



DATA COMMUNICATION CONCEPTS

CHAPTER 8

LAN TECHNOLOGIES

OBJECTIVES

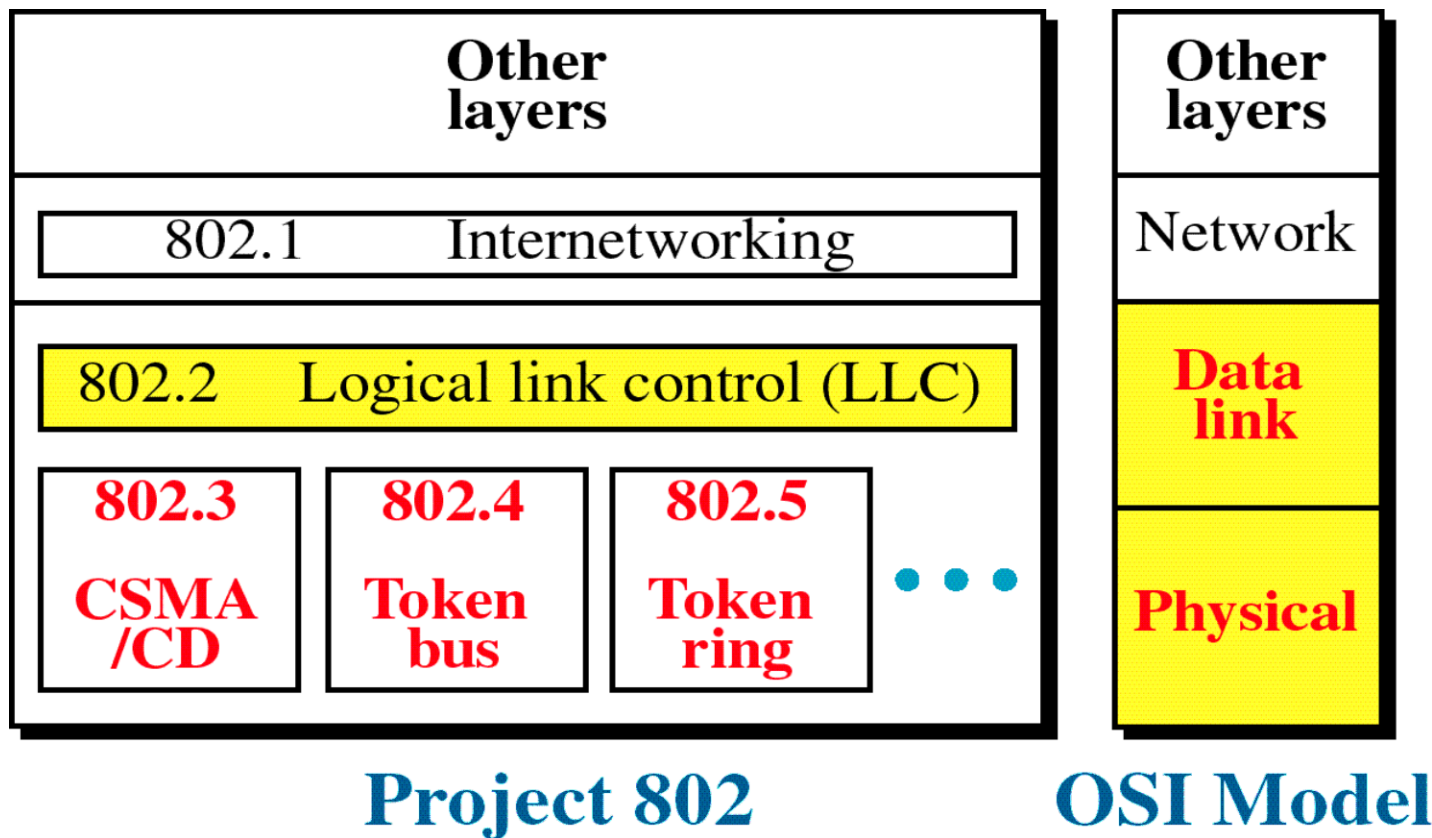
At the end of this chapter, you should be able to:

- Identify the network architecture specified by Project 802.
- Identify and understand the access method used in each standard specified.
- Implementation of each standards.

8.1 INTRODUCTION TO NETWORK ARCHITECTURE

- 4 architectures of LANs:

- | | | |
|-----------------|---|-------------------------------------------------|
| i. Ethernet | } | Standards of the IEEE & part of its Project 802 |
| ii. Token Bus | | |
| iii. Token Ring | | |
| iv. FDDI | } | An ANSI standard |

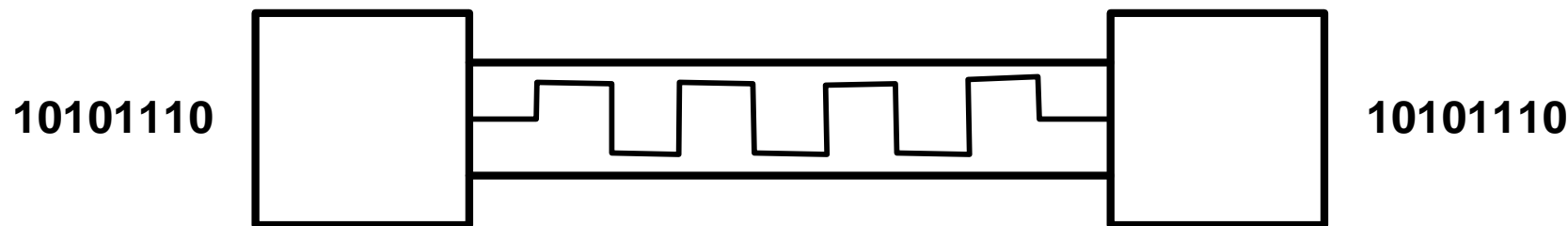


8.2 ETHERNET (IEEE 802.3)

- Ethernet is a LAN standard using CSMA/CD access method.
- Supported by IEEE 802.3
- IEEE 802.3 defines 2 categories:
 - i. Baseband:
 - Specifies a digital signal (Manchester encoding)
 - ii. Broadband:
 - Specifies an analog signal (PSK encoding)

Baseband

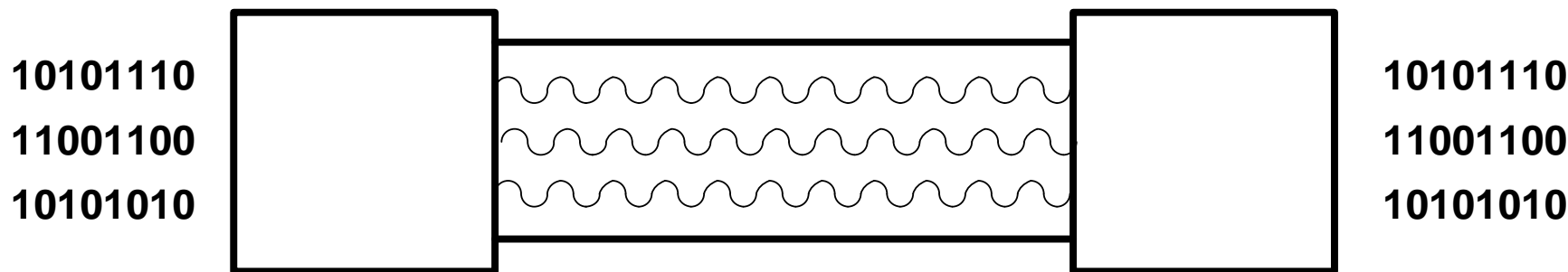
- A technology in which a signal is transmitted directly onto a channel without modulating a carrier.
- It send single signal over the cable.



- 5 different standards:
 - i. 10Base5
 - ii. 10Base2
 - iii. 10Base-T
 - iv. 1Base5
 - v. 100Base-T

Broadband

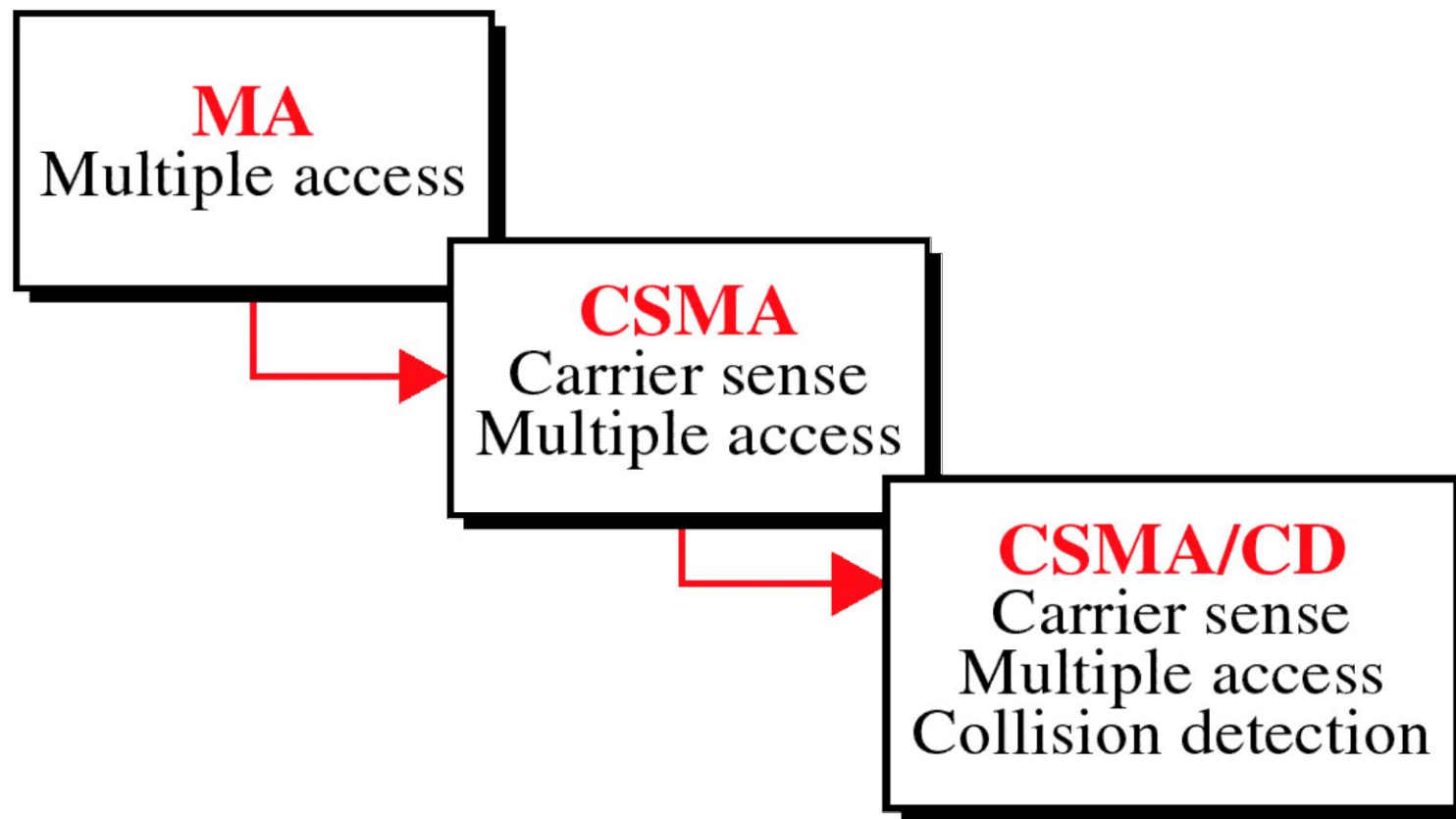
- A technology in which a signal shares the bandwidth of a medium



- IEEE defines only one specification for the broadband:
 - 10Broad36

Access Method: CSMA/CD

- Ethernet uses *Carrier Sense Multiple Access with Collision Detection* access mechanism.
- Evolution of CSMA/CD:



Evolution of CSMA/CD

■ MA:

- every workstation had equal access to a link
- access to the line was open to any node at any time.

■ CSMA:

