Politeknik Elektronika Negeri Surabaya

Introduction

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Data Communications
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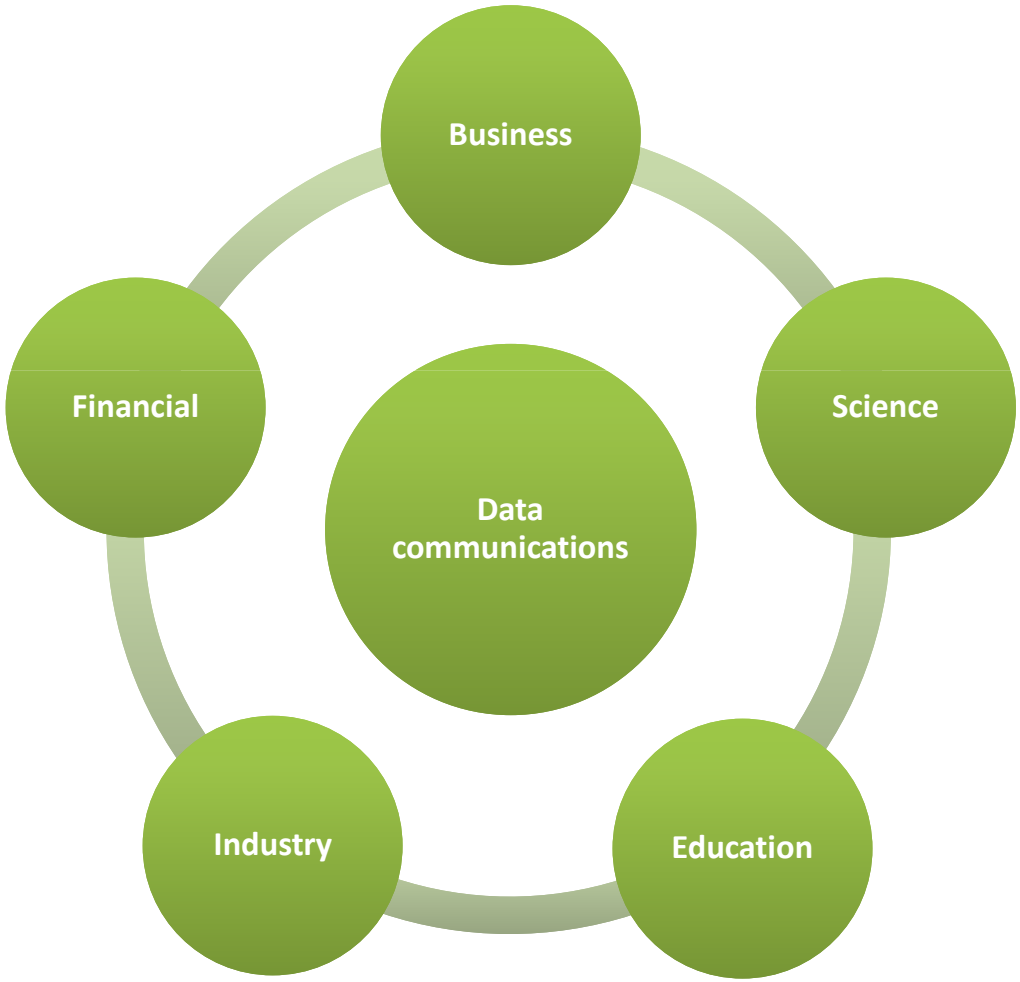
Data Communications

- The development of the personal computer brought about tremendous changes

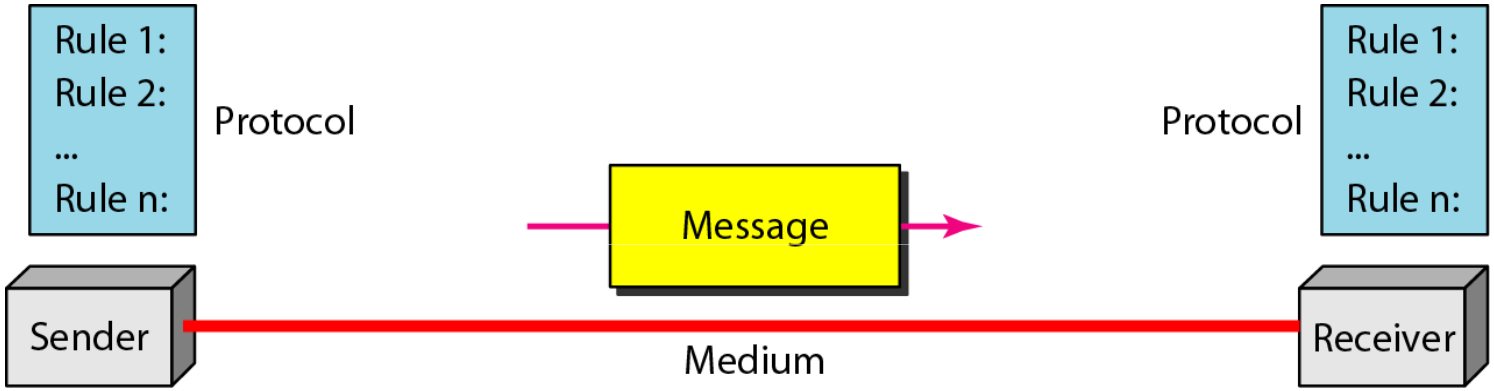


- Technological advances
  - Faster signals / higher data rate
  - Accurate information
  - Reliable
  - More flexible
  - Mobility
  - Cooperative

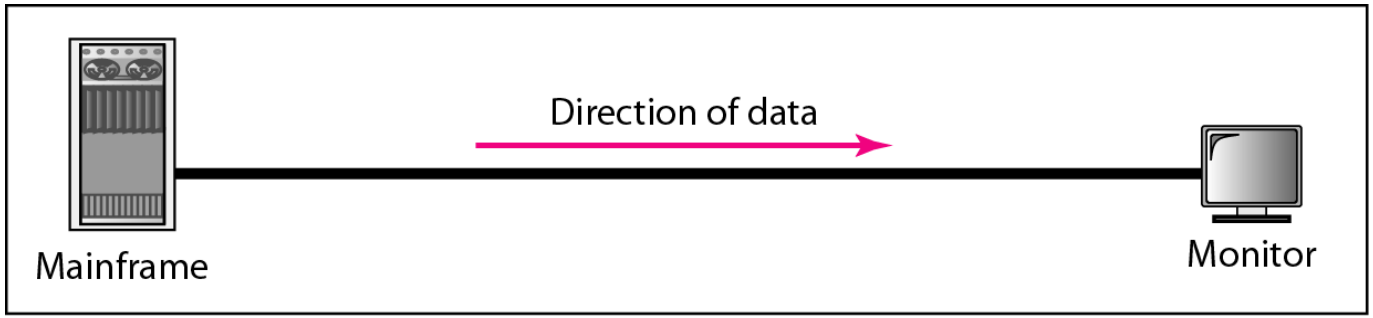
Effectiveness depends on:

- **Delivery** : deliver data to the correct destination
- **Accuracy** : deliver the data accurately
- **Timeliness** : Data delivered late are useless
- **Jitter** : Jitter refers to the variation in the packet arrival time

