ITT300
Introduction to Data Communication and Networking

Chapter 1
Introduction

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1.1 INTRODUCTION

What is data communication?

The exchange of data between two devices via some form of transmission medium.

EFFECTIVENESS

1. **Delivery** - the system must deliver data to the correct destination.
2. **Accuracy** - the system must deliver data accurately.
3. **Timeliness** - The system must deliver data timely.
4. **Jitter** – The system must avoid the variation in arrival time.

DATA COMMUNICATIONS SYSTEM

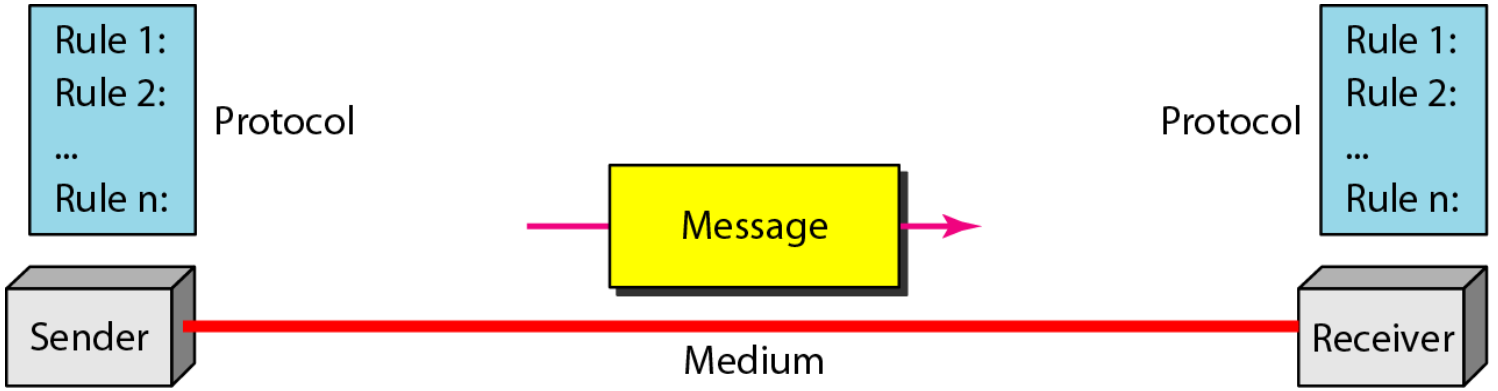

Figure 1.1 *Five components of data communications system*

FIVE COMPONENTS

1. **Message** – data to be communicated.
2. **Sender** – device that sends data.
3. **Receiver** – device that receives data.
4. **Transmission medium** – physical path in which datatravels from sender to receiver.
5. **Protocol** – set of rules that represents an agreement between the communicating devices.

DATA FLOW

1. **Simplex** – one device can transmit; the other can only receive.
2. **Half-Duplex** – each device can both transmit and receive, but not at the same time.
3. **Full-Duplex** – both devices can transmit and receive simultaneously.

