# COMMUNICATION AND DATA TRANSMISSION NETWORKS"

Ing. Manuel Benites

**9 Data link protocols**

a. Asynchronous and synchronous protocols

b. Character-oriented protocols

c. Bit-oriented protocols (HDLC).

**10 LAN networks**

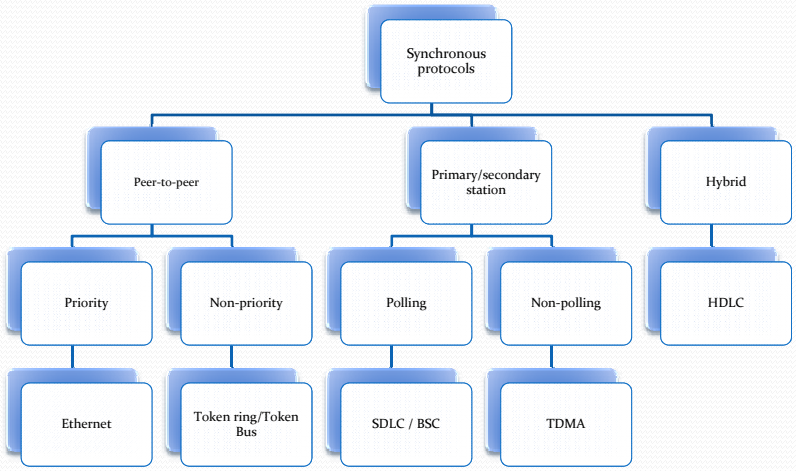
a. Types of architecture

b. Access methods

9 **Data link protocols**
a. Asynchronous and synchronous protocols

*A data link protocol is a set of specifications used for the implementation of the data link layer.*

9 **Data link protocols**
a. Asynchronous and synchronous protocols



## 9 Data link protocols
### a. Synchronous protocols

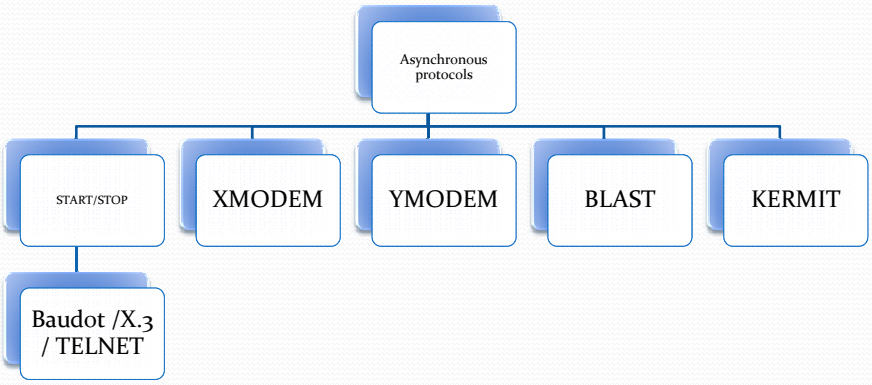
- Primary/secondary station protocols
  - Polling
    - **SDLC:** Subset of the HDLC protocol
    - **BSC:** Byte- or character-oriented protocol
  - Non-polling
    - **TDMA:** Time-division multiple-access protocol
- Hybrid
  - **HDLC:** Bit-oriented line protocol

## 9 Data link protocols
### a. Synchronous protocols

- Peer to peer
  - Priority
    - **Ethernet:** Probabilistic protocol (802.3 standard), based on carrier sense multiple access with collision detection (CSMA/CD)
  - Non-priority
    - **Token Ring:** Deterministic protocol, IEEE standard 802.5
    - **Token Bus:** Deterministic protocol, IEEE standard 802.4

## 9 Data link protocols

a. Asynchronous and synchronous protocols




## 9 Data link protocols

a. Asynchronous protocols

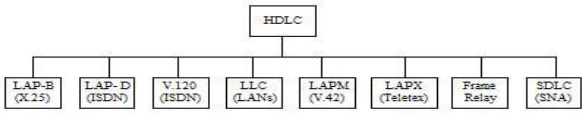
- **START/STOP** protocols
- **XMODEM:** Stop and wait protocol, uses ARQ, half duplex
- **YMODEM:** Similar to XMODEM, uses CRC-16, half duplex
- **BLAST:** Full duplex protocol
- **KERMIT:** Similar to XMODEM, widely used in the industry.

9 **Data link protocols**
c. Bit-oriented protocols (HDLC)

**High-level Data Link Control** (***HDLC***) is a bit-oriented protocol for point-to-point and point-to-multipoint link communications. It implements ARQ mechanisms.

