

# **CHAPTER 1**

# **INTRODUCTION**

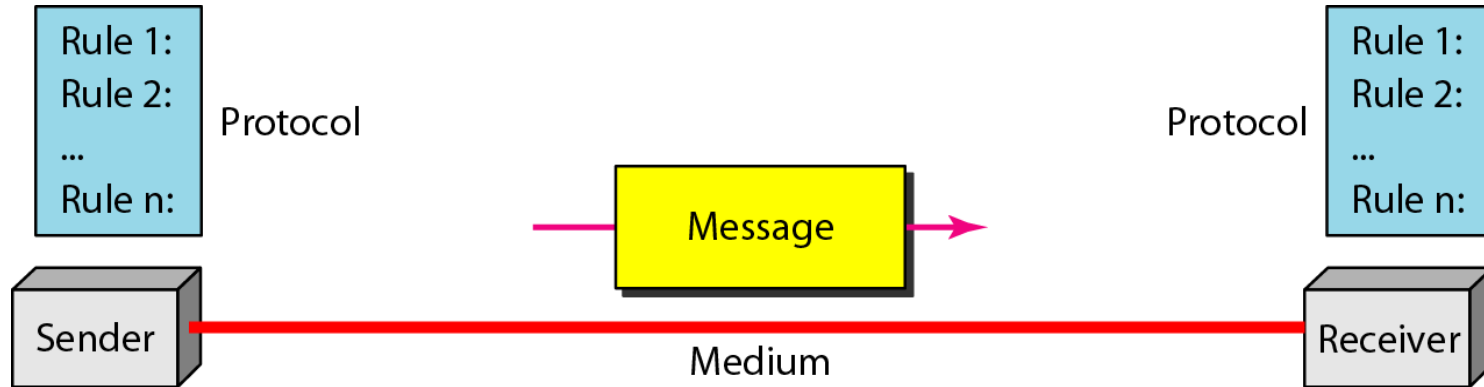
# DATA COMMUNICATIONS

- 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.

# Effectiveness of data Communication

- Delivery
  - Correct Destination
  - Authorized receiver
- Accuracy
  - Deliver data accurately
- Timeliness
  - Late are useless
- Jitter
  - Variation in packet arrival time

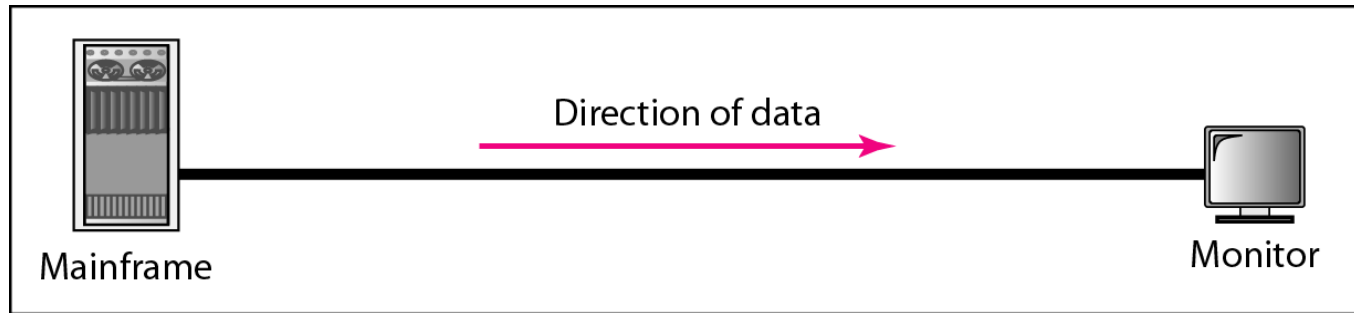
**Figure 1** *Five components of data communication*



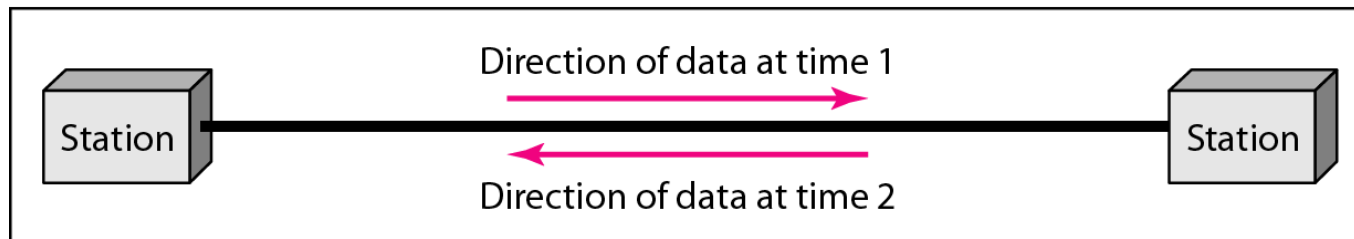
# Data Representation

- Text
  - Represented as sequence of bits (0s or 1s)
  - Unicode – 32 bit any symbol or character
- Number
  - Represented as sequence of bits (0s or 1s)
- Images
  - Represented as sequence of bits (0s or 1s)
  - Pixel → bit pattern
- Audio & Video