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

DATA FLOW

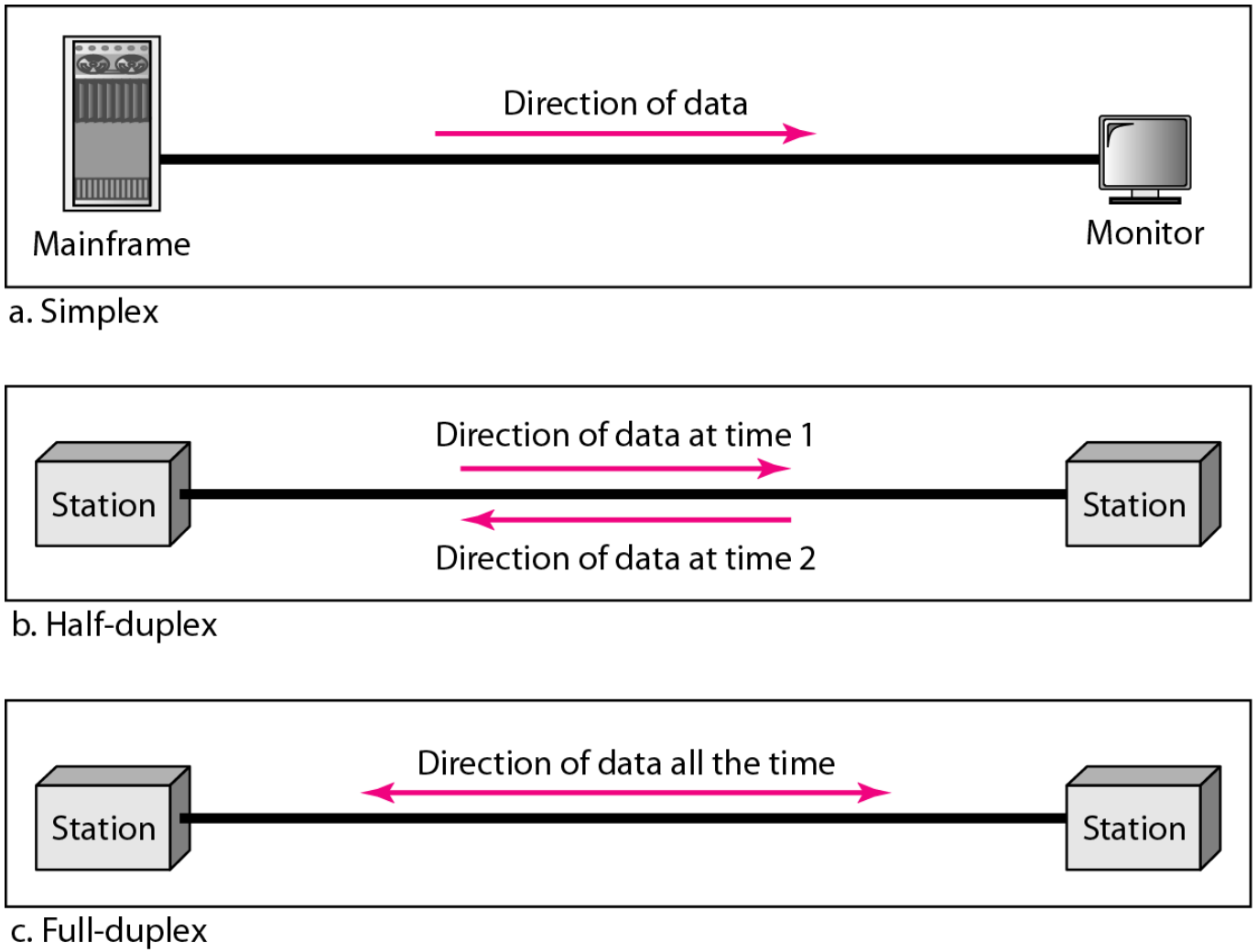

Figure 1.2 *Data flow (simplex, half-duplex, and full-duplex)*

1-2 NETWORKS

- What is a network?

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

- Most networks use **distributed processing** – a task is divided among multiple computers.

NETWORK CRITERIA

1. **Performance – quality of network service.**
   - Measured by:
     i. **Transmit time** – amount of time for data to travel from one device to another.
     ii. **Response time** – elapsed time between an inquiry and a response.

NETWORK CRITERIA

2. **Reliability – user's satisfaction about network.**
   - Measured by :
     - frequency of failure
     - the time for recovering the failure
     - robustness in a catastrophe.
3. **Security – data protecting.**
   - Measured by :
     - data collision, etc.

PHYSICAL STRUCTURES

1. Physical Connection

- Two possible types of connections:

a) Point-to-Point

- dedicated link between two devices.

b) Multipoint (Multi-drop)

- more than two devices share a single link either spatially or temporally.