Components of a data communication system

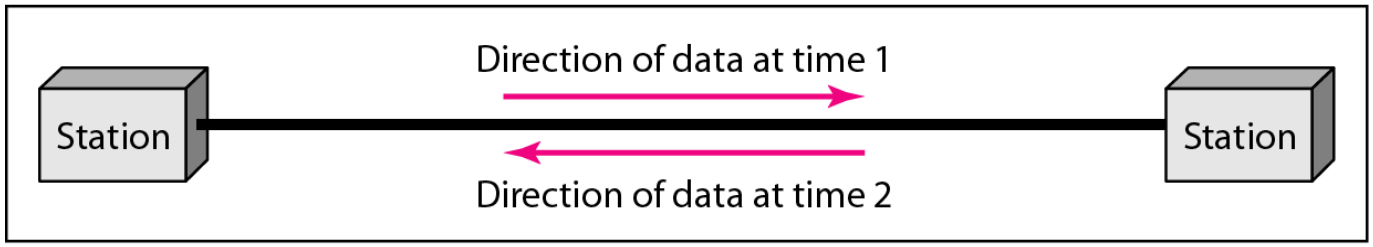


Data flow (simplex, half-duplex, and full-duplex)



a. Simplex

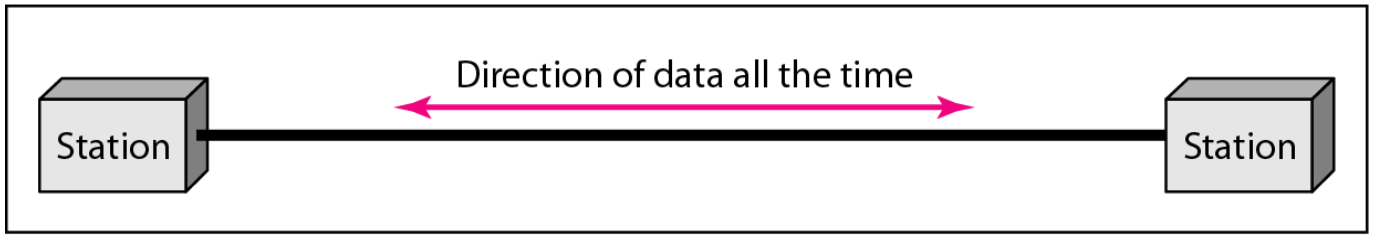
- **Simplex** : unidirectional; one transmits, other receives



b. Half-duplex

- **Half-duplex** : each can transmit/receive; communication must alternate

Data flow (simplex, half-duplex, and full-duplex)