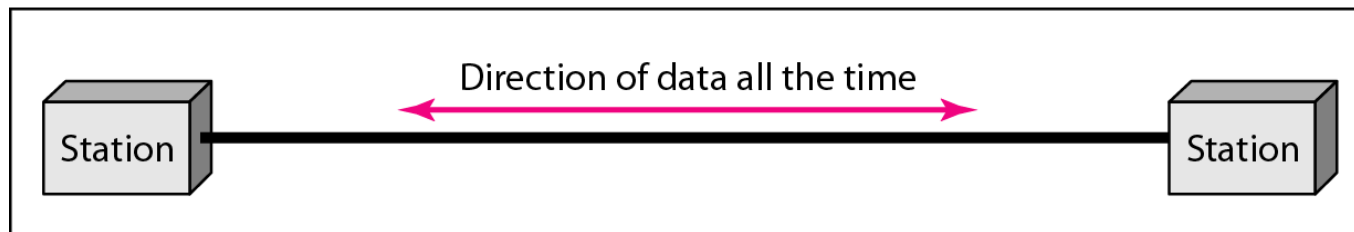
**Figure 2** *Data flow (simplex, half-duplex, and full-duplex)*



a. Simplex



b. Half-duplex



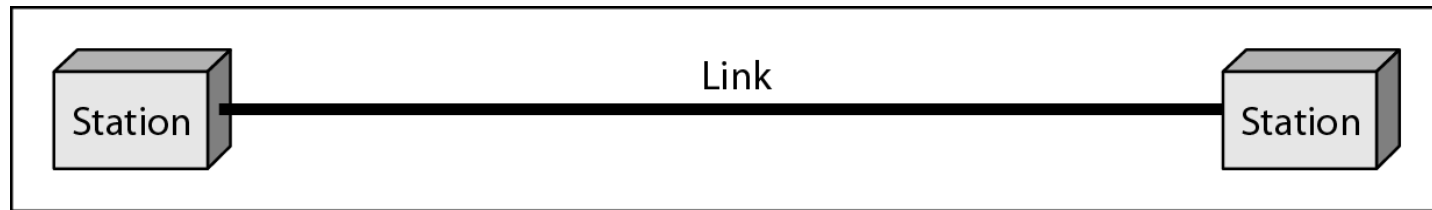
c. Full-duplex

# NETWORKS

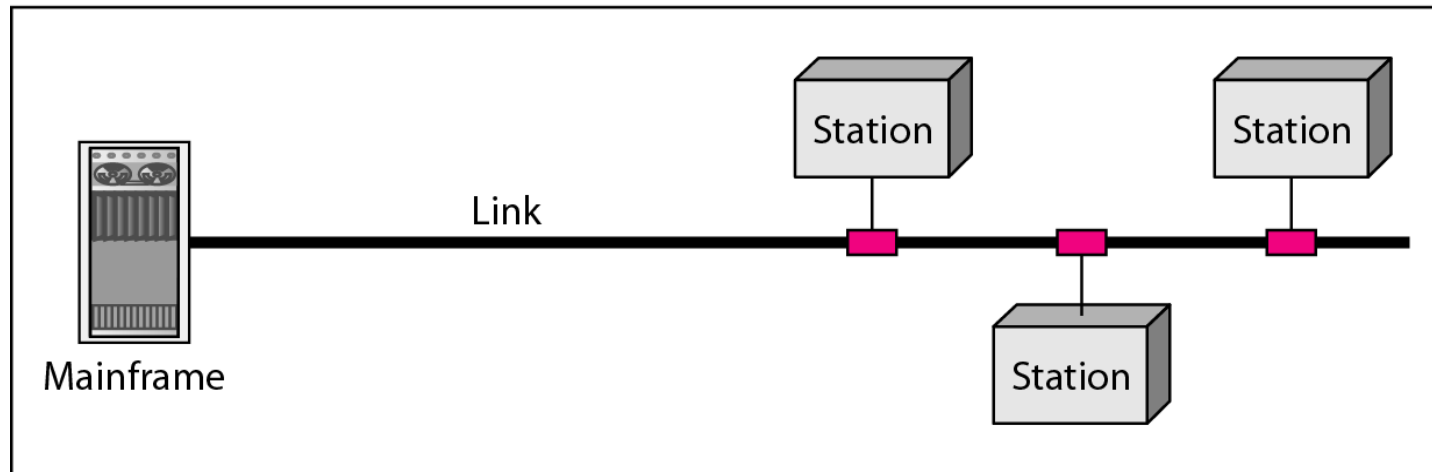
*A **network** is a set of devices (often referred to as **nodes**) connected by communication **links**.*