PHYSICAL STRUCTURES

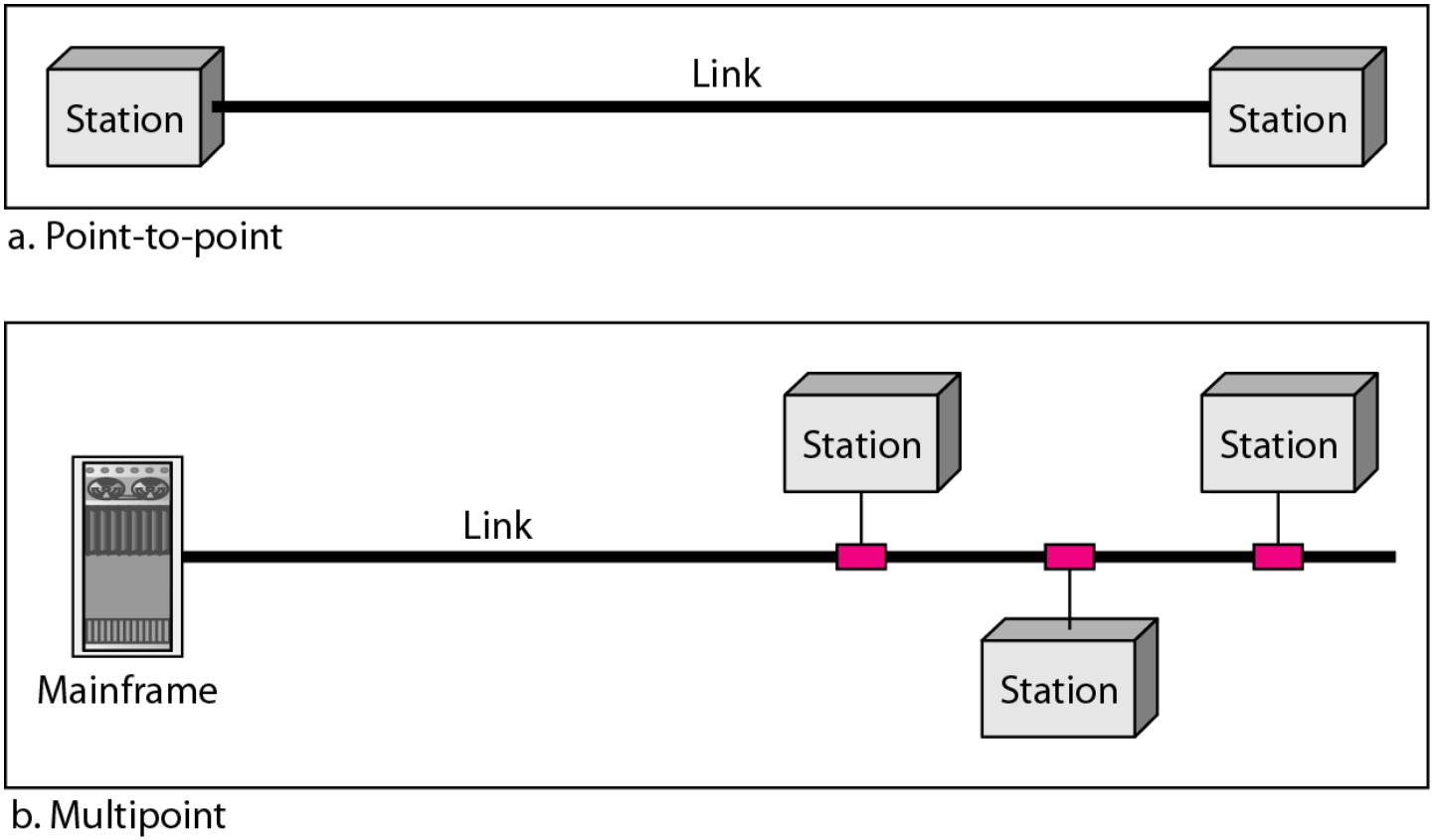

Figure 1.3 *Types of connections: point-to-point and multipoint*

2. Topology

- the way in which a network is laid out physically.