c. Full-duplex

- **Full-duplex** : both can transmit/receive simultaneously

Networks

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

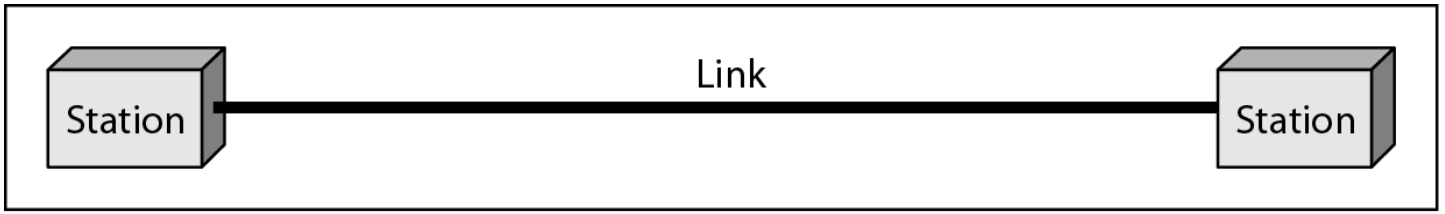
Network Criteria

- **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

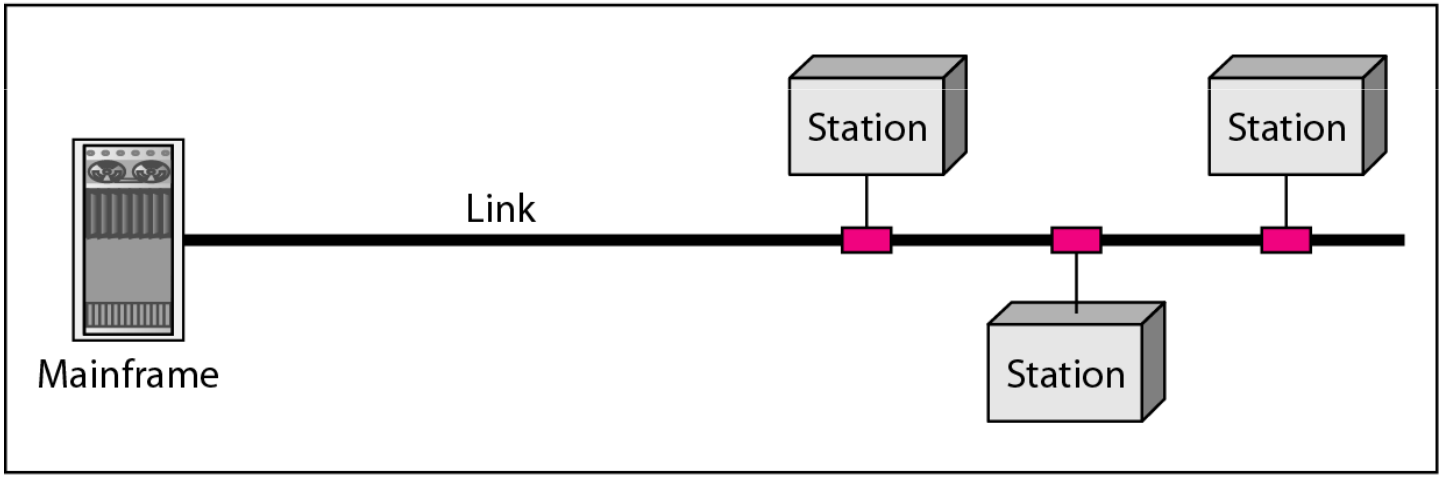
Physical Structures

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

Types of connections: point-to-point and multipoint

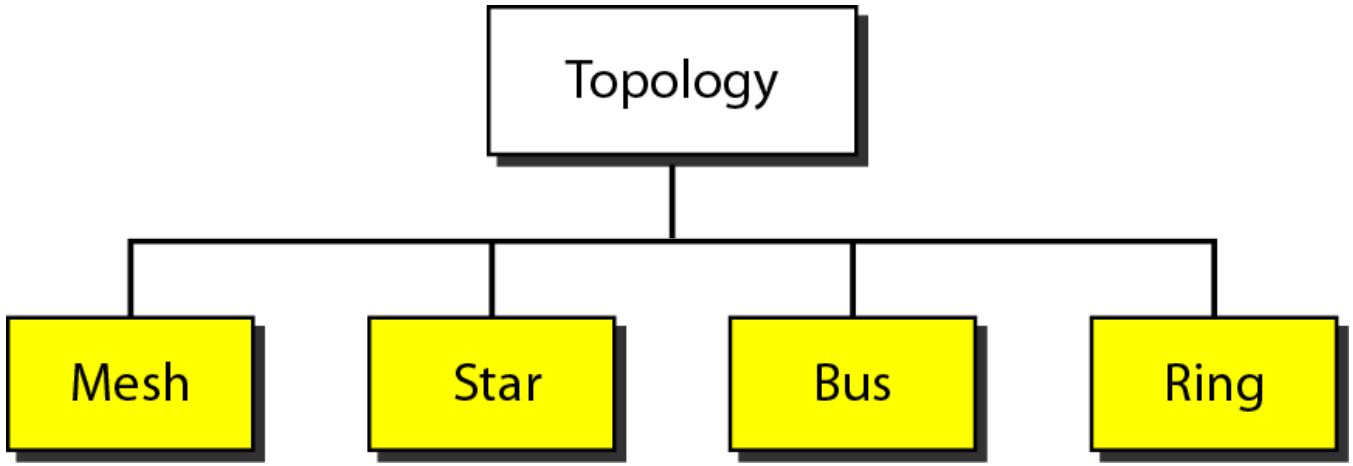


a. Point-to-point

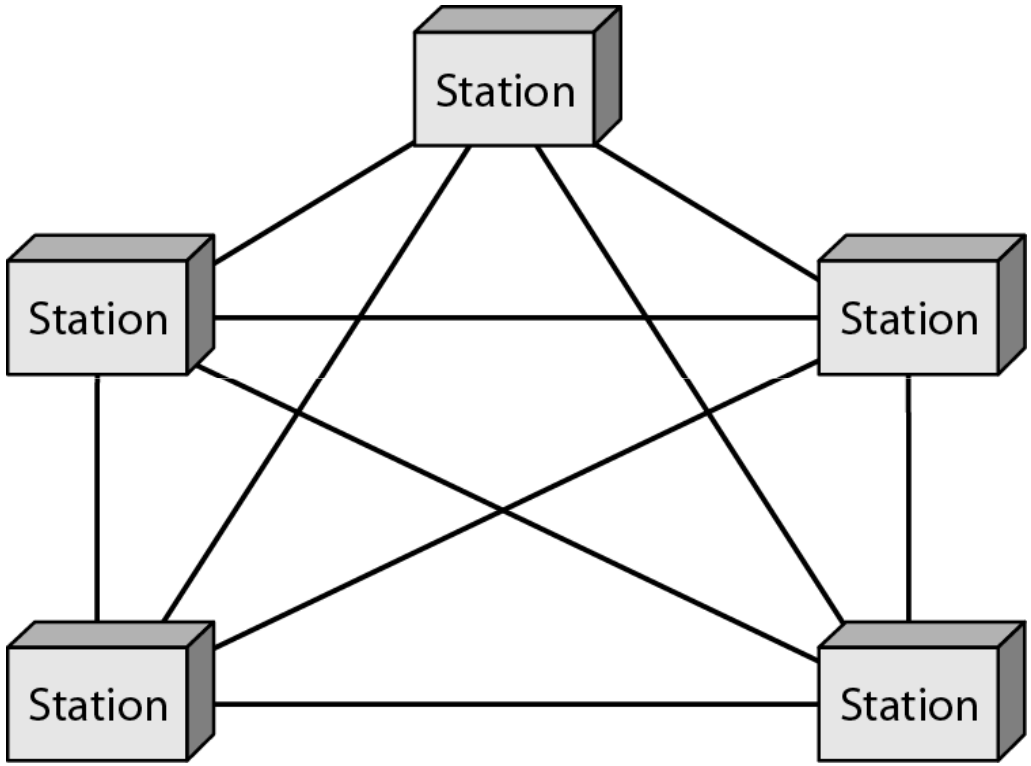


b. Multipoint

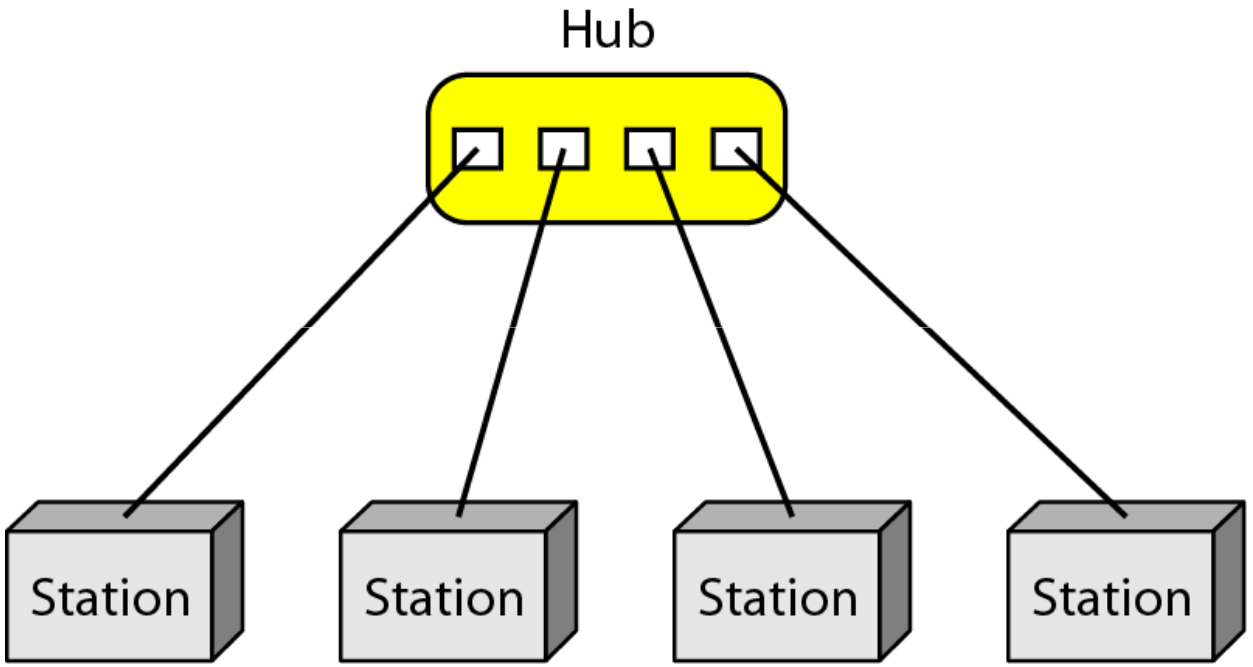
Categories of topology



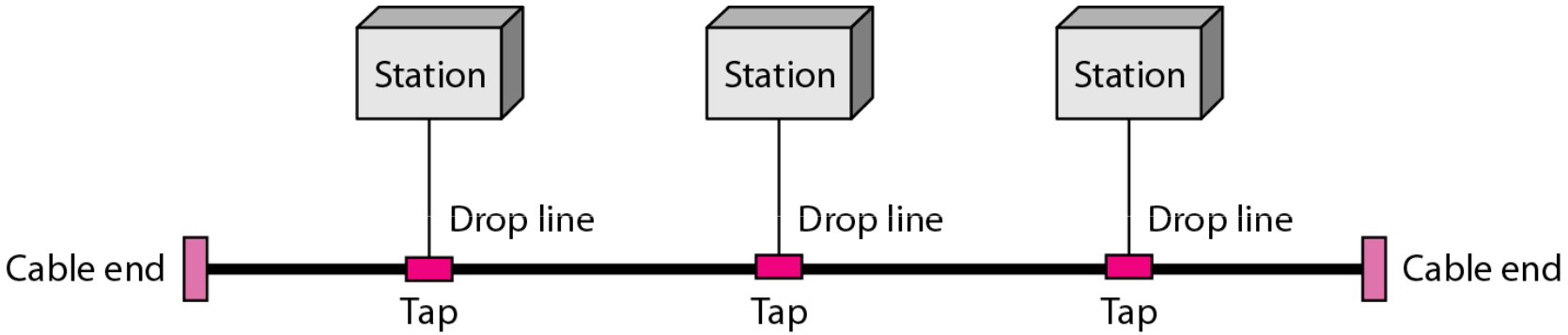
A fully connected mesh topology (five devices)