HDLC is a bit-oriented line protocol specification of the International Standardization Organization (ISO), and is the basis for the development of numerous protocols widely used in the link layer.

9 **Data link protocols**
c. Bit-oriented protocols (HDLC)



## 9 Data link protocols

### c. Bit-oriented protocols (HDLC)

- **LAPB**: is the procedure used for accessing the balanced link in +X.25, layer 2. It operates within the three layers of X.25 in the link layer, and provides a safe delivery of data beetween the user device and the packet network.
- **LAPD**: is the procedure for accessing channel D used in ISDN interfaces. Its purpose is to safely transfer ISDN messages between user devices and the ISDN node.
- **V.120**: this recommendation contains an HDLC protocol used in ISDN terminal adaptors for multiplexing operations. It uses many of the LAPD addressing concepts, and permits the multiplexing of multiple users over a single link.

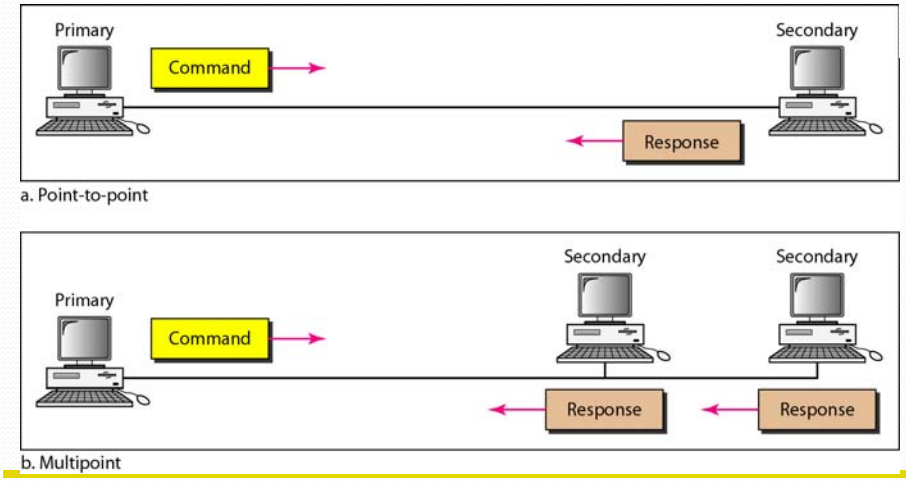
## 9 Data link protocols

### c. Bit-oriented protocols (HDLC).

- **LLC**: the logic link control protocol is used in IEEE.802e and ISO 8802 local area networks (LANs). It is configured in many ways for the provision of different types of HDLC services.
- **LAP-M**: the link access procedure protocol for modems is relatively new and gives modems a powerful HDLC capacity. It operates on modems under standard V.42 and is responsible for the safe delivery of traffic through the communication link between two modems.
- **LAP-X**: is a half-duplex control protocol used in teletex technology.
- **Frame Relay**: this protocol uses an HDLC procedure for its link operations. It owes its name mainly to its purpose, which is to highlight HDLC-type frames through the network. Frame Relay was derived from many of the LAPD and V.120 operations.
- **SDLC**: this protocol is layer 2 of IBM systems network architecture (SNA), which is a multi-layer protocol. It is responsible for the safe delivery of traffic.

9 **Data link protocols**
c. Bit-oriented protocols (HDLC).

*Normal response mode*



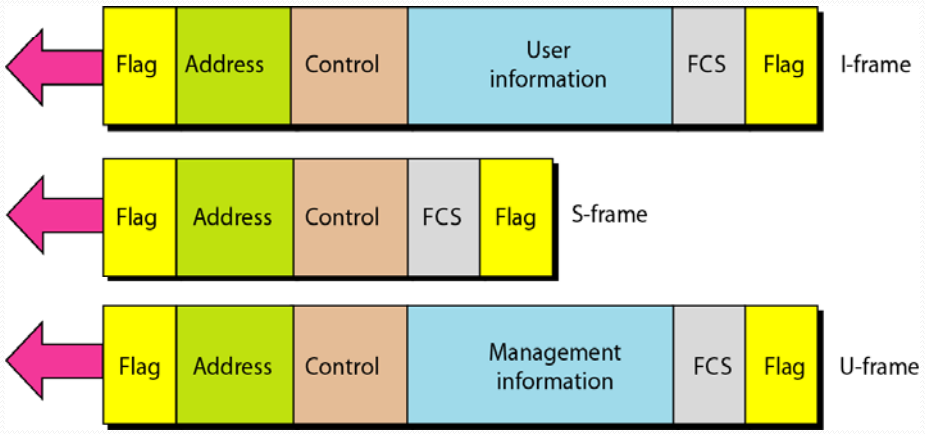

9 **Data link protocols**
c. Bit-oriented protocols (HDLC).