*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.*

**Figure 3** *Types of connections: point-to-point and multipoint*



a. Point-to-point



b. Multipoint



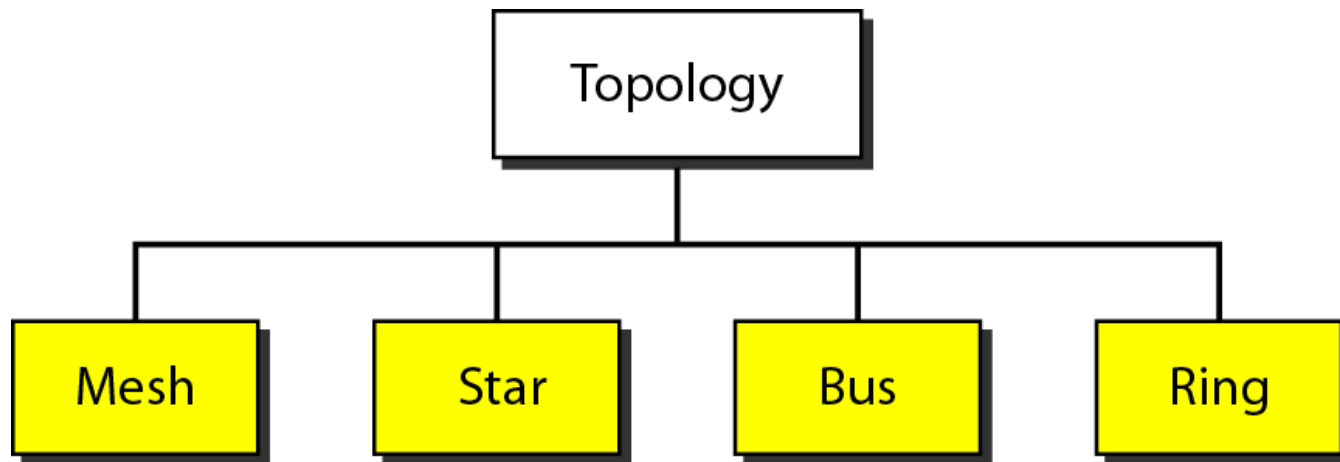
# Topology

- **Way in which network is laid out physically.**
- Two or more devices connect to a link;
- two or more links form a topology.
- **geometric representation** of the relationship of all the links and linking devices (usually called nodes) to one another.

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**Figure 4** *Categories of topology*

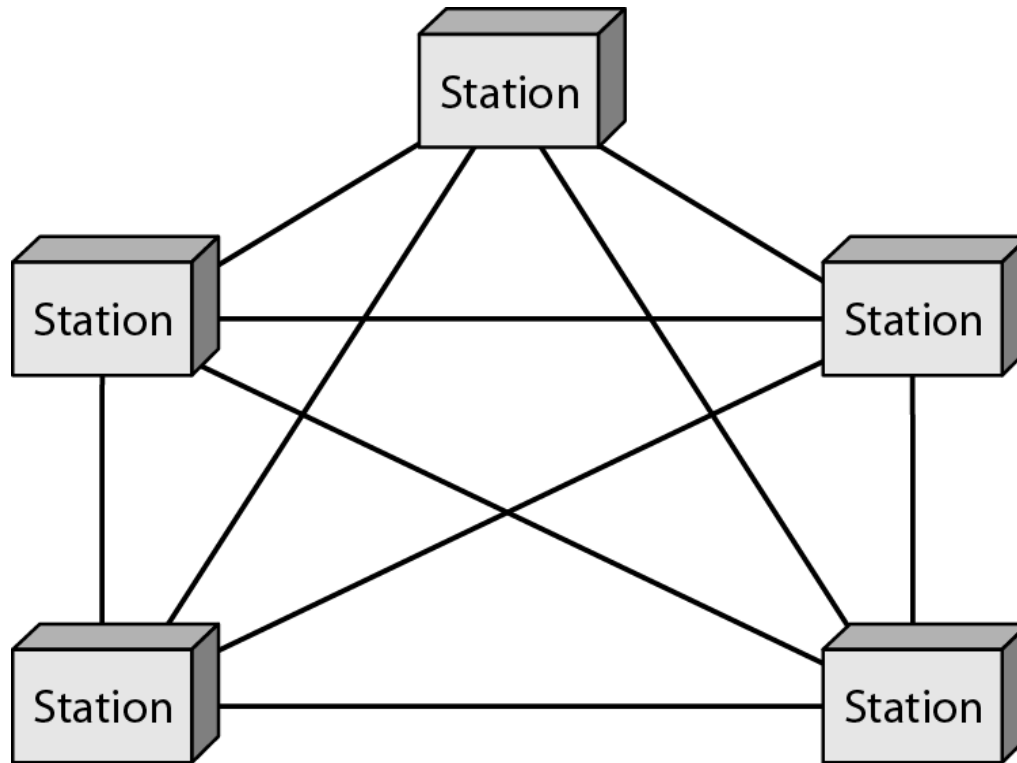
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**Figure 5** *A fully connected mesh topology (five devices)*

