



# Chapter 1

## Introduction

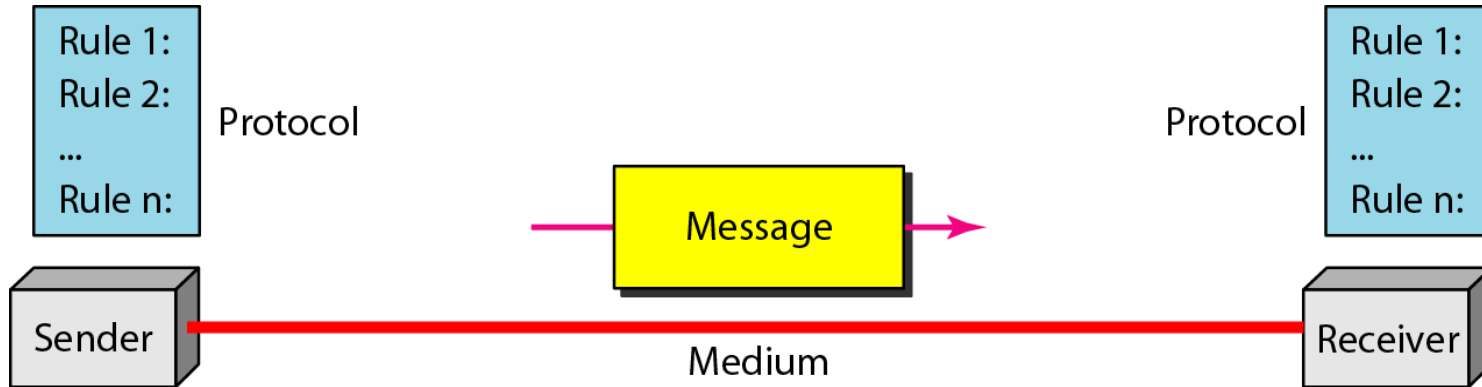
# 1-1 DATA COMMUNICATIONS

*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.*

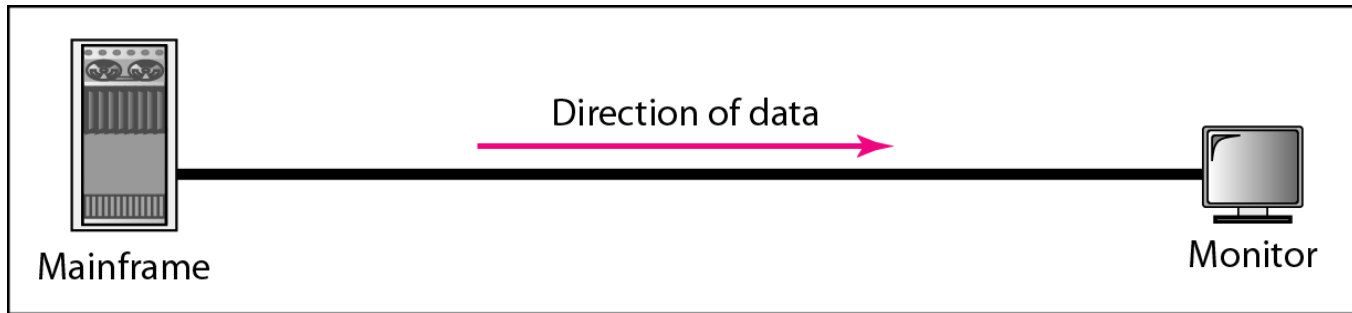
## **Topics discussed in this section:**

- **Components of a data communications system**
- **Data Flow**

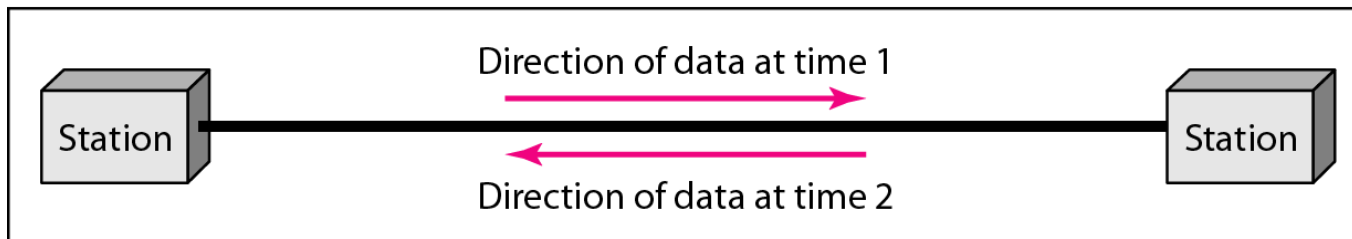
**Figure 1.1** *Components of a data communication system*