*Asynchronous balanced mode*

**9** **Data link protocols**

c. Bit-oriented protocols (HDLC).

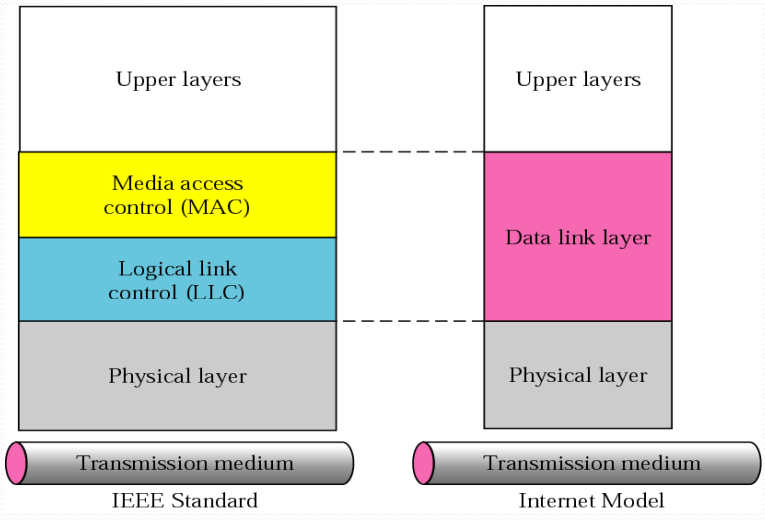
*HDLC frames*




**10** **LAN networks**

a. Types of architecture

**LAN compared to the Internet model**

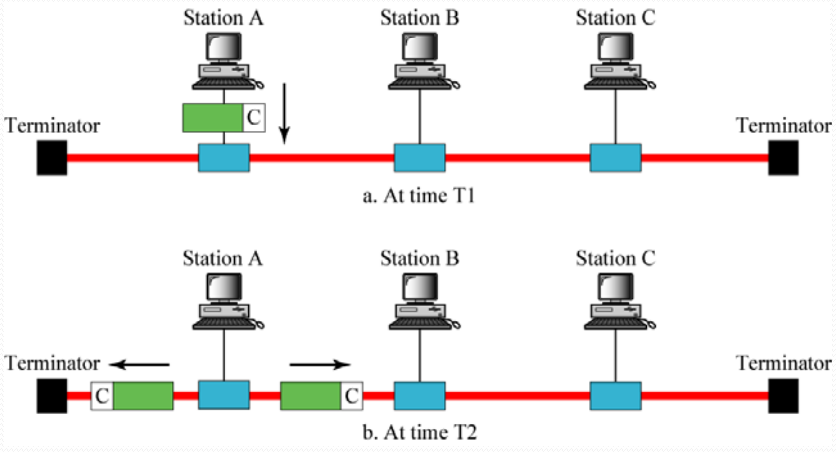


## 10 LAN networks
a. Types of architecture

- Bus-type topology
- Ring-type topology
- Star-type topology

## 10 LAN networks
a. Types of architecture