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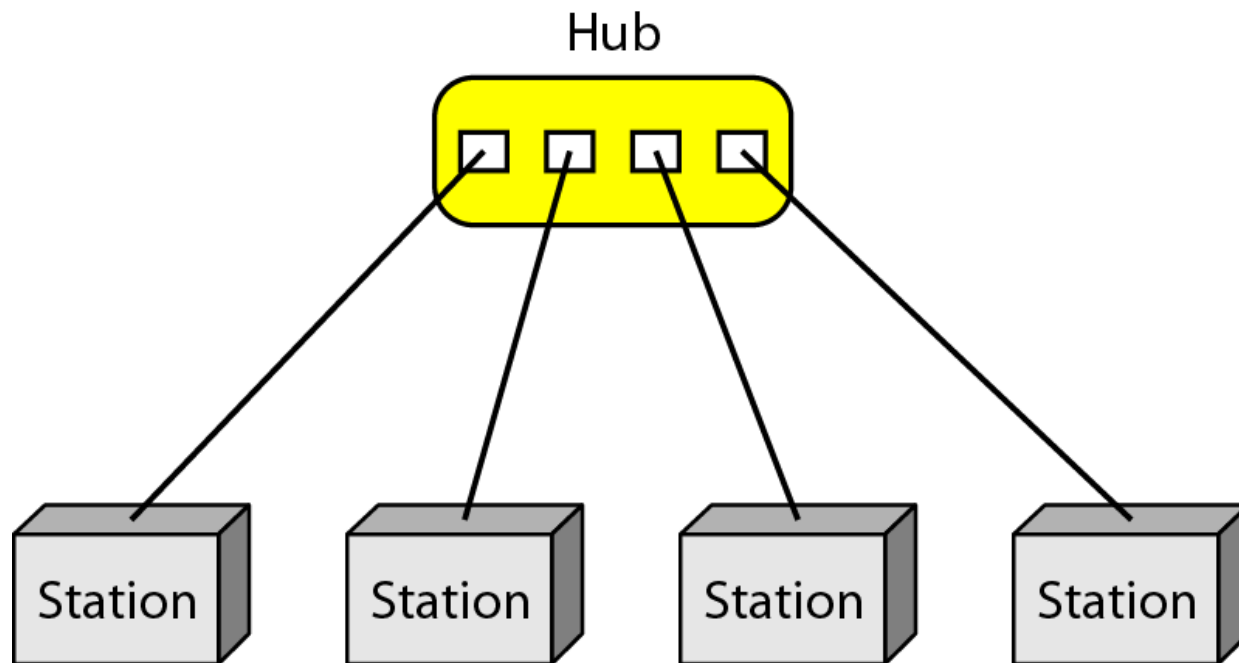
# Mesh Topology

- **n** stations
- **$n(n-1)/2$  duplex mode** links
- **n-1** ports
  
- Dedicated link
- Robust
- Privacy / Security
- Ex. connection of telephone regional offices

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**Figure 6** *A star topology connecting four stations*

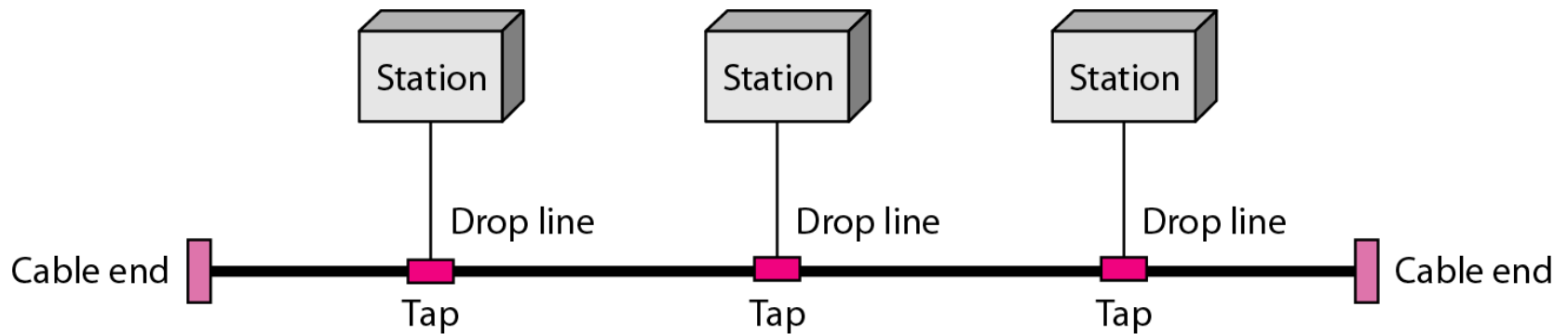
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**Figure 7** *A bus topology connecting three stations*