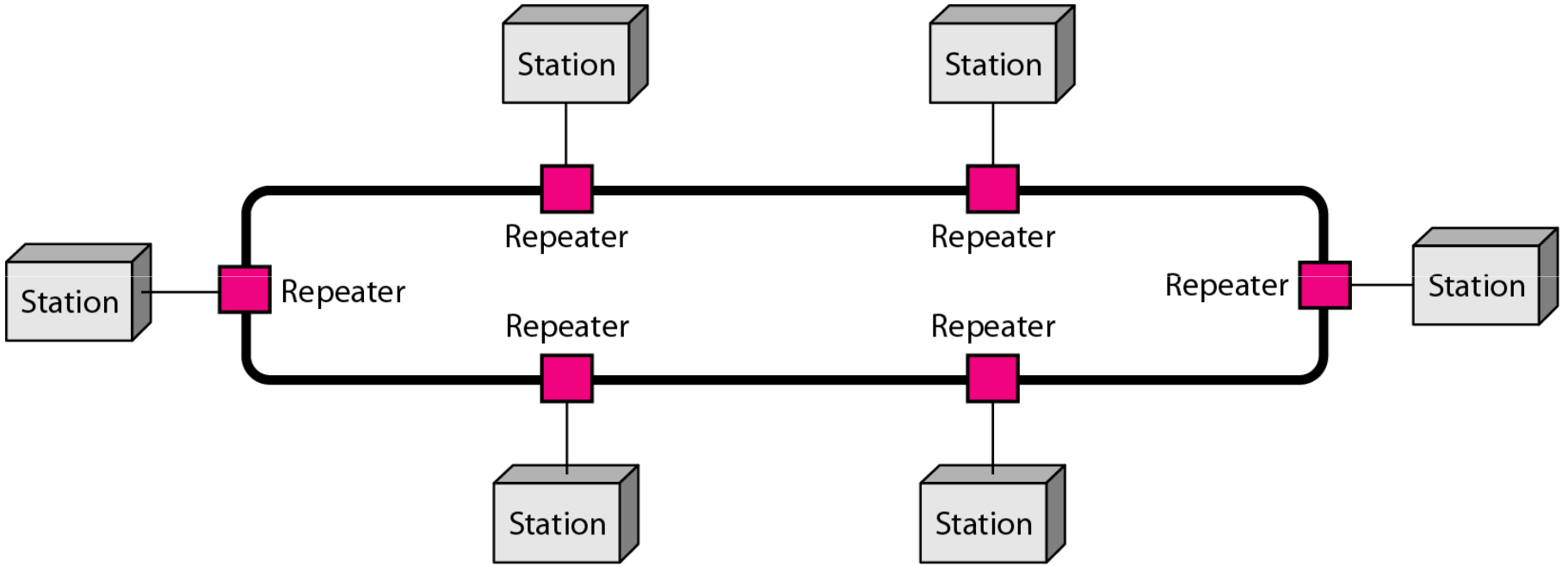
A star topology connecting four stations



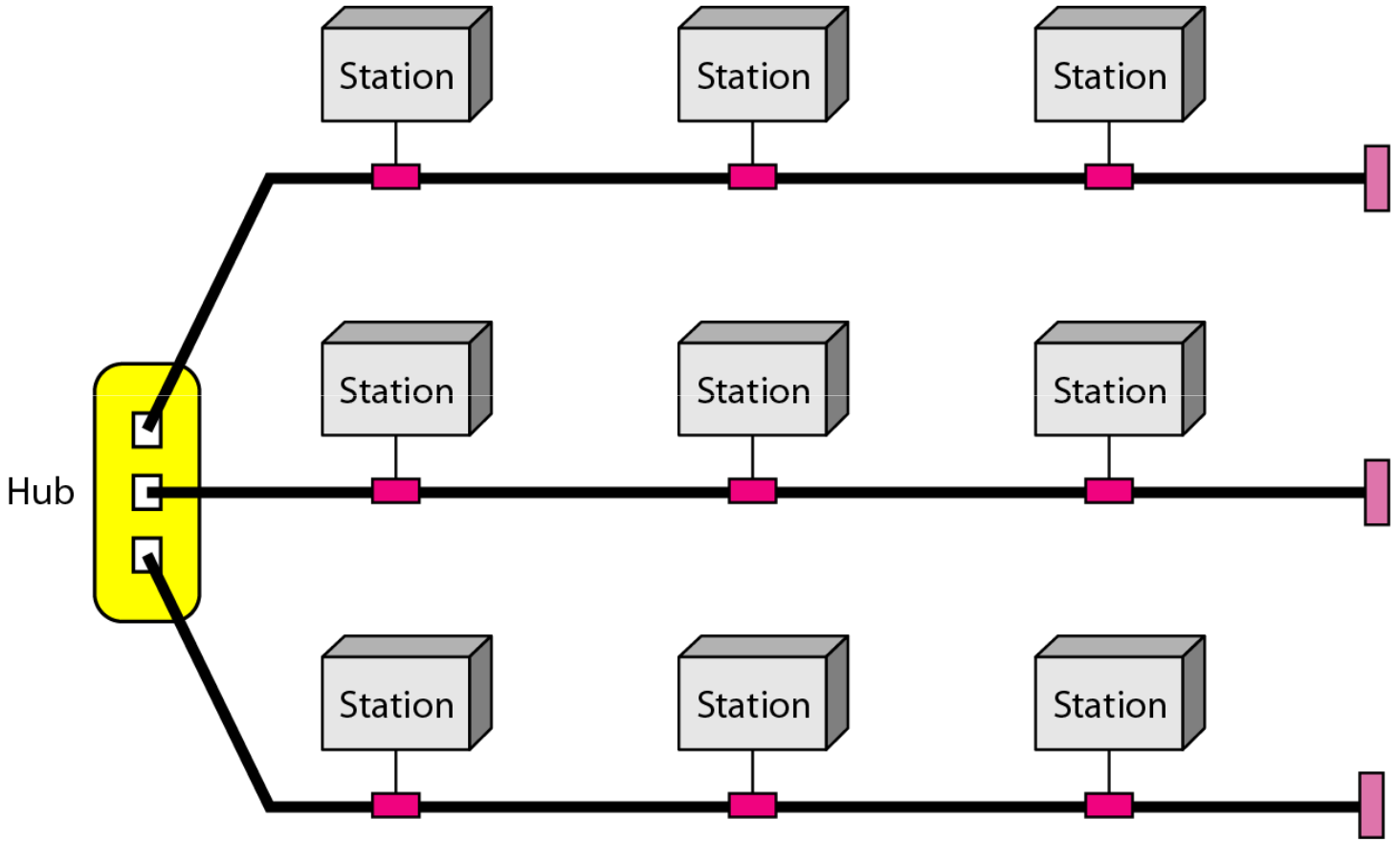
A bus topology connecting three stations



