure 1.8 *A ring topology connecting six stations*



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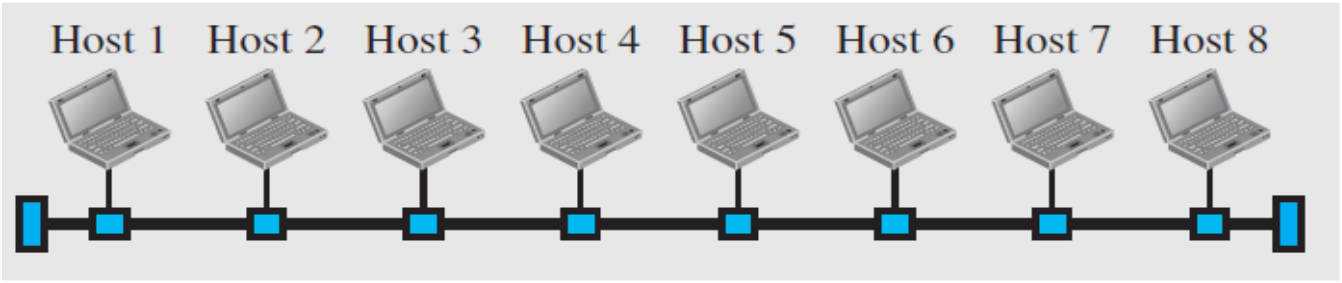
Advantages:

- Ease of installation and reconfiguration.
- Fault isolation is simplified.

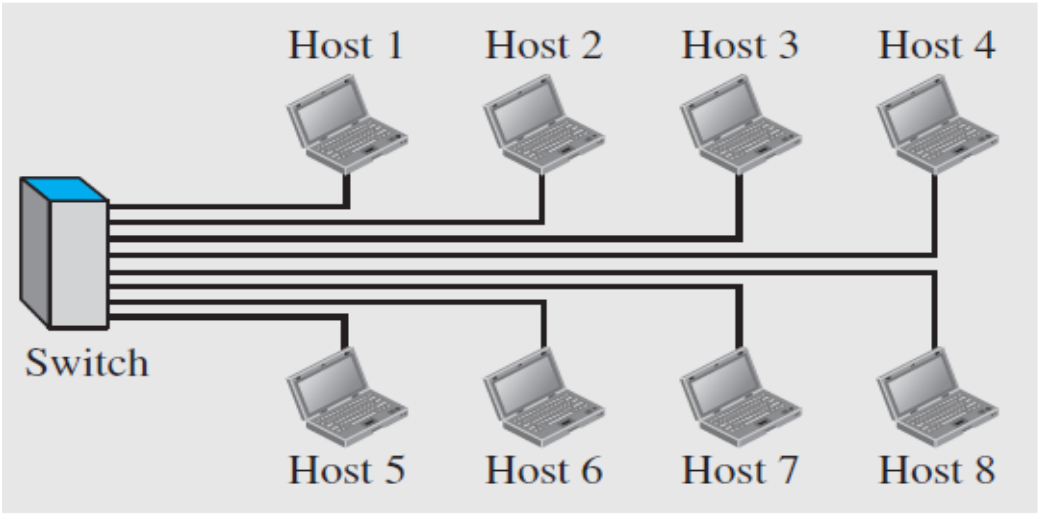
Disadvantages:

- unidirectional traffic.

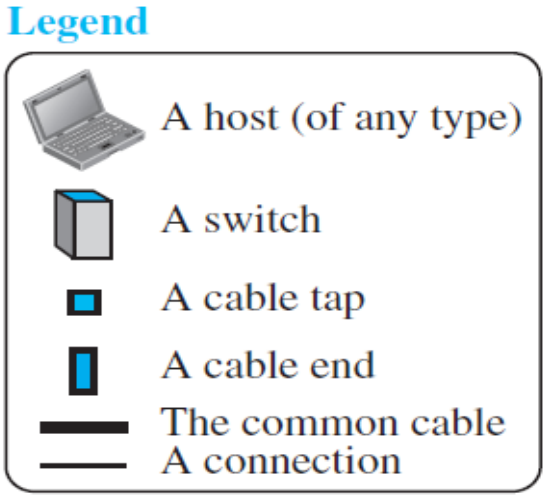
1-3 NETWORK TYPES



a. LAN with a common cable (past)



b. LAN with a switch (today)