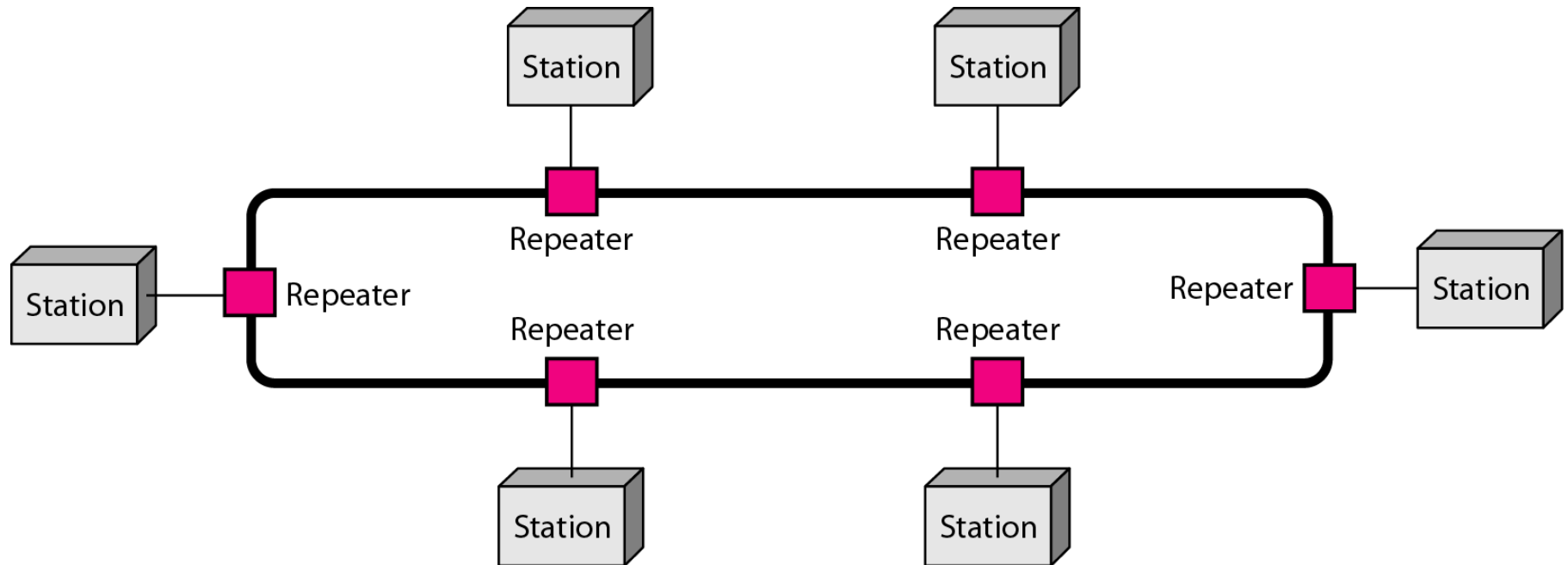
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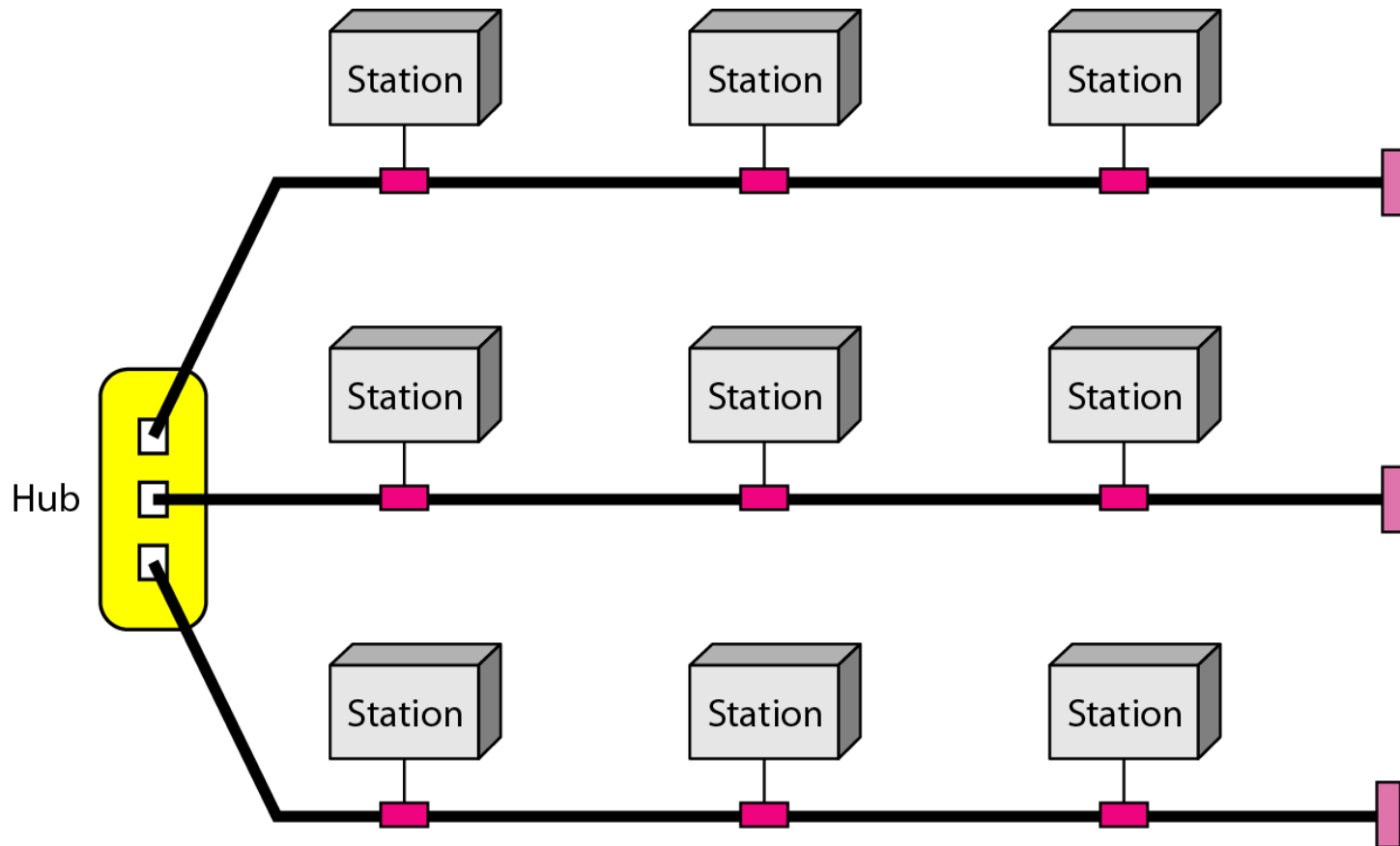
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**Figure 8** *A ring topology connecting six stations*

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**Figure 9** *A hybrid topology: a star backbone with three bus networks*