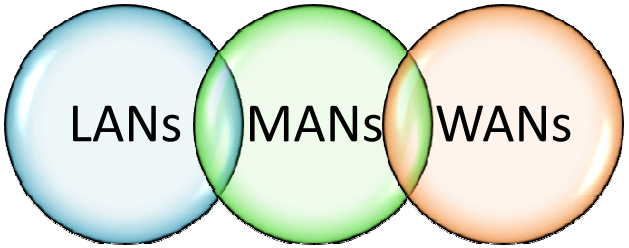
A ring topology connecting six stations



A hybrid topology: a star backbone with three bus networks

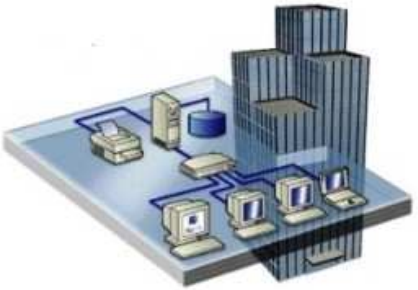


Categories of Networks



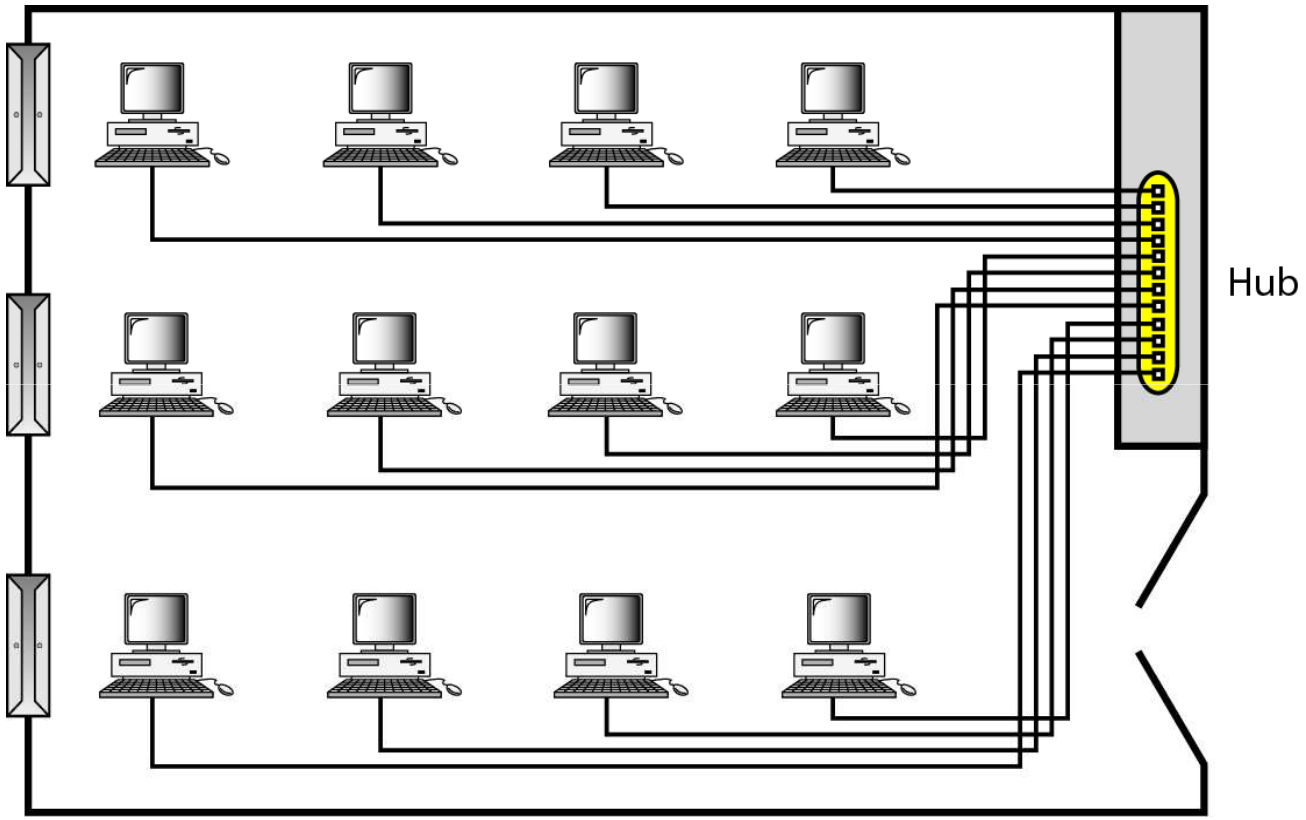
- **Local Area Networks (LANs)**
  - Short distances
  - Designed to provide local interconnectivity
- **Metropolitan Area Networks (MANs)**
  - Provide connectivity over areas such as a city, a campus
- **Wide Area Networks (WANs)**
  - Long distances
  - Provide connectivity over large areas