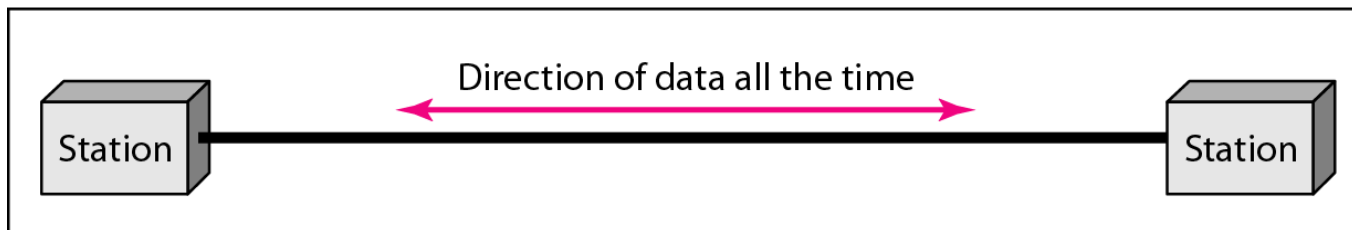
**Figure 1.2** *Data flow (simplex, half-duplex, and full-duplex)*



a. Simplex



b. Half-duplex



c. 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. A link can be a cable, air, optical fiber, or any medium which can transport a signal carrying information.*

## *Topics discussed in this section:*

- Network Criteria
- Physical Structures
- Categories of Networks

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# Network Criteria

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- **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

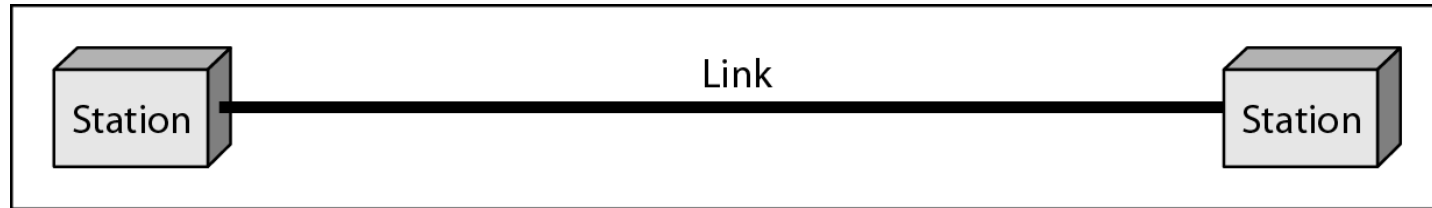
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# Physical Structures

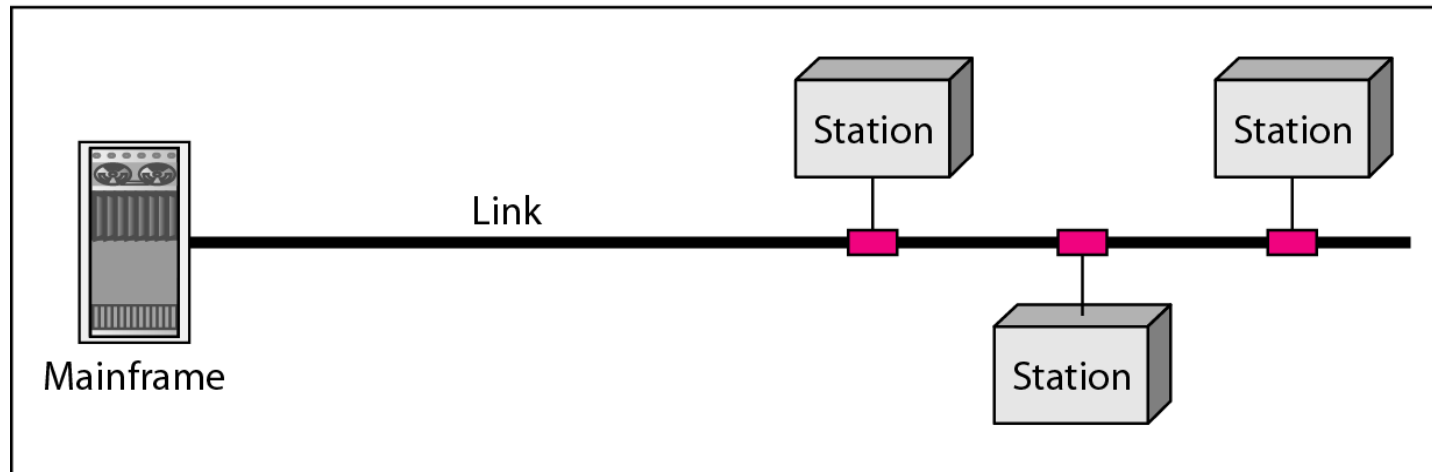
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- **Type of Connection**
  - Point to Point - single transmitter and receiver
  - Multipoint - multiple recipients of single transmission
- **Physical Topology**
  - Connection of devices
  - Type of transmission - unicast, mulitcast, broadcast