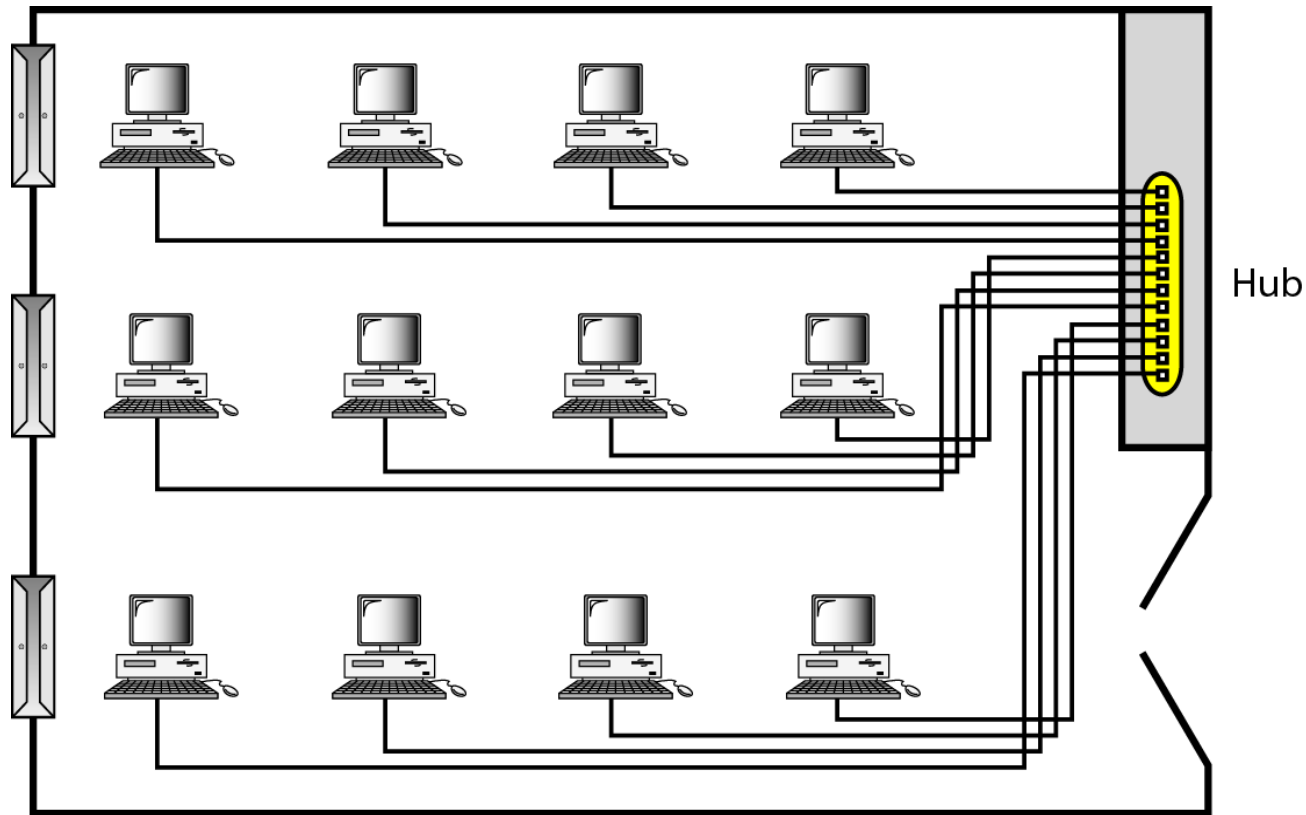
# Categories of Networks

- Local Area Network (LAN)
- Wide Area Network (WAN)
- Metropolitan Area Network (MAN)

# Local Area Network

- Area less than 2 mi.
- Usually privately owned
- links the devices in a single office, building, or campus
- Ex. moodle

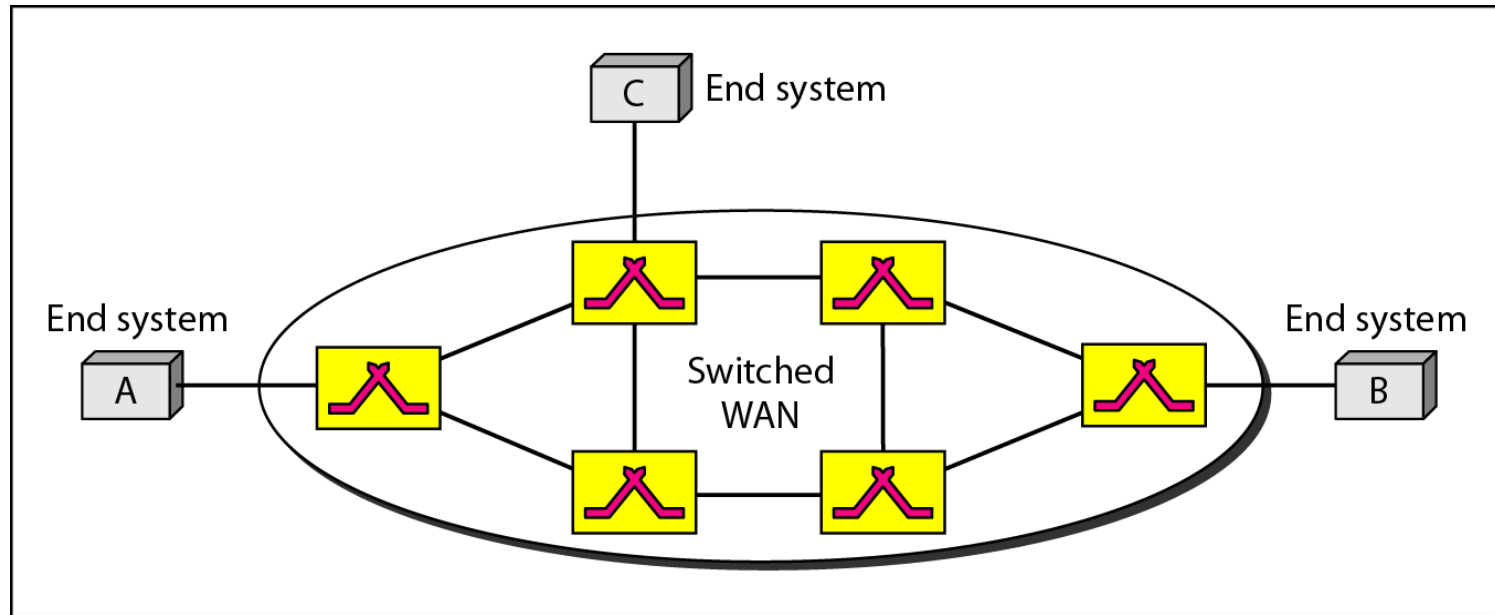
**Figure 10** *An isolated LAN connecting 12 computers to a hub in a closet*