LANs, MANs and WANs

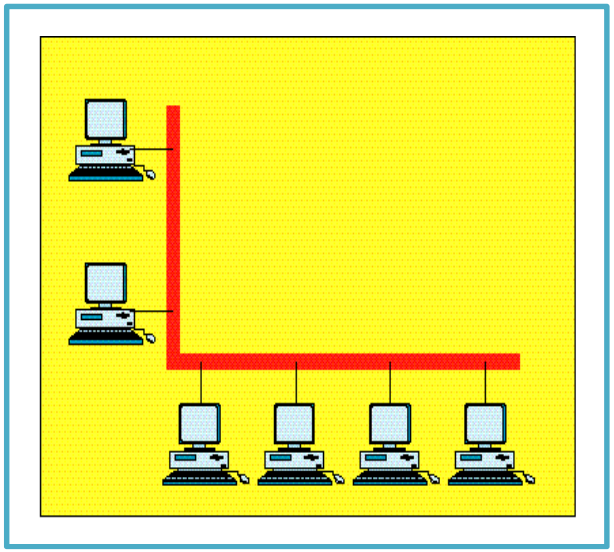


LAN

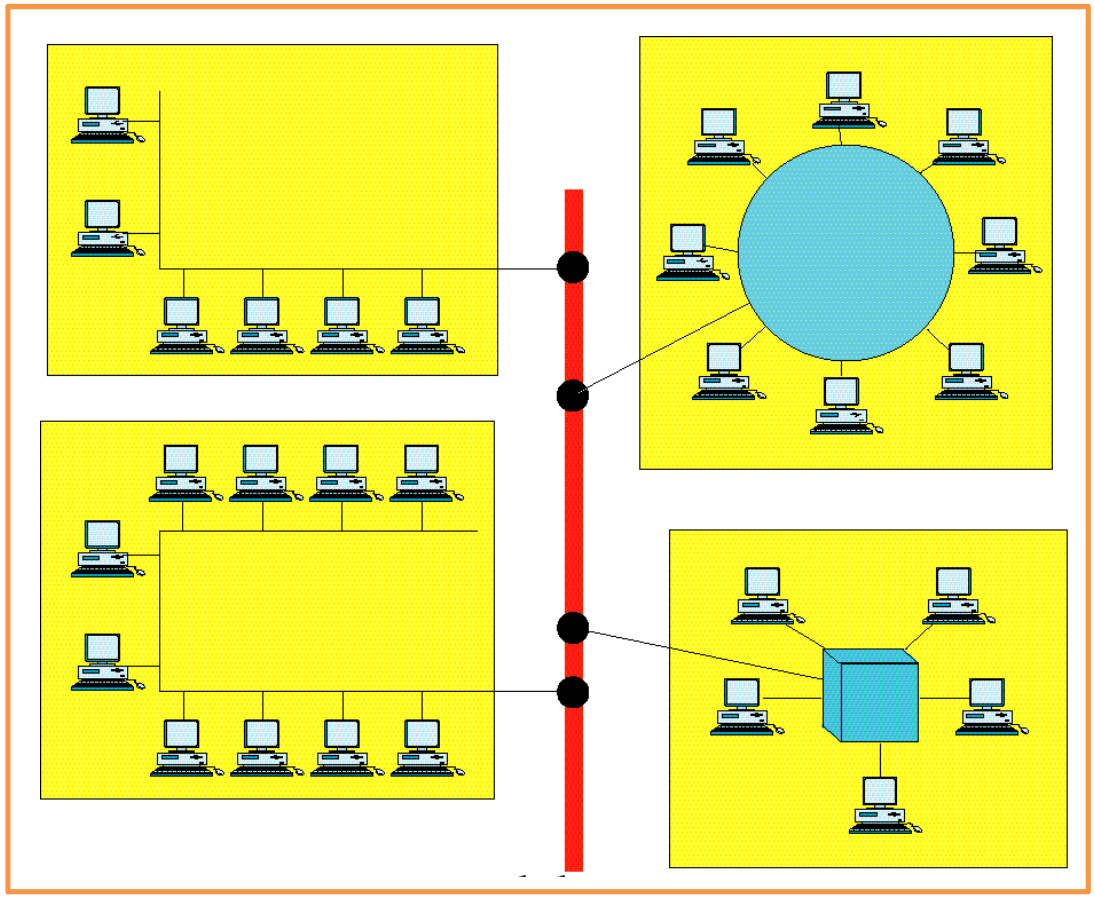
An isolated LAN connecting 12 computers to a hub in a closet



Local Area Network (LAN)