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Local Area Network (LAN):

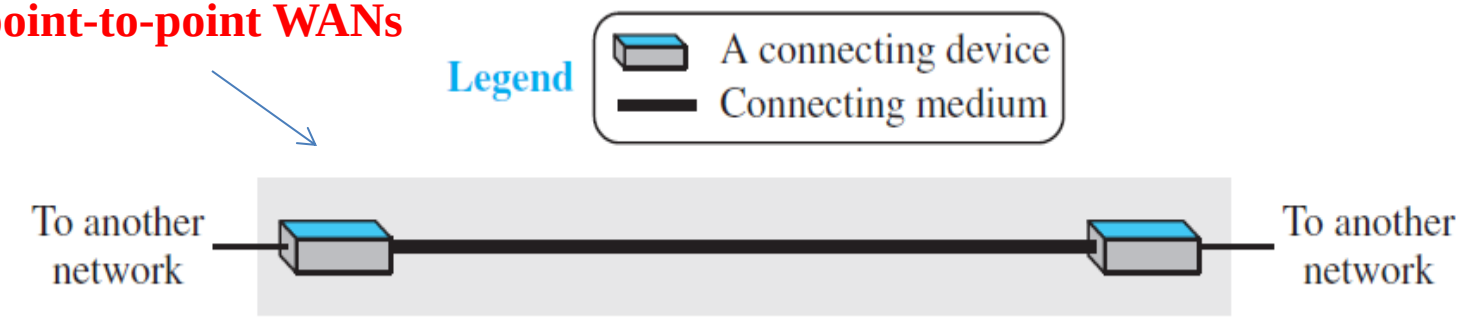
- A **local area network (LAN)** is usually privately owned and connects some hosts in a single office, building, or campus.

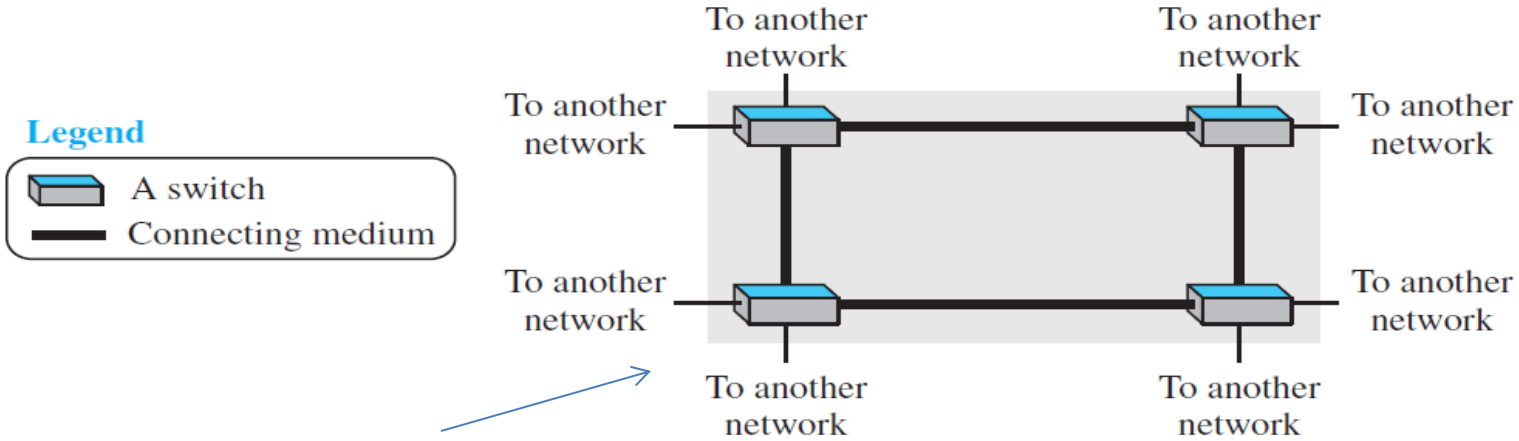
Wide Area Network (WAN):