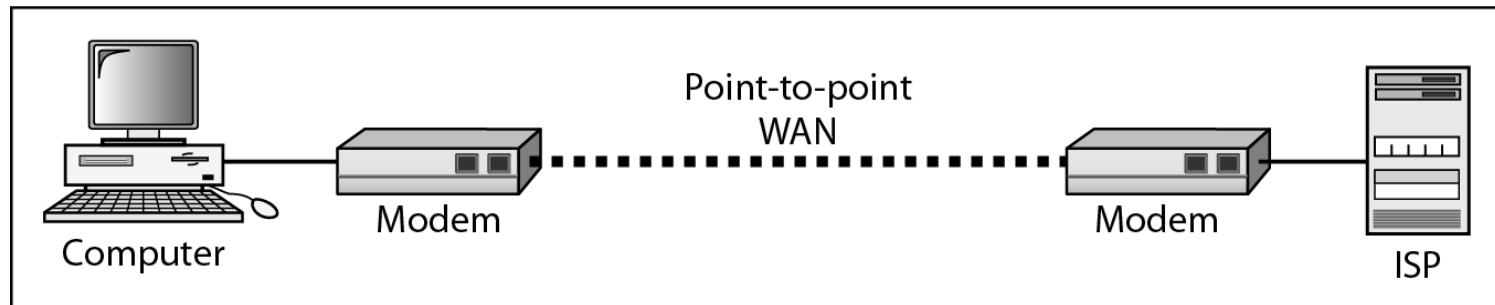
# Wide Area Network

- Internet
- A good example of a switched WAN is the **asynchronous transfer mode (ATM)** network, which is a network with fixed-size data unit packets called cells.