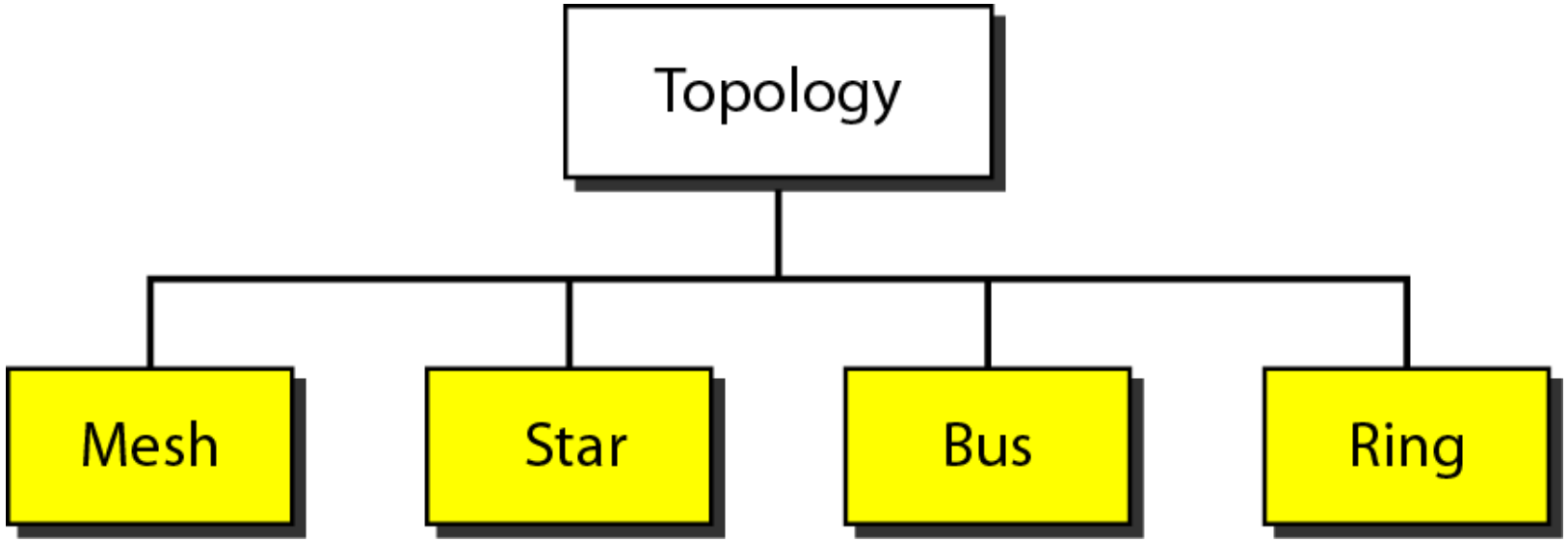

Figure 1.4 *Categories of topology*

MESH TOPOLOGY

- **Every devices has a dedicated point to point link .**
- For *n* devices, physical channel = n(n-1)/2