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



a. Point-to-point



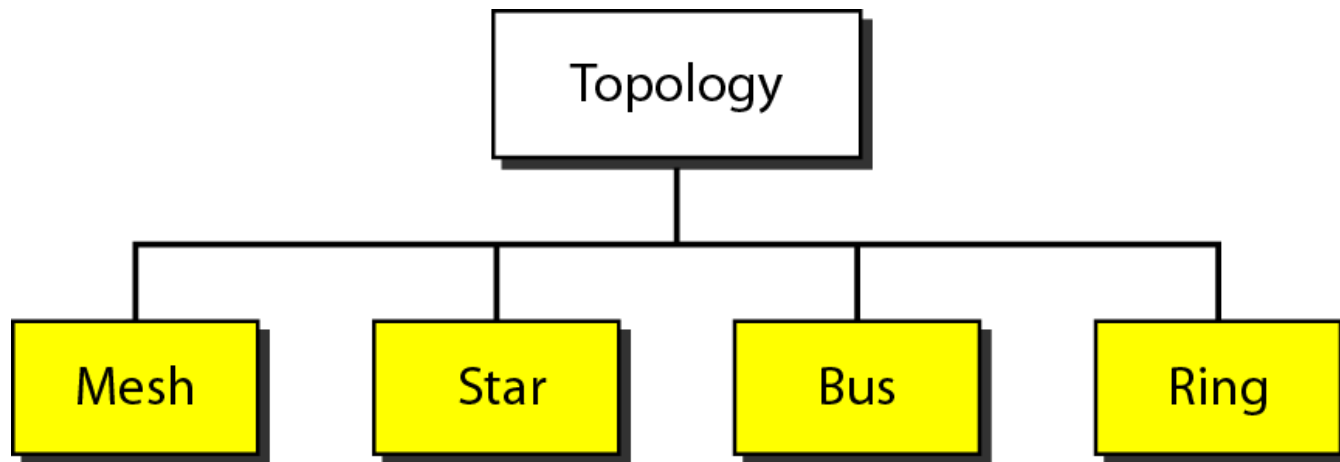
b. Multipoint



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**Figure 1.4** *Categories of topology*

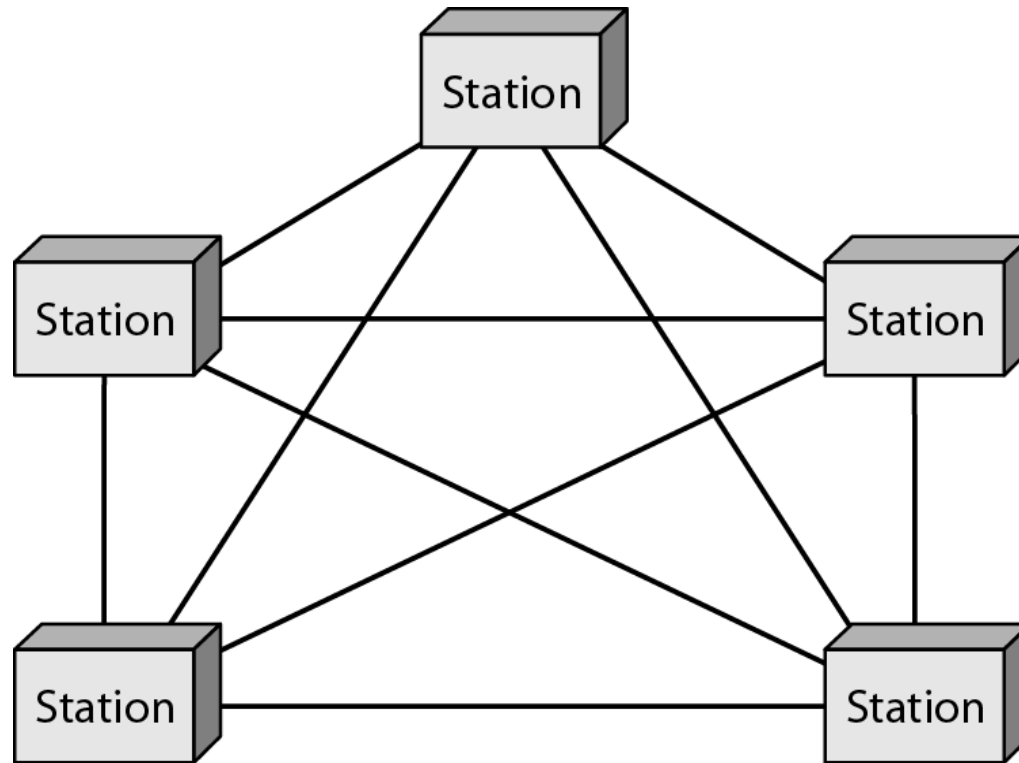
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**Figure 1.5** *A fully connected mesh topology (five devices)*