**Operation of the bus topology**



10 **LAN networks**
a. Types of architecture

**Operation of the bus topology**

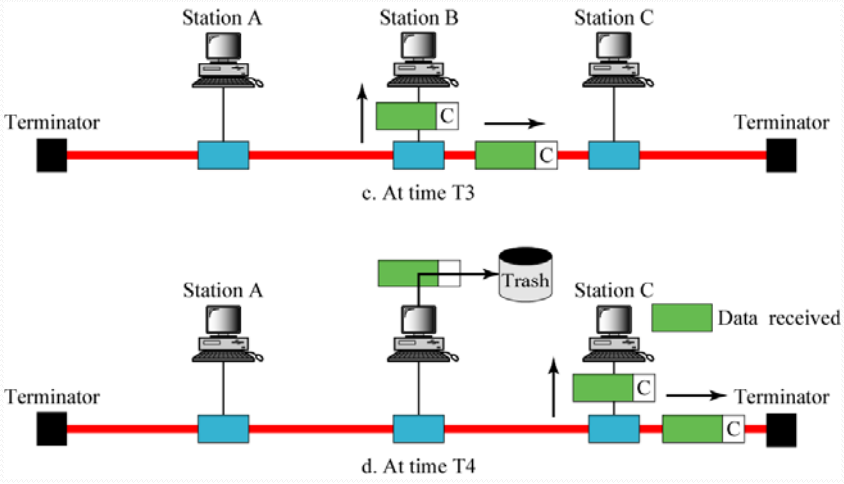



**Figure 6-4**

10 **LAN networks**
a. Types of architecture

**Bidirectional transmission**

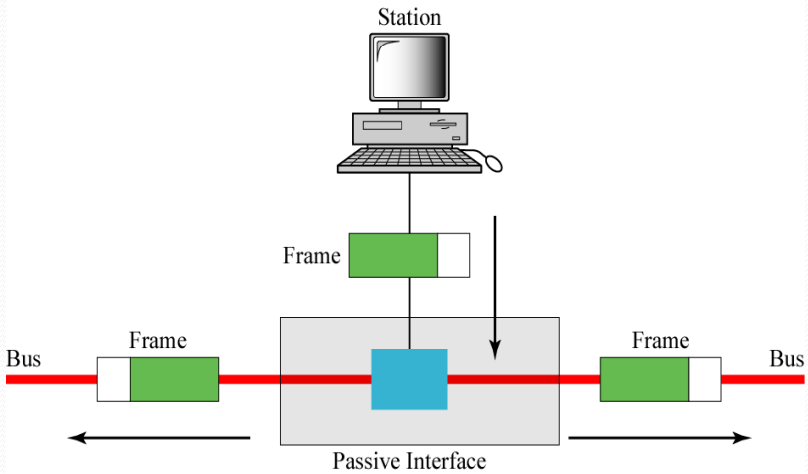


Figure 6-7

10 LAN networks

a. Types of architecture

**Ring topology**

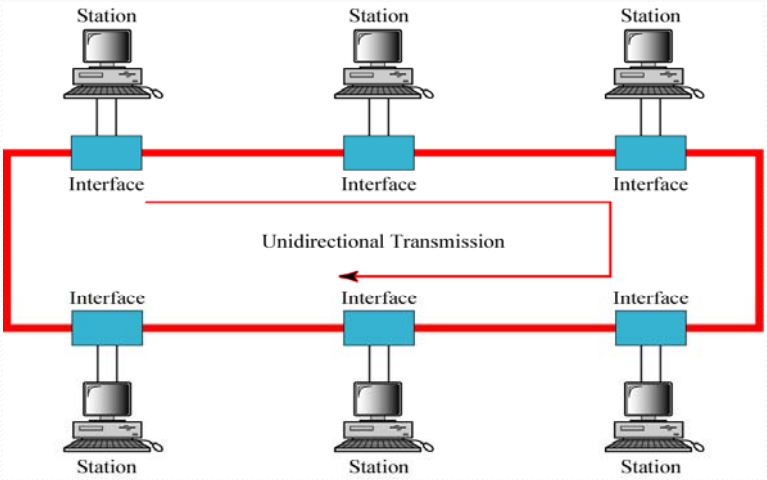
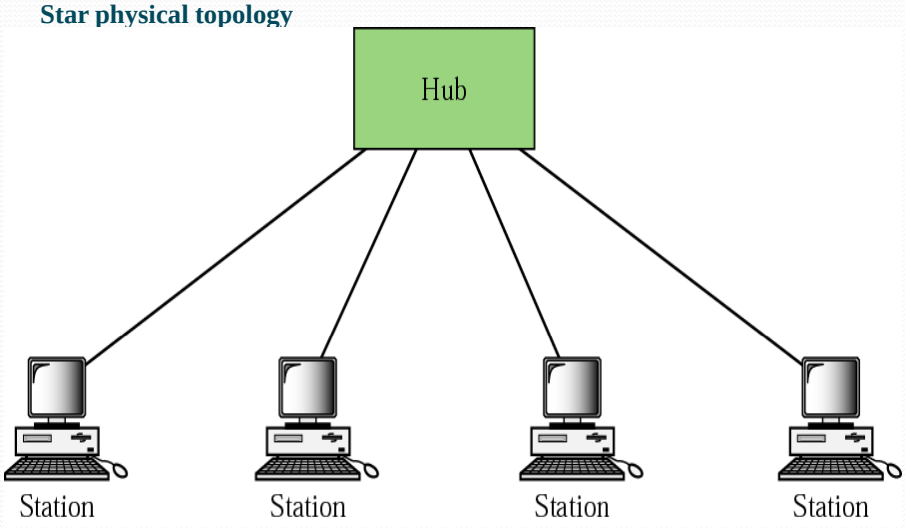