MESH TOPOLOGY

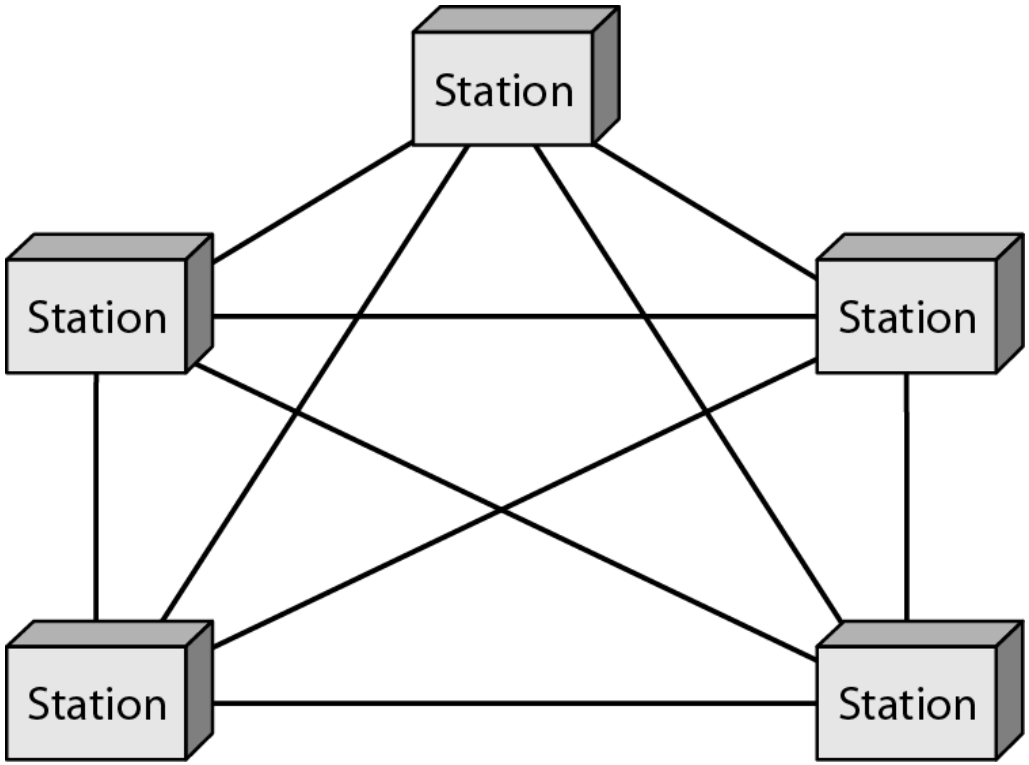

Figure 1.5 *A fully connected mesh topology (five devices)*

STAR TOPOLOGY

- Each devices has a **dedicated point to point link only to a central controller (hub).**