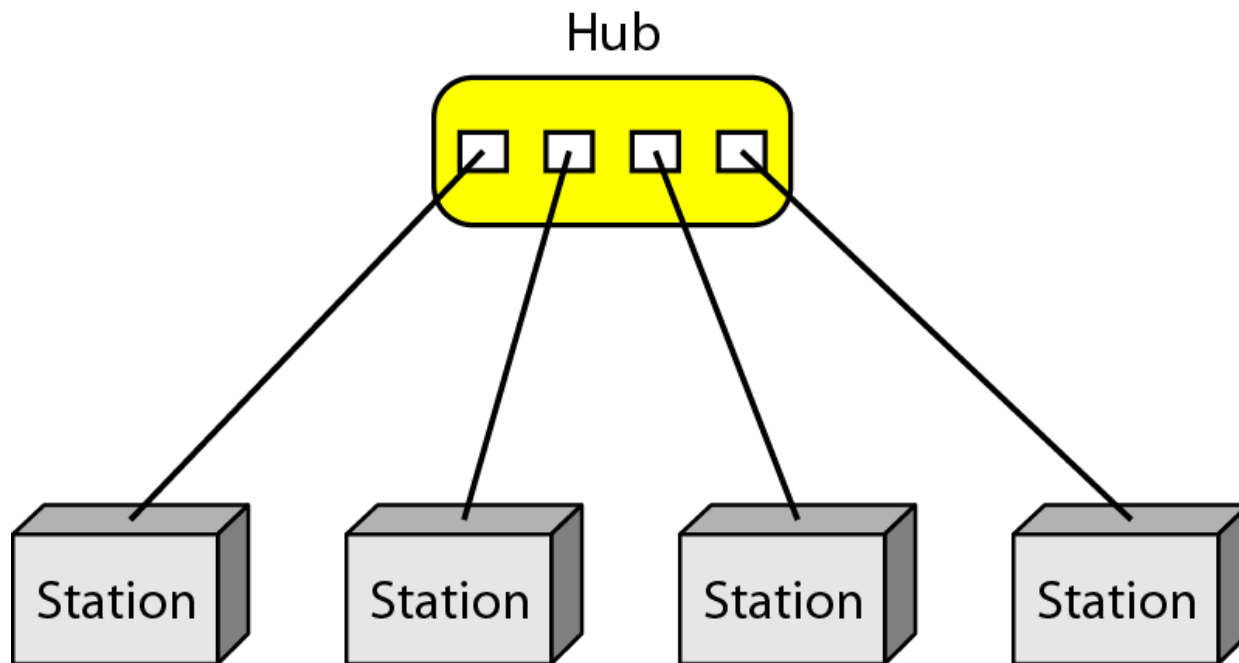
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**Figure 1.6** *A star topology connecting four stations*

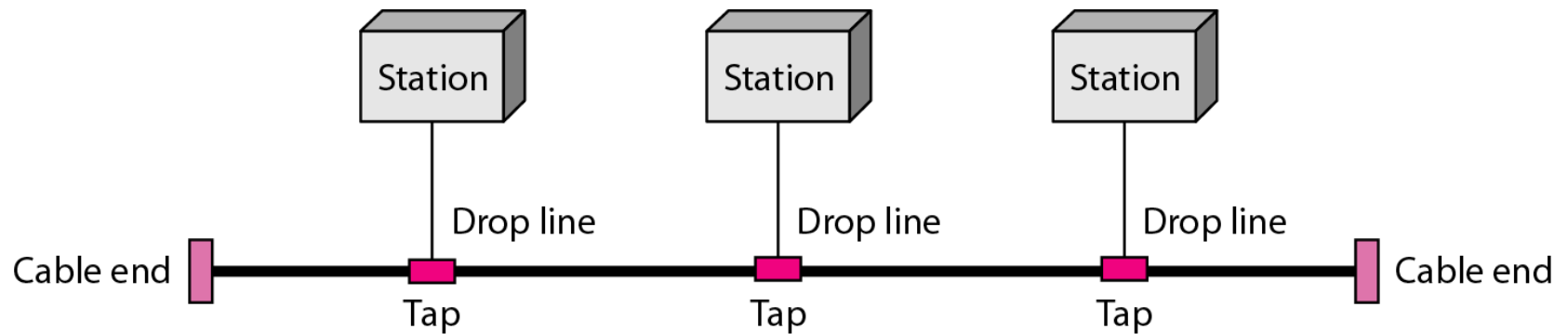
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**Figure 1.7** *A bus topology connecting three stations*