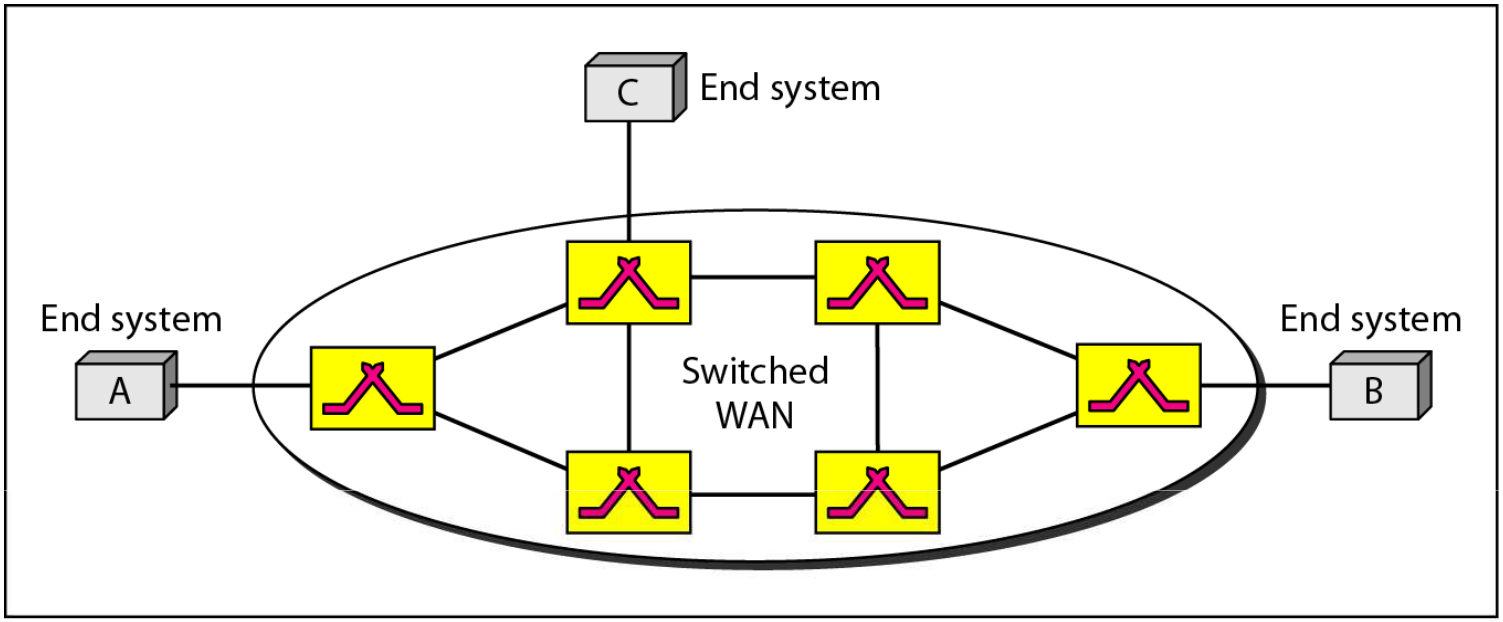


Single-building LAN

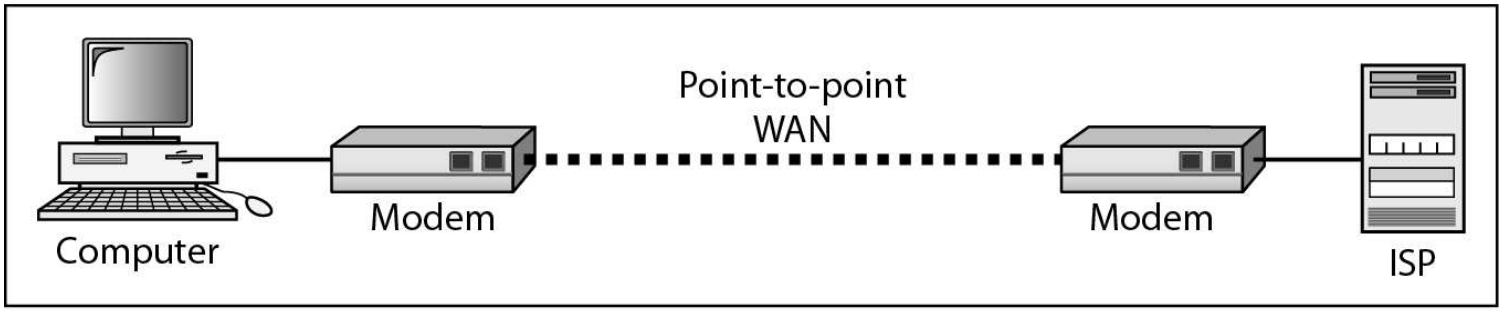


Multiple-building LAN

WANs: a switched WAN and a point-to-point WAN

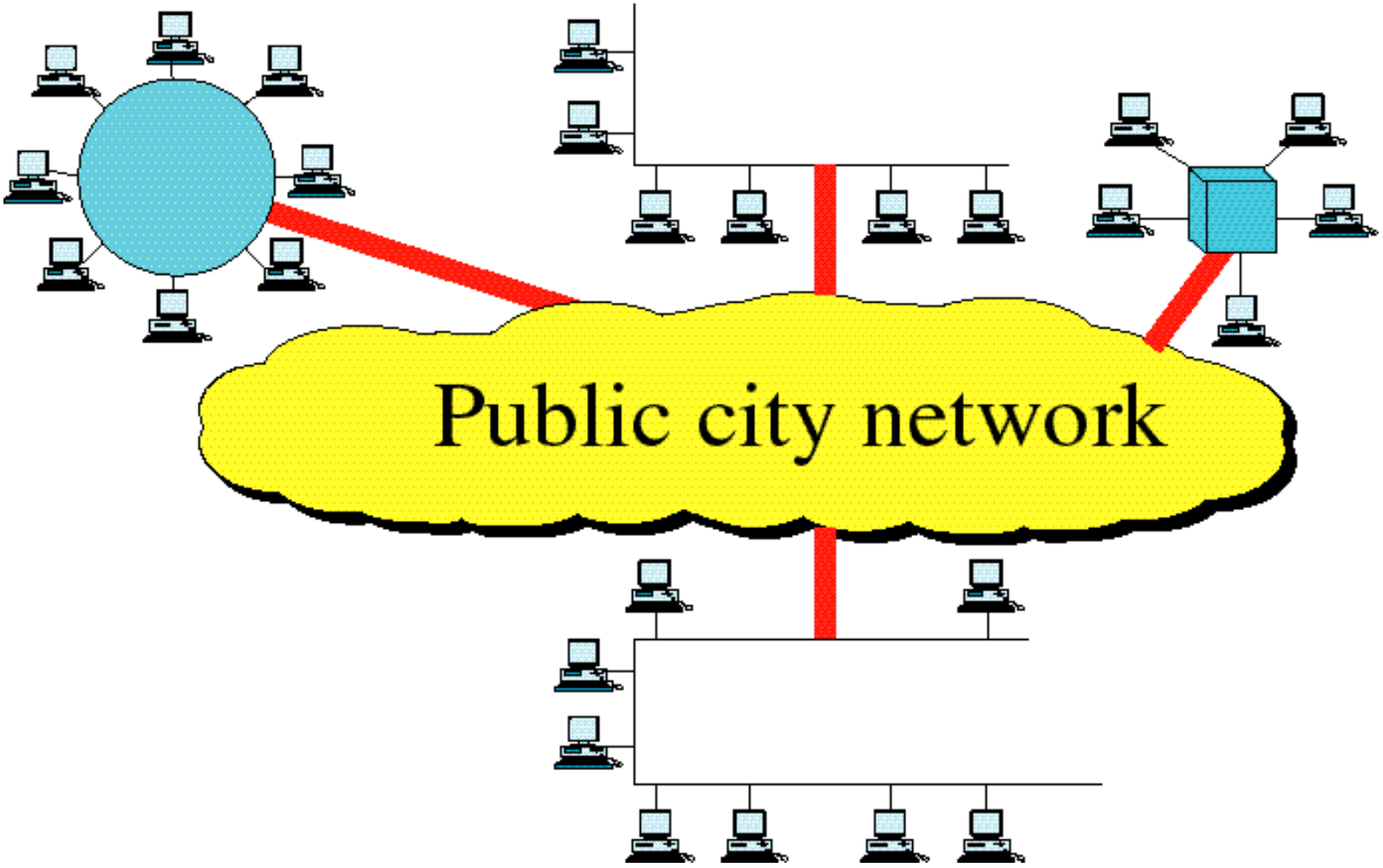


a. Switched WAN

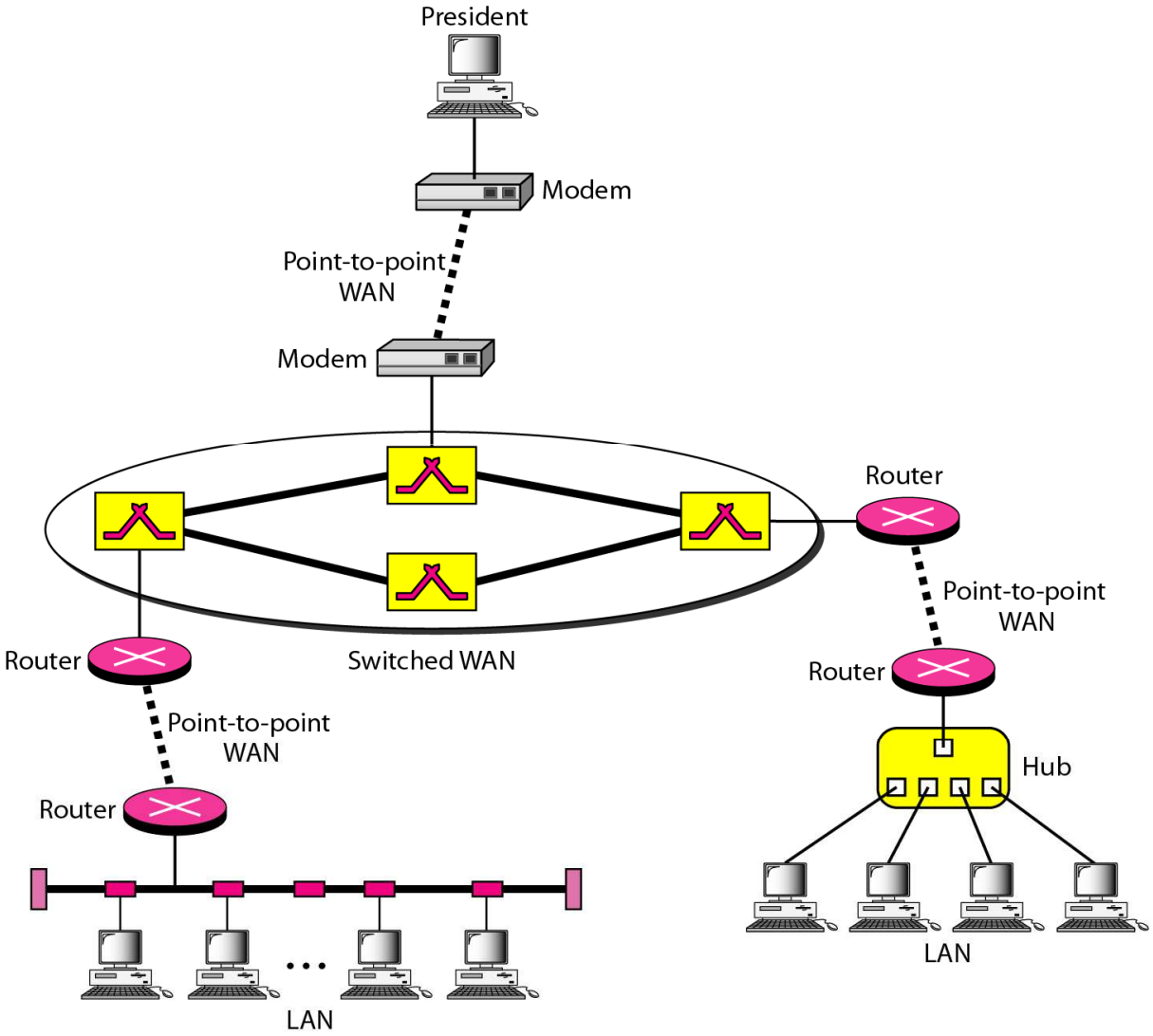


b. Point-to-point WAN

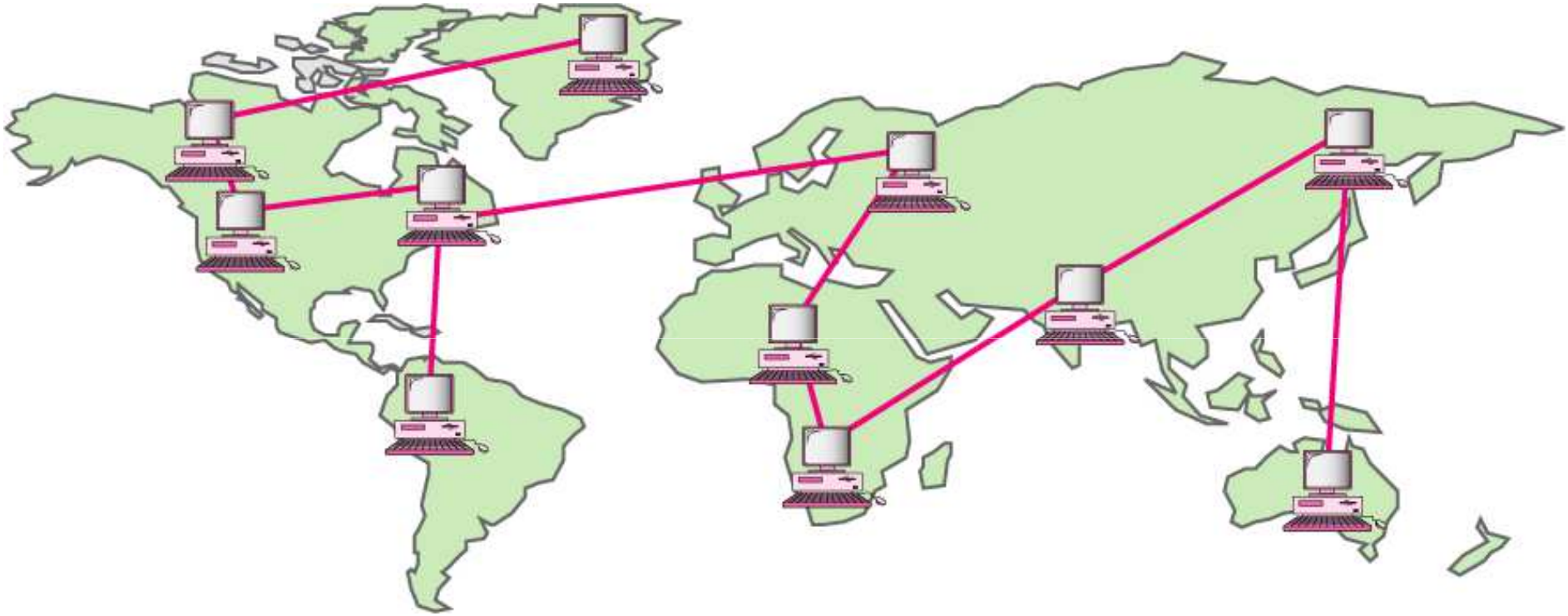
Metropolitan Area Networks (MAN)



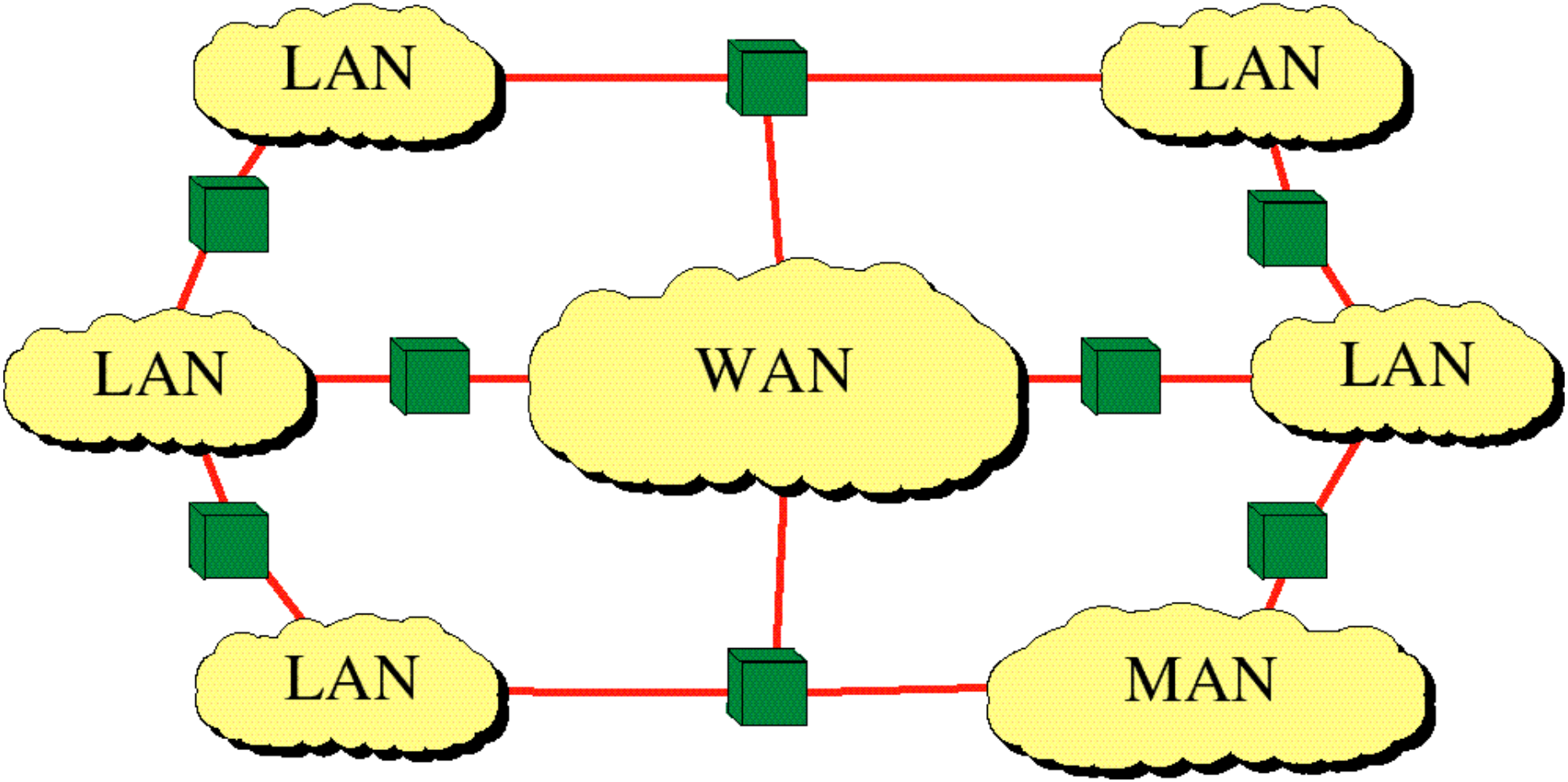
A heterogeneous network made of four WANs and two LANs



Wide Area Networks (WAN)



Internetwork (Internet)



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**

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.

Standarts

- **Standards** are necessary to ensure that products from different manufacturers can work together as expected
- **Types** –
  - De jure (Formal) – legislated by an officially recognized body
  - De facto – by convention or widespread use
- **Standards Organizations**
  - Committees – ISO, ITU-T, ANSI, IEEE, and EIA
  - Forums – special-interest groups that quickly evaluate and standardize new technologies
  - Regulatory agencies – FCC