- a **WAN** has a wider geographical Span than LAN, spanning a town, a state, a country, or even the world.

point-to-point WANs and switched WANs:

point-to-point WANs





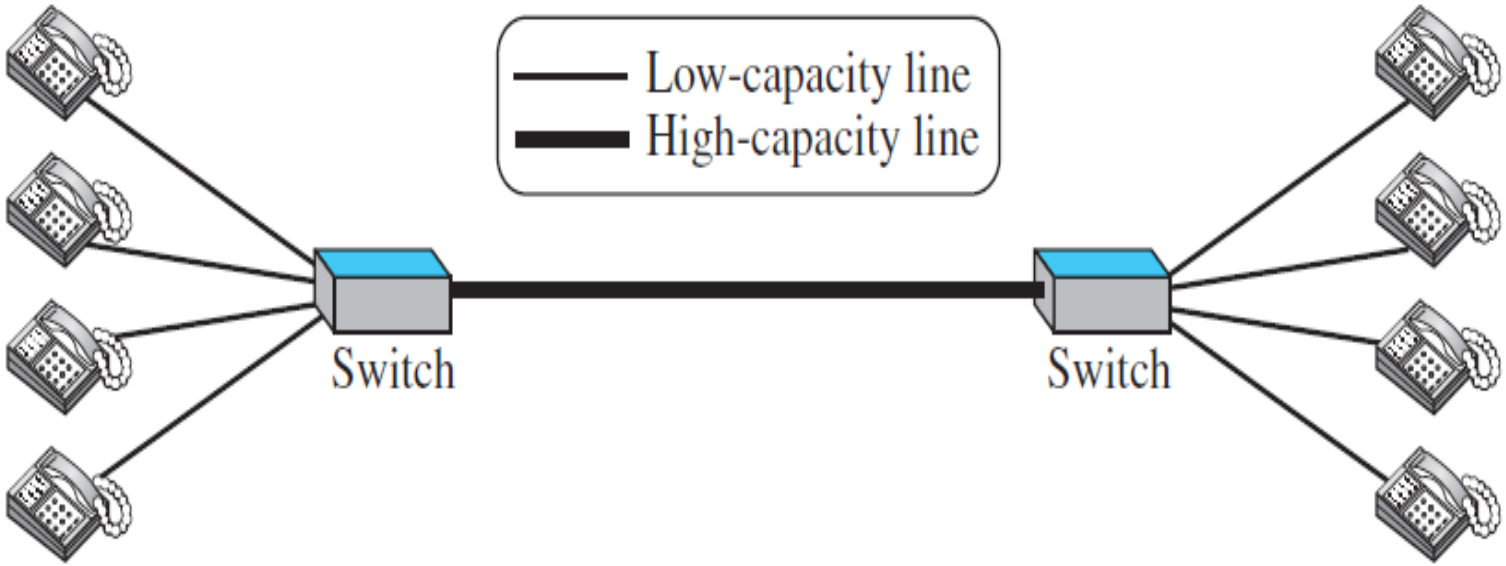
switched WANs

Switching:

- An **internet is a switched network** in which a switch connects at least two links together. A switch needs to forward data from a network to another network when required. The two most common types of switched networks are **circuit-switched** and **packet-switched networks**.