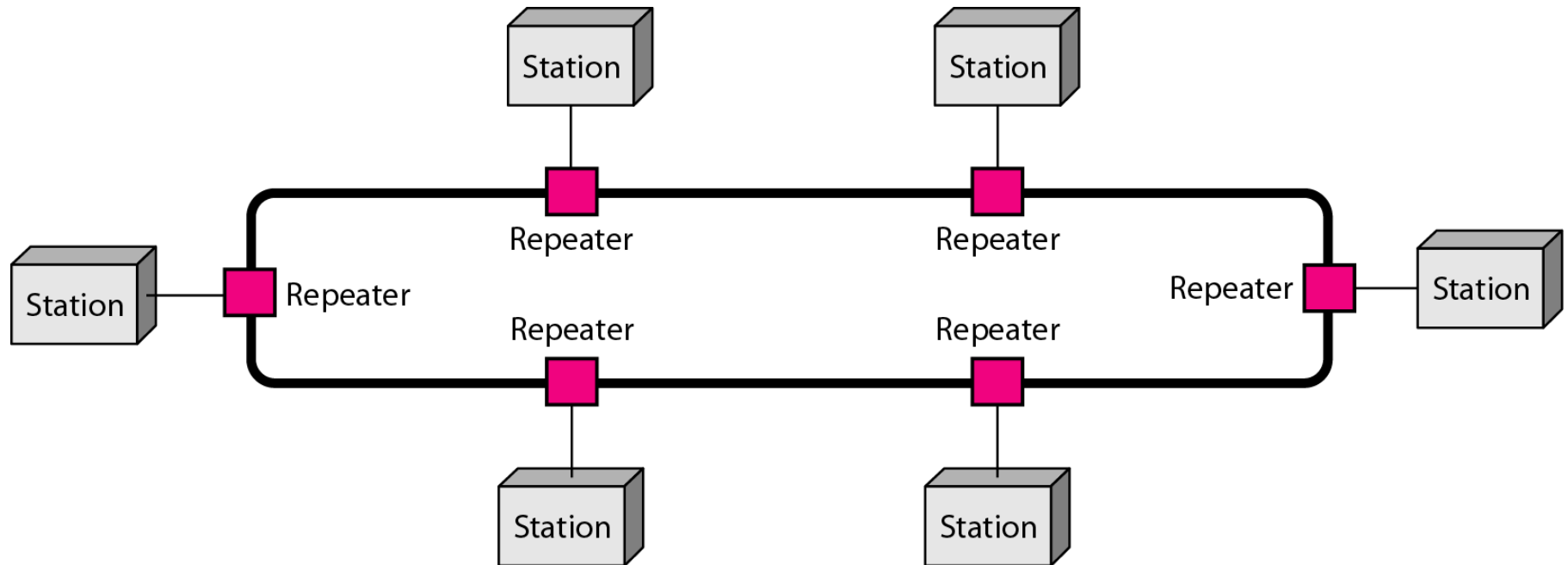
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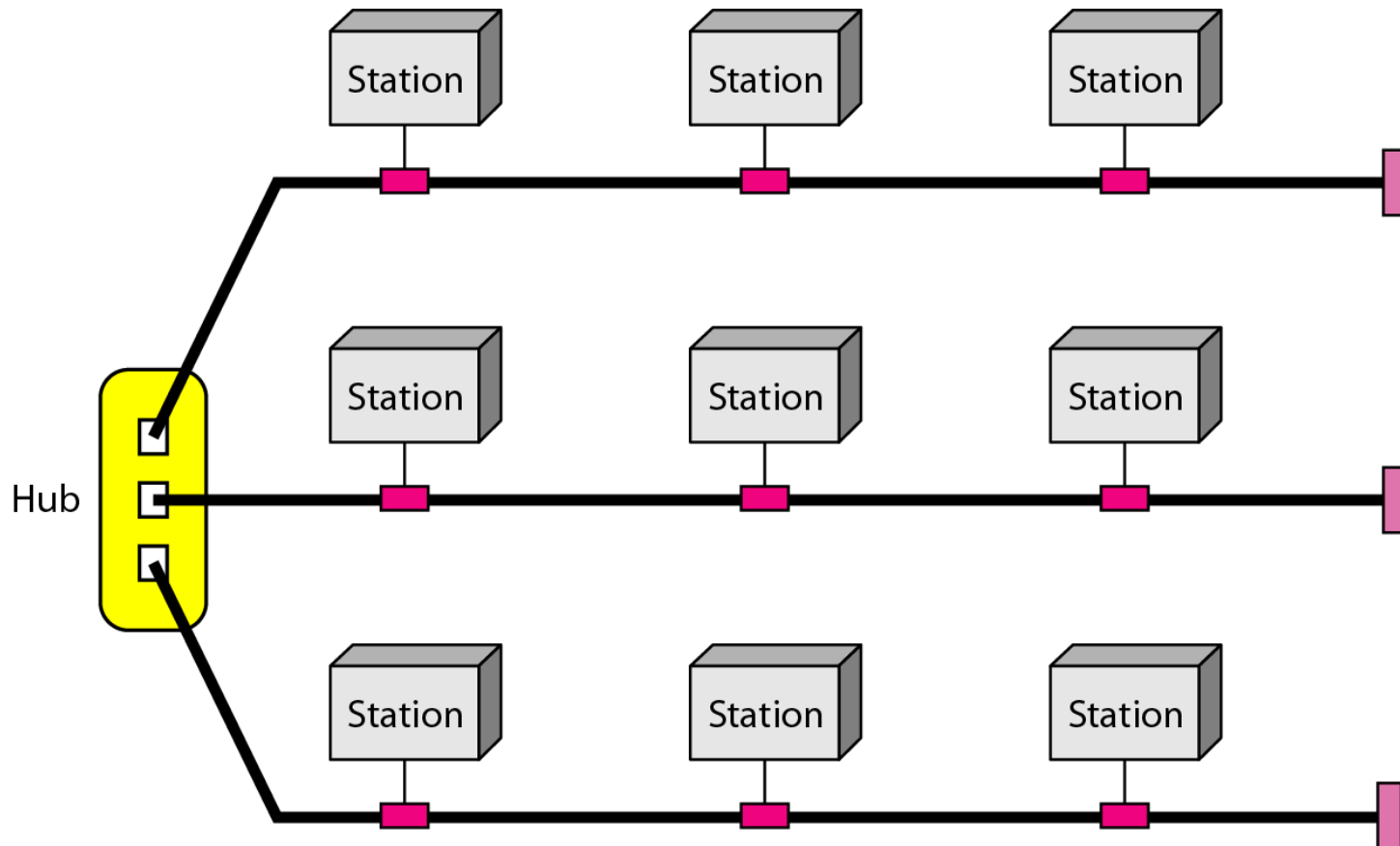
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**Figure 1.8** *A ring topology connecting six stations*

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**Figure 1.9** *A hybrid topology: a star backbone with three bus networks*