STAR TOPOLOGY

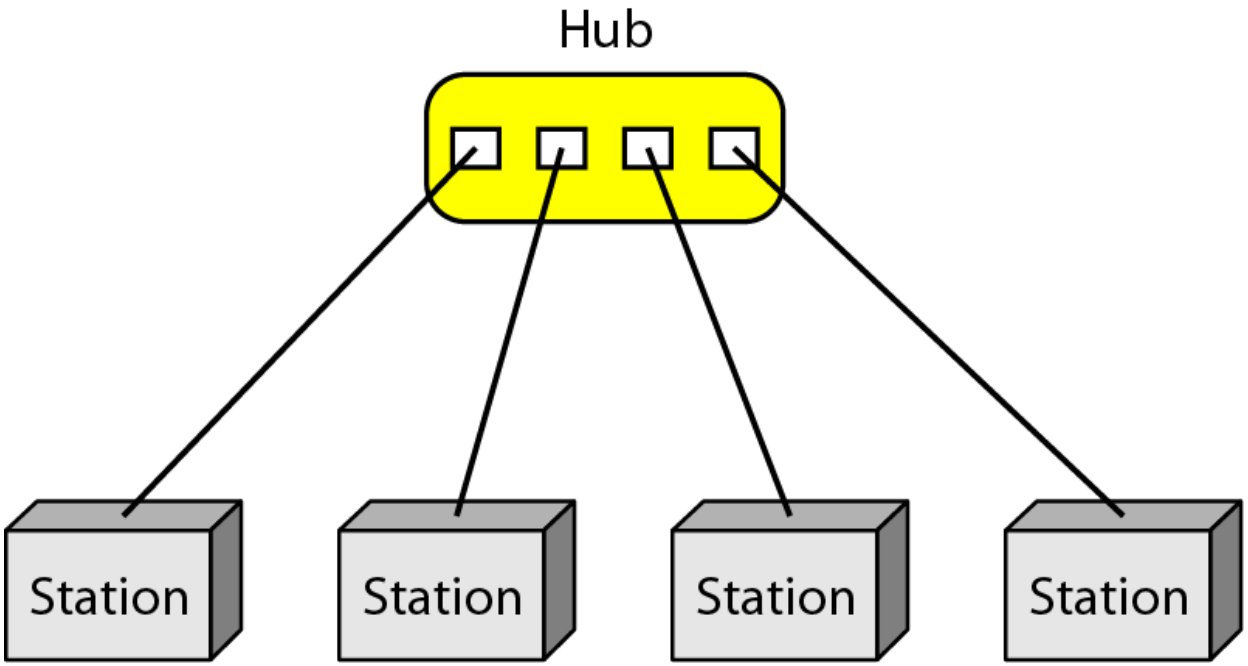

Figure 1.6 *A star topology connecting four stations*

BUS TOPOLOGY

- **All the devices in a network linking to one long cable acts as a backbone** – multipoint connection.

BUS TOPOLOGY

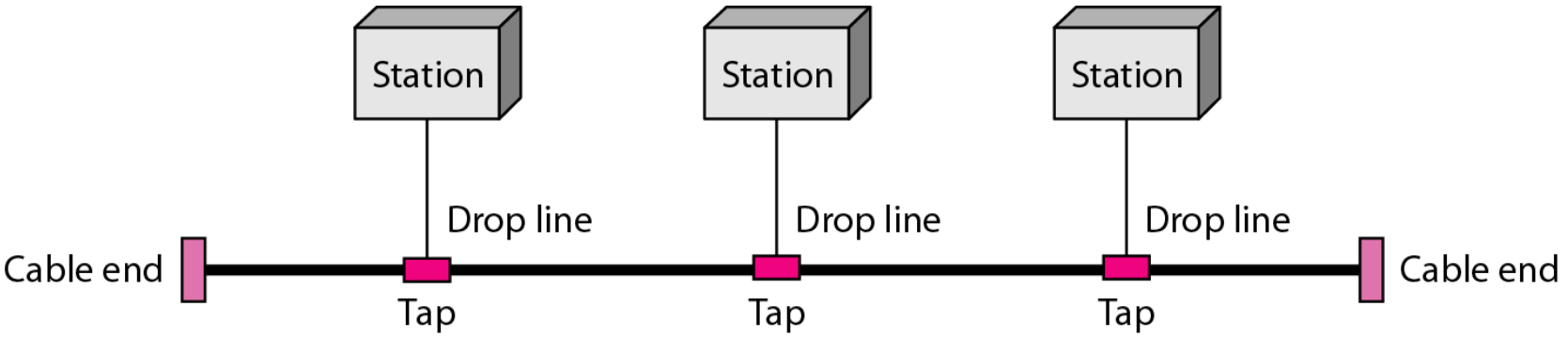

Figure 1.7 ***A bus topology connecting three stations***

RING TOPOLOGY

- Each devices has a **dedicated point to point connection with only the two device on either side of it.**