Figure 9-5

10 LAN networks

a. Types of architectures

**Star physical topology**

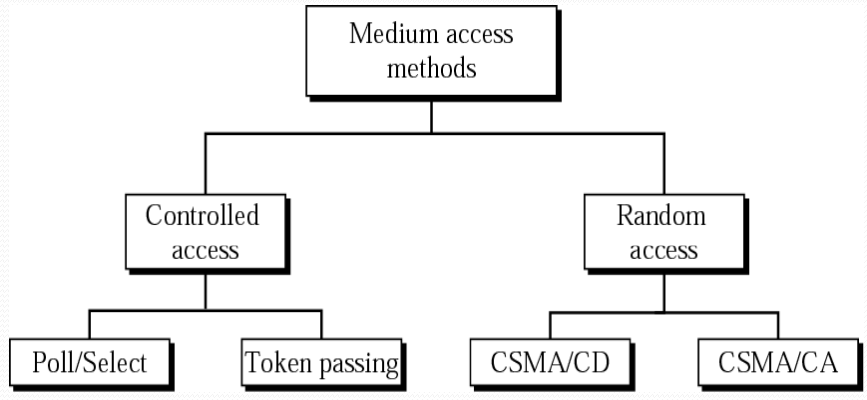


10 **LAN networks**
a. Types of architecture

***At present, the star topology is the physical topology***

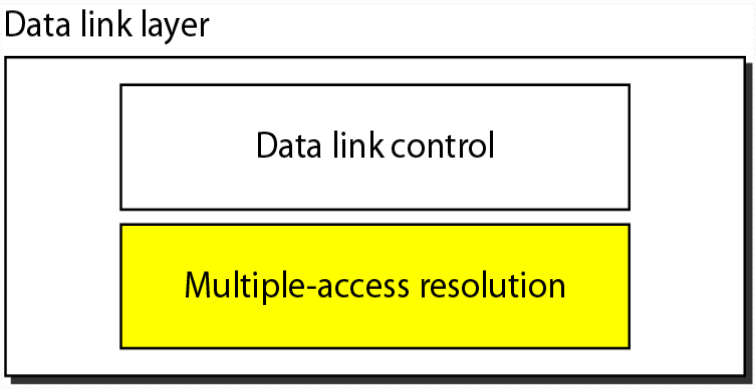
10 **LAN networks**
b. Access methods

Medium access methods



10 **LAN networks**
b. Access methods

Data link layer divided into two functionality-oriented sub-layers



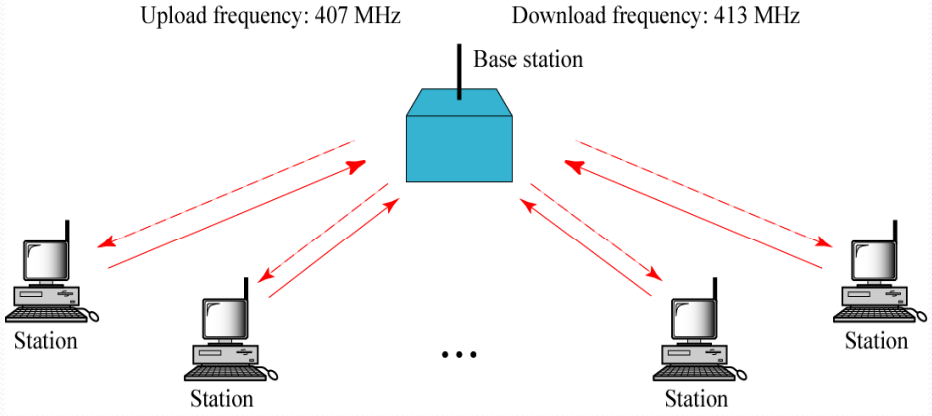

10 **LAN networks**
b. Access methods

**Random access method**

In random or containment access methods, no station is superior to other stations and none is assigned control over others. No station may decide over the delivery or non-delivery of information by another station. Any time a station has data, it sends it, and uses a protocol-defined procedure to decide whether to send it or not.