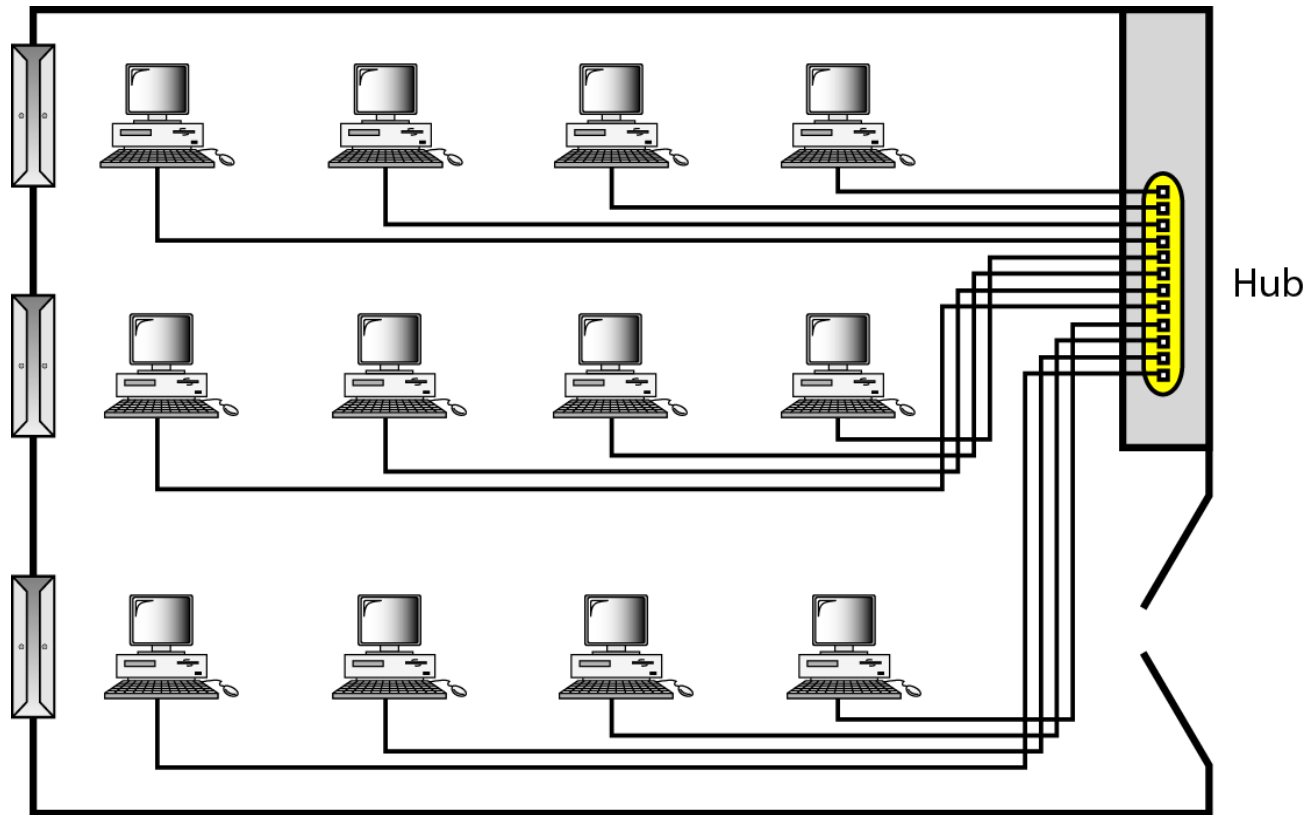
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# Categories of Networks

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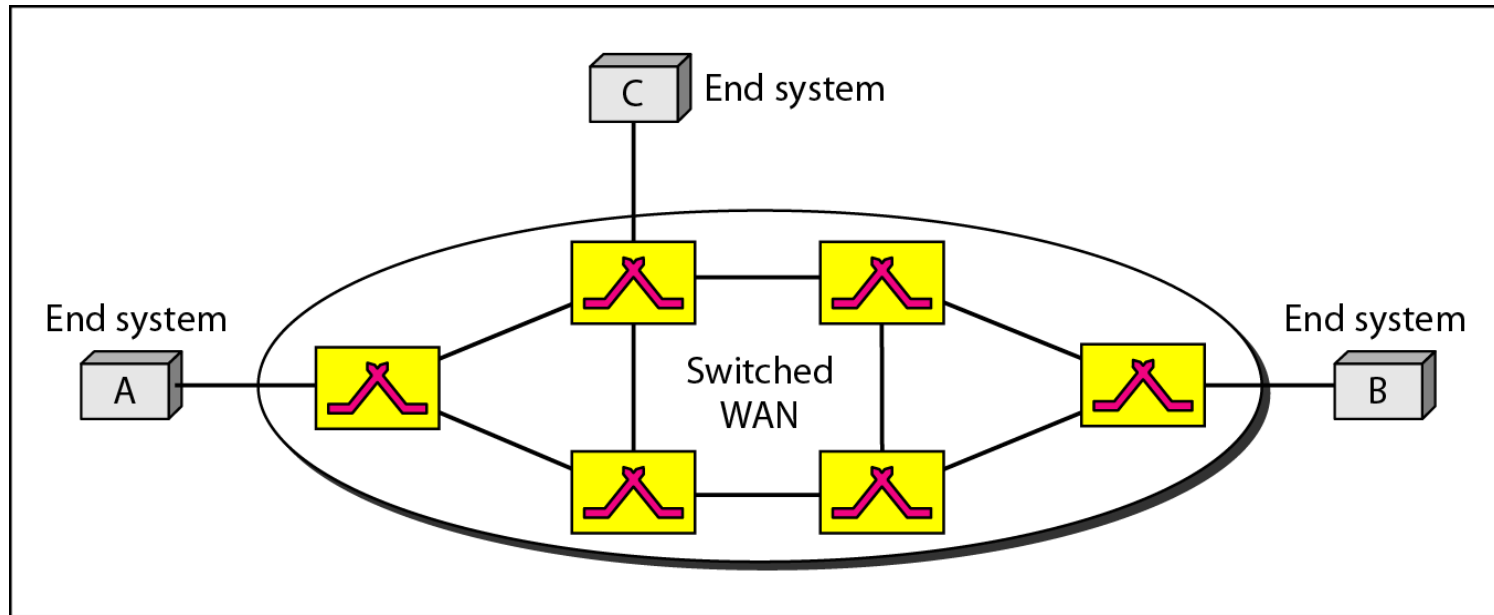
- **Local Area Networks (LANs)**
  - Short distances
  - Designed to provide local interconnectivity
- **Wide Area Networks (WANs)**
  - Long distances
  - Provide connectivity over large areas
- **Metropolitan Area Networks (MANs)**
  - Provide connectivity over areas such as a city, a campus