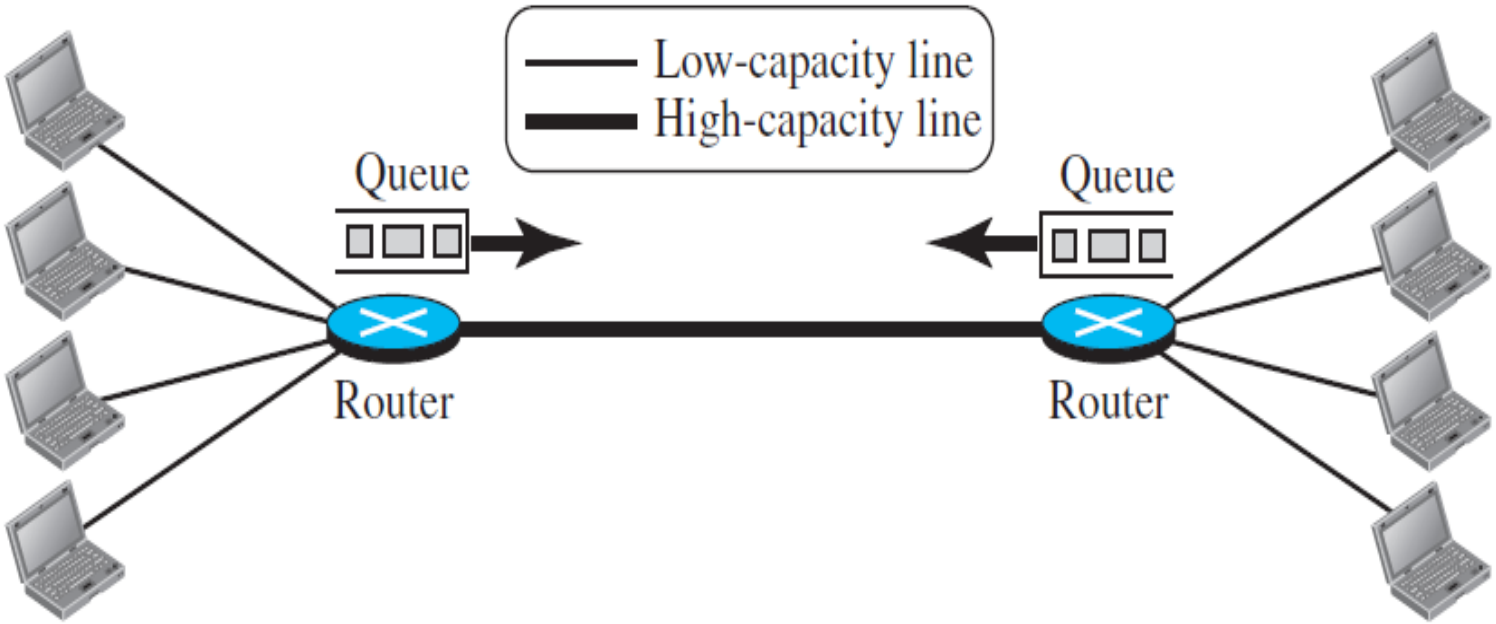
Circuit-Switched Network:

- A dedicated connection, called a **circuit**, is always available between the two end systems; the switch can only make it active or inactive.



Packet-Switched Network:

- The communication between the two ends is done in blocks of data called **packets**.