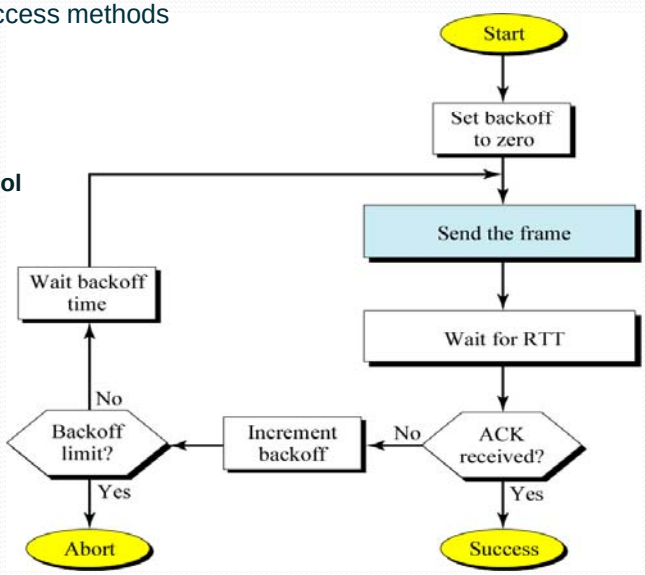
## 10 LAN networks
b. Access methods

**ALOHA Network**



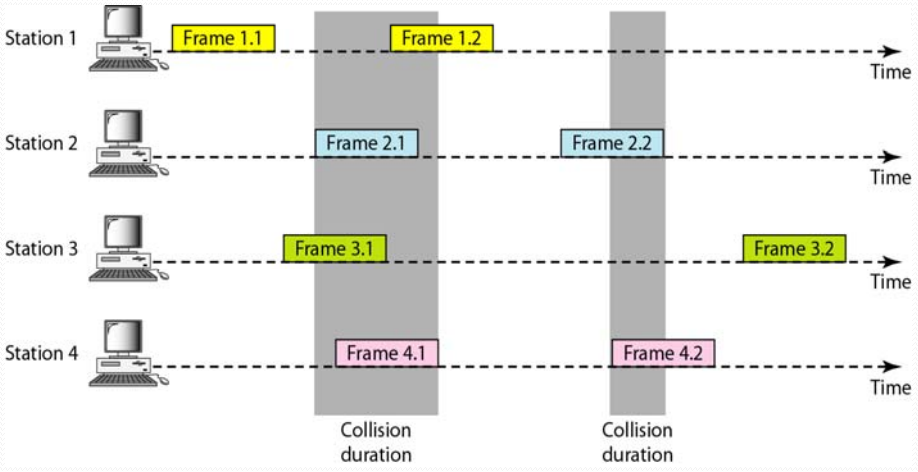

## 10 LAN networks
b. Access methods

**Procedure for Pure ALOHA Protocol**



**10 LAN networks**
b. Access methods

Frames in a pure ALOHA network

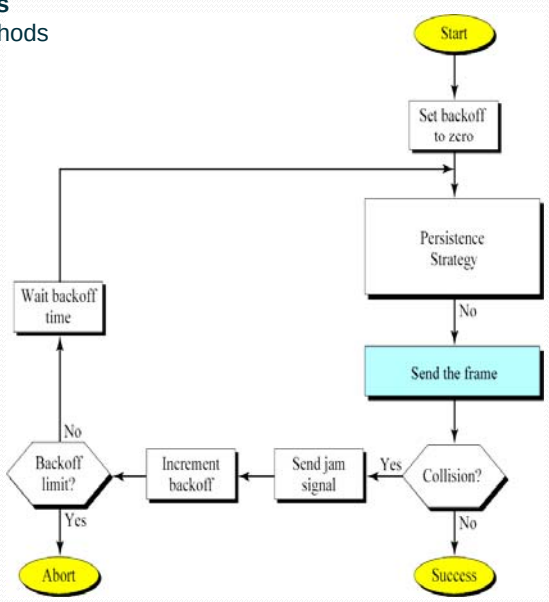



**10 LAN networks**
b. Access methods

*CSMA/CD is used in Ethernet-type LAN networks.*

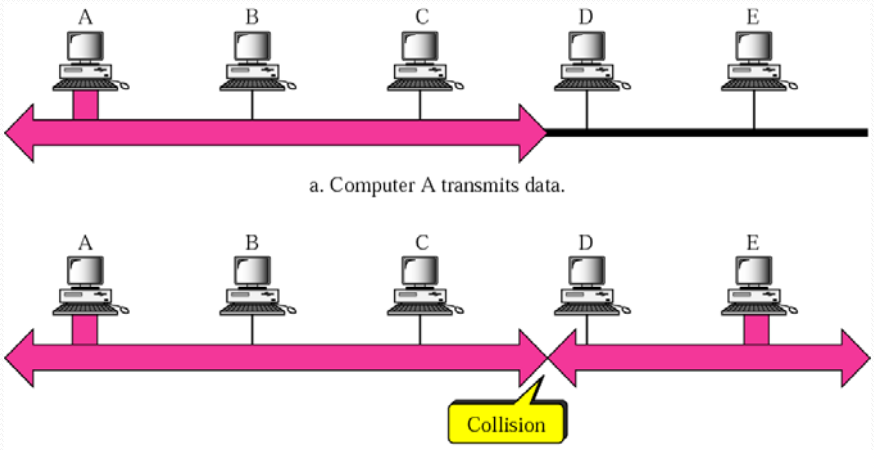
10 **LAN networks**
b. Access methods

**CSMA/CD Procedure**




10 **LAN networks**
b. Access methods

**Collision in CSMA/CD**




a. Computer A transmits data.

b. Before the signal reaches Computer E, E transmits data. Collision occurs.