**Figure 1.10** *An isolated LAN connecting 12 computers to a hub in a closet*

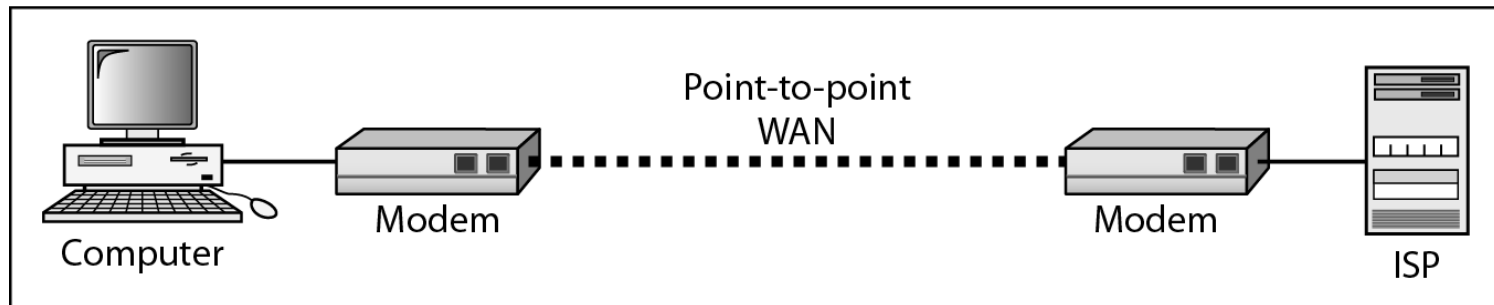




**Figure 1.11** *WANs: a switched WAN and a point-to-point WAN*

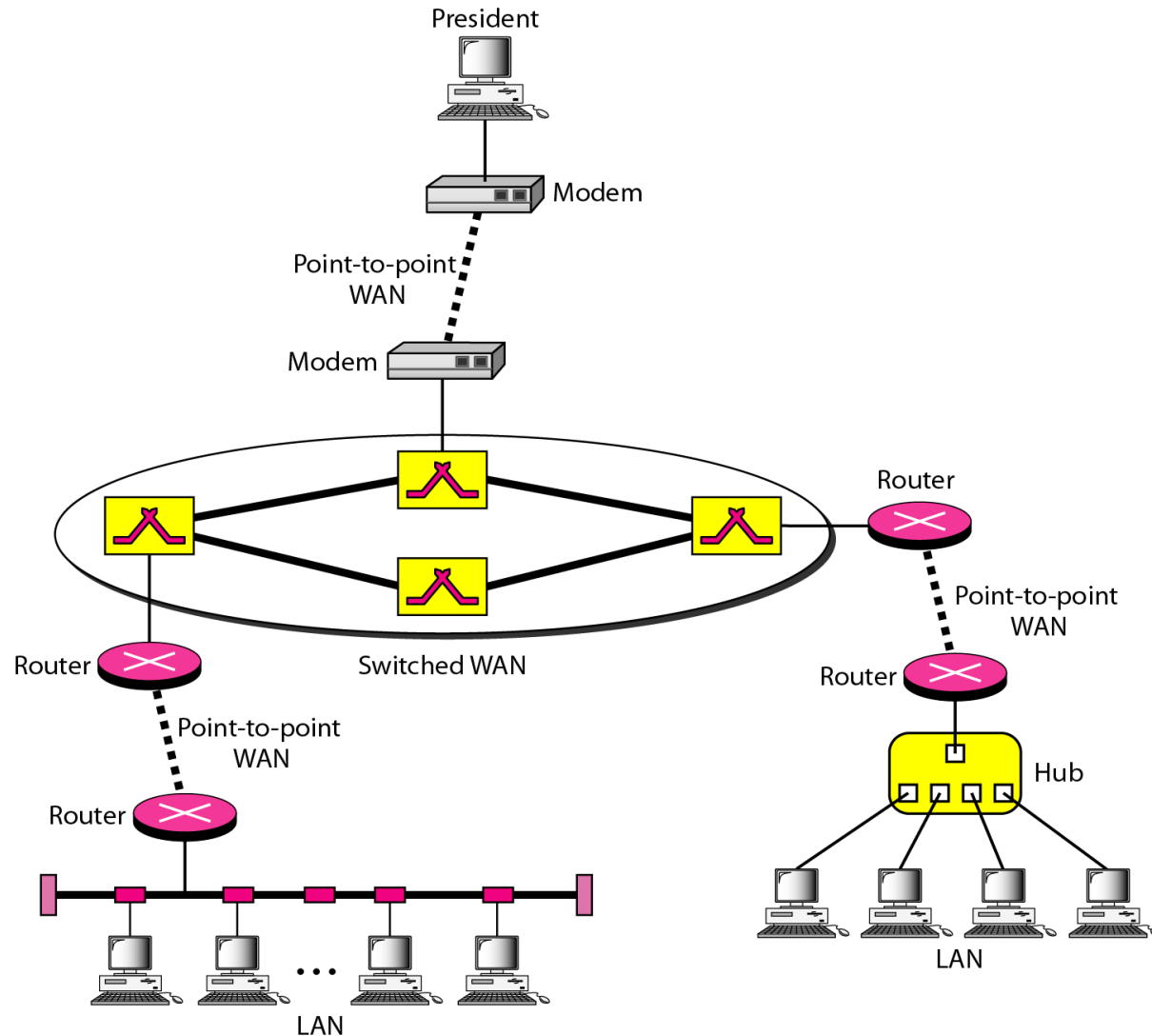


a. Switched WAN



b. Point-to-point WAN

**Figure 1.12** *A heterogeneous network made of four WANs and two LANs*



## 1-3 THE INTERNET

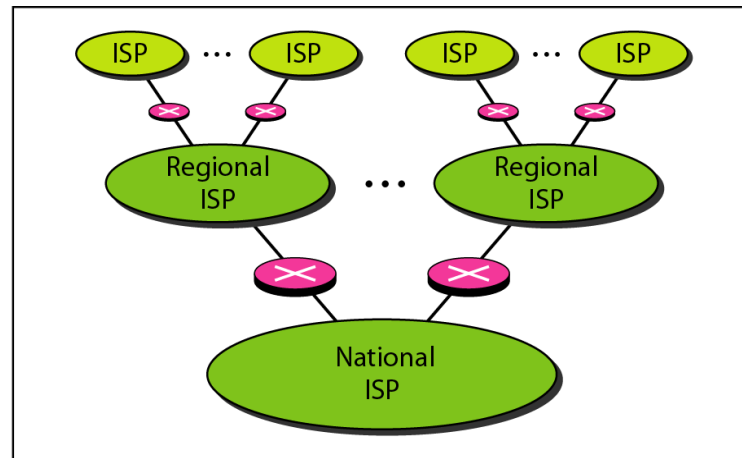
*The **Internet** has revolutionized many aspects of our daily lives. It has affected the way we do business as well as the way we spend our leisure time. The Internet is a communication system that has brought a wealth of information to our fingertips and organized it for our use.*