RING TOPOLOGY

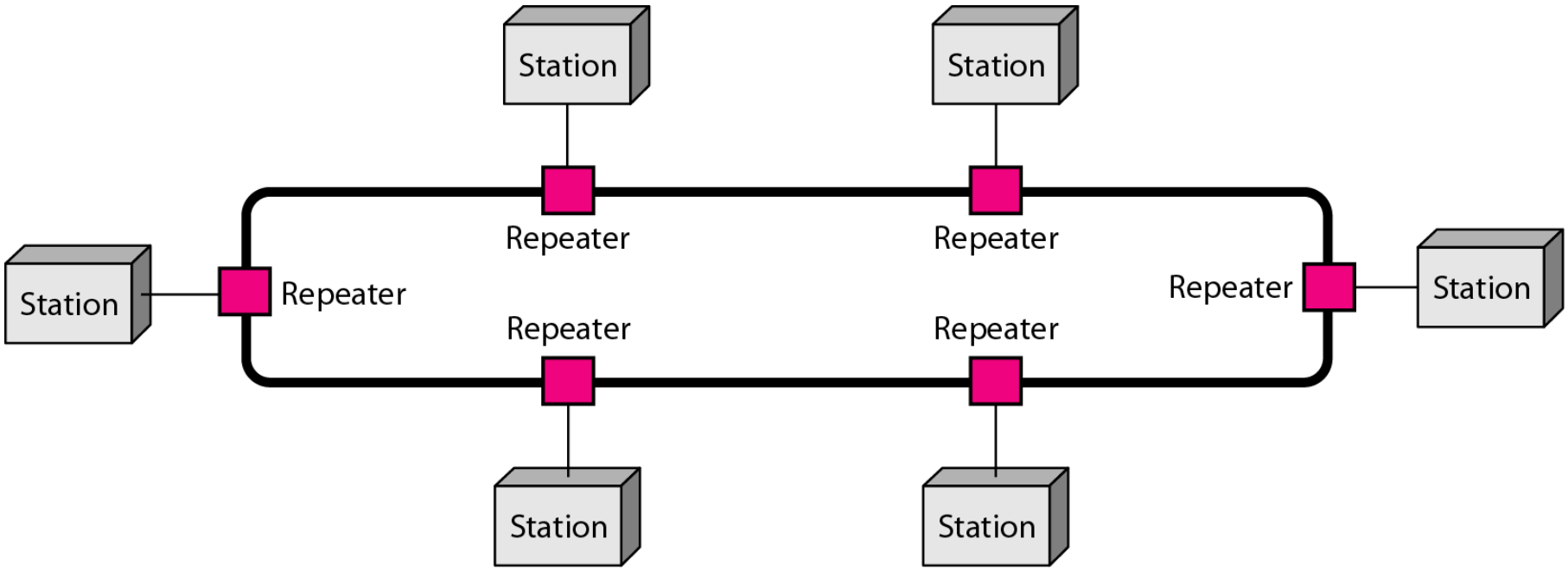

Figure 1.8 *A ring topology connecting six stations*

HYBRID TOPOLOGY

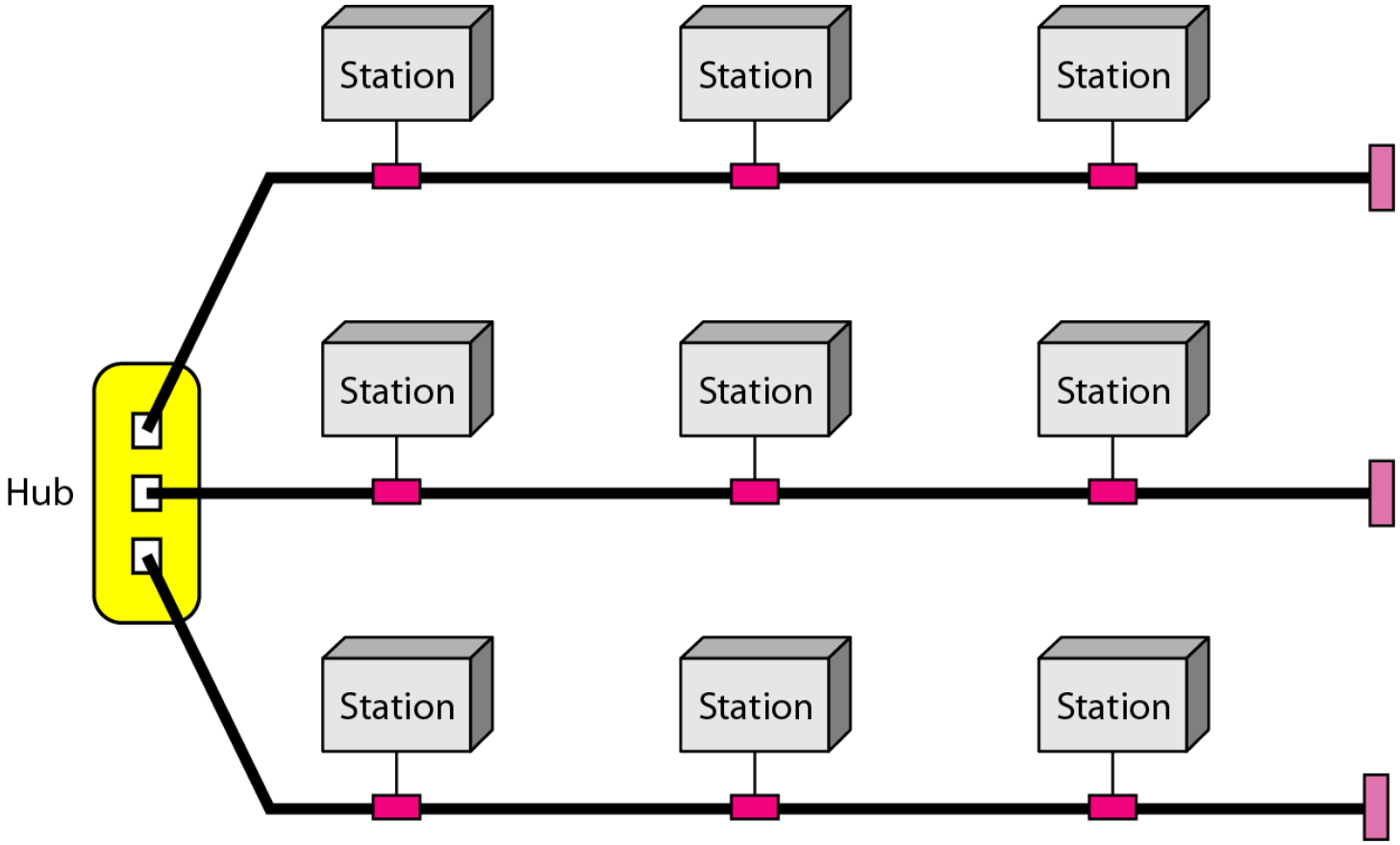

Figure 1.9 *A hybrid topology: a star backbone with three bus networks*

NETWORK MODELS

- Computer networks are created by **different entities.**
- **Standards** are needed so that these heterogeneous **network can communicate between entities.**
- Two best-known standards:

  1. OSI model

  - defines a seven-layer network

  2. Internet model

  - define a five-layer network

CATEGORIES OF NETWORK

1. Local Area Network (LAN)

- Network with a limited geographical area.
- Normally covers a **single office, building , campus or an organization.**

2. Metropolitan Area Network (MAN)

- Network with a size between a LAN and a WAN.
- Normally **covers the area inside a town or a city**.

CATEGORIES OF NETWORK

3. Wide Area Network (WAN)

- Provides long-distance transmission of information over large geographic areas.
- Normally covers **a number of LANs, entire city or entire world.**
- Types:
  - **i. Switched WAN**
  - **ii. Point-to-point WAN**

INTERCONNECTION OF NETWORKS

- **Internetwork**
- When two or more networks (either LAN, WAN, or MAN) are connected, they become an internetwork, or internet.

1-3 THE INTERNET

- Refer to Manual ITT300

1-4 PROTOCOLS AND STANDARDS

What is protocols?

- **A set of rules that governs an agreement between the communicating devices.**

PROTOCOLS

- Elements of protocol:
  1. **Syntax**
     - structure or format of data.
  2. **Semantics**
     - meaning of each section.
  3. **Timing**
     - when data should be sent and how fast they can be sent.

STANDARDS

- What is standards?

  - **provide guidelines** to manufacturers, vendors, government and other service providers.
  - to ensure that **products** from different manufactures **can work together**.

STANDARDS

- Categories of standards :

1. De facto

- standards that have been adopted as **standards through widespread** use.

2. De jure

- standards that have been **legislated by an officially recognized** body.

STANDARDS ORGANIZATIONS

- **Standards Creation Committees**
  i. **International Organization for Standardization (ISO)**
  ii. **International Telecommunication Union-Telecommunication Standards Sector (ITU-T)**
  iii. **American National Standards Institute (ANSI)**
  iv. **Institute of Electrical and Electronics engineers (IEEE)**
  v. **Electronic Industries Association (EIA)**

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Q & A

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