10 **LAN networks**
b. Access methods

*CSMA/CA is used in wireless LAN networks*

10 **LAN networks**
b. Access methods

**CSMA/CA procedure**

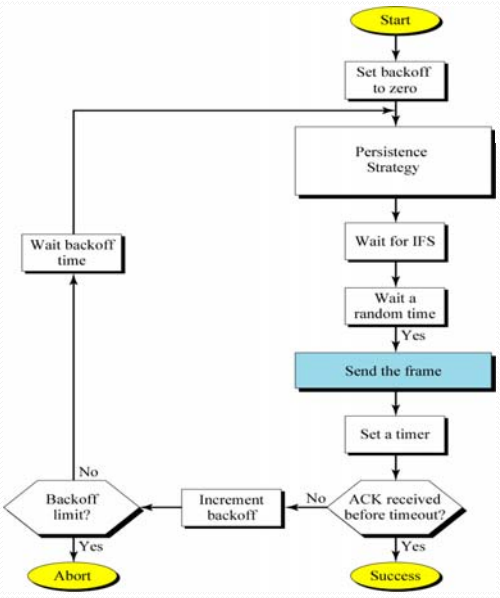


Figure 15-1

**10 LAN networks**
b. Access methods

Wireless Transmission

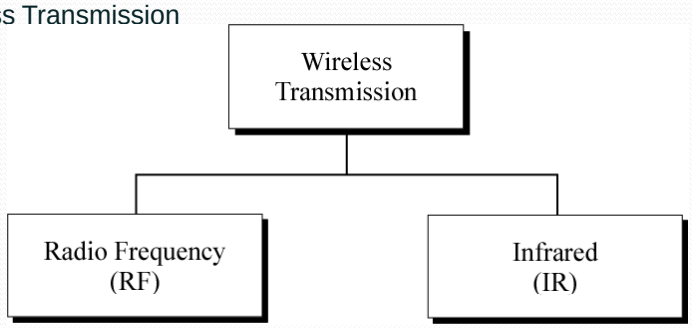
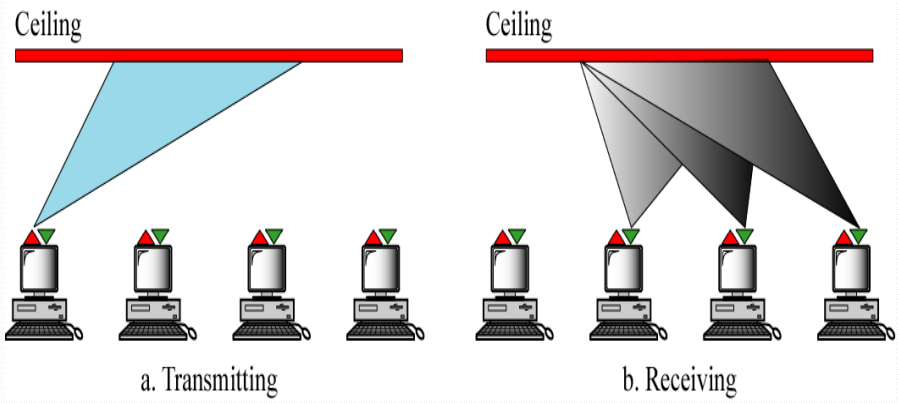