### **Topics discussed in this section:**

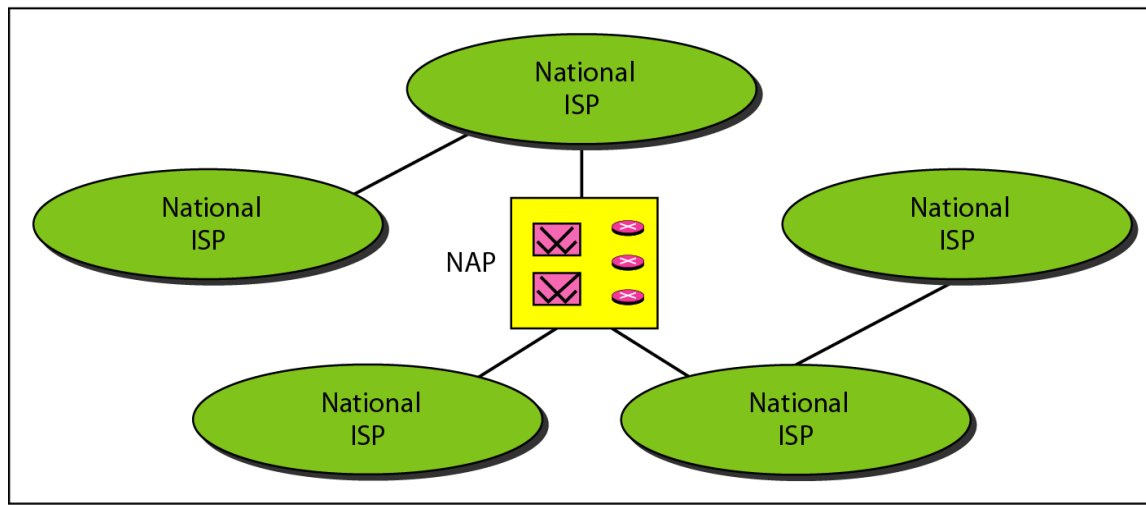
Organization of the Internet

Internet Service Providers (ISPs)

**Figure 1.13** *Hierarchical organization of the Internet*



a. Structure of a national ISP



b. Interconnection of national ISPs

# 1-4 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. The key elements of a protocol are syntax, semantics and timing*

## *Topics discussed in this section:*

- Syntax
- Semantics
- Timing

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# Elements of a Protocol

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- **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.