**Figure 11** *WANs: a switched WAN and a point-to-point WAN*

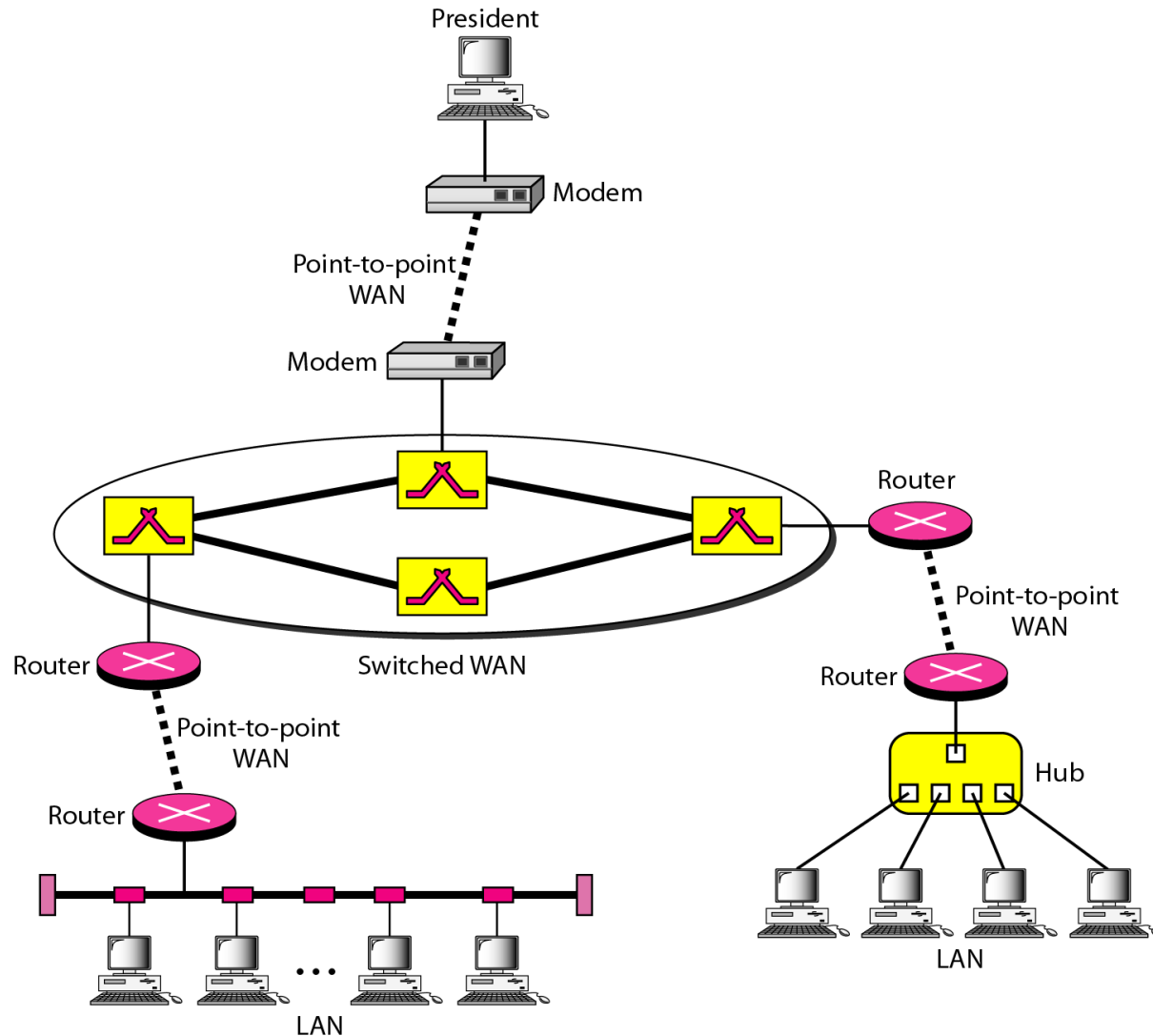


a. Switched WAN



b. Point-to-point WAN

**Figure 12** *A heterogeneous network made of four WANs and two LANs*



# Metropolitan Area Networks

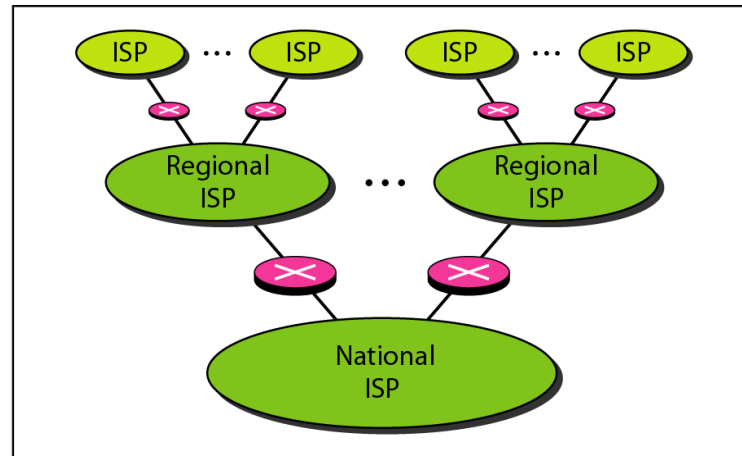
- size between a LAN and a WAN
- covers the area inside a town or a city
- Ex. cable TV network that originally was designed for cable TV, but today can also be used for high-speed data connection to the Internet

# **THE INTERNET**

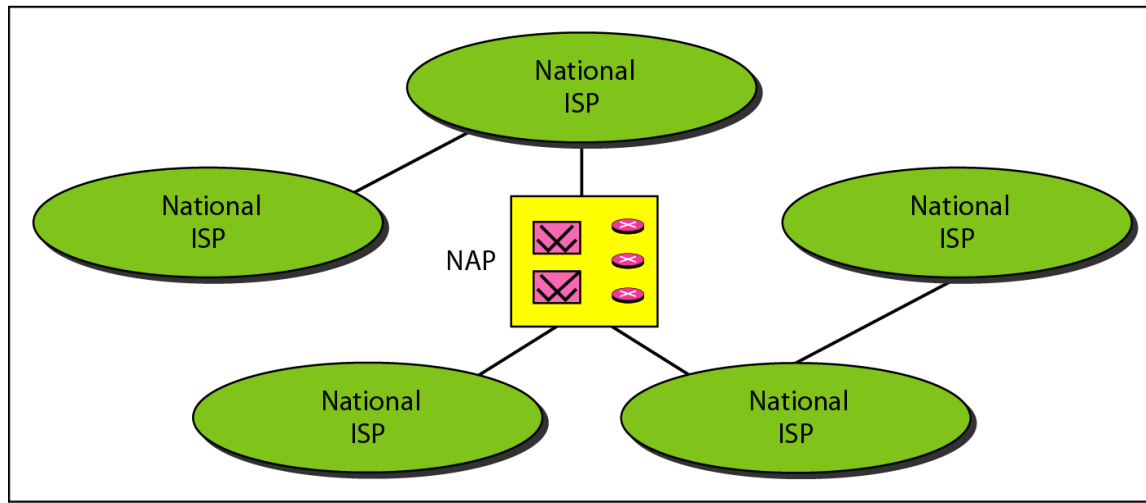
**When two or more networks are connected, they become an internetwork, or internet.**



**Figure 13** *Hierarchical organization of the Internet*



a. Structure of a national ISP



b. Interconnection of national ISPs