Figure 15-7

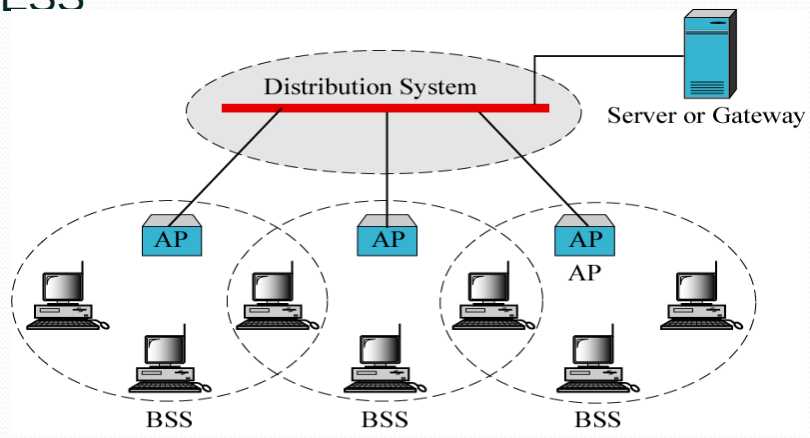
**10 LAN networks**
b. Access methods

Infrared Diffused LAN



10 **LAN networks**
b. Access methods

ESS

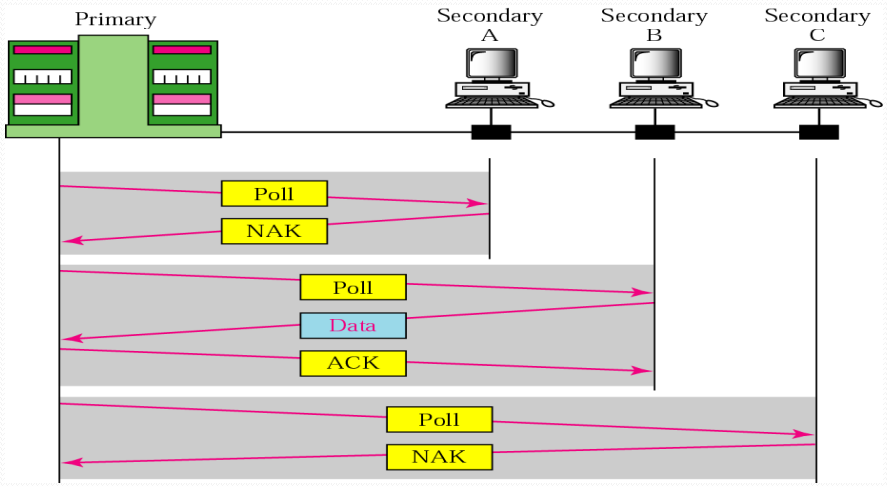



10 **LAN networks**
b. Access methods

*The poll/select method is the most widely used in time-sharing systems, when a central computer is used for controlling other computers*

10 **LAN networks**
b. Access methods

Polling access method




10 **LAN networks**
b. Access methods

*Token passing uses a token as a baton to access the medium of a local area network (LAN)*

**10 LAN networks**
b. Access methods

**Token Passing Network**

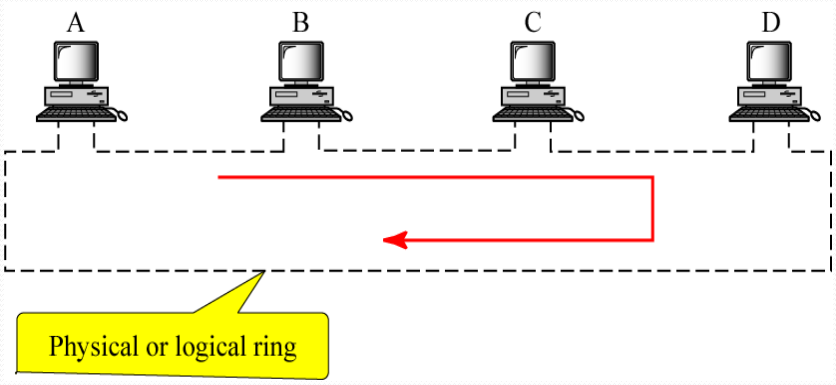
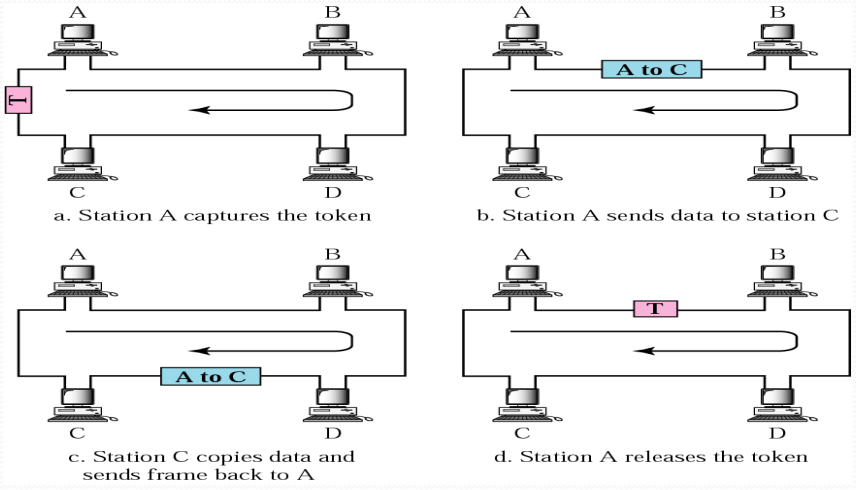



Figure 5-17

**10 LAN networks**
b. Access methods

Token Passing Network



**10 LAN networks**

b. Access methods

**Token Passing Procedure**