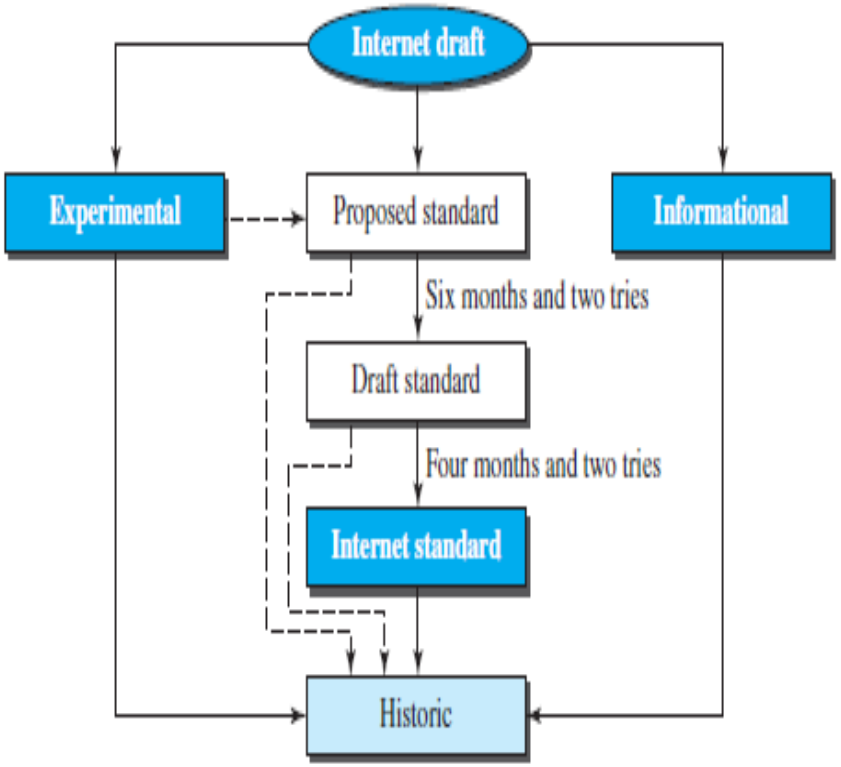
1- 4 STANDARDS AND ADMINISTRATION

- An **Internet standard** is a thoroughly tested specification that is useful to and adhered to by those who work with the Internet. It is a formalized regulation that must be followed.
- A specification begins as an Internet **draft**. An Internet **draft** is a working document with no official status and a six-month lifetime. Upon recommendation from the Internet authorities, a draft may be published as a **Request for Comment (RFC).**

RFC Maturity Levels:

- Proposed Standard.
- Draft Standard.
- Internet Standard.
- Historic.
- Experimental.
- Informational.

Figure 1.16 *Maturity levels of an RFC*



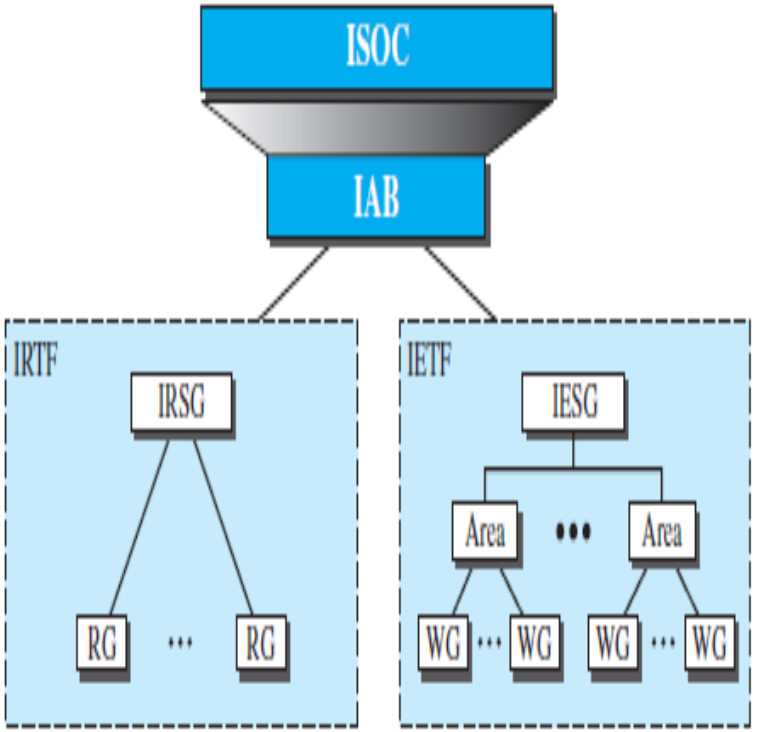
Requirement Levels:

- Required.
- Recommended..
- Elective.
- Limited Use.
- Not Recommended.

Internet Administration:

- ISOC (Internet Society)
- IAB (Internet Architecture Board)
- IETF (Internet Engineering Task Force)
- IRTF (Internet Research Task Force)

Figure 1.17 *Internet administration*



Reference:

- Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, TMH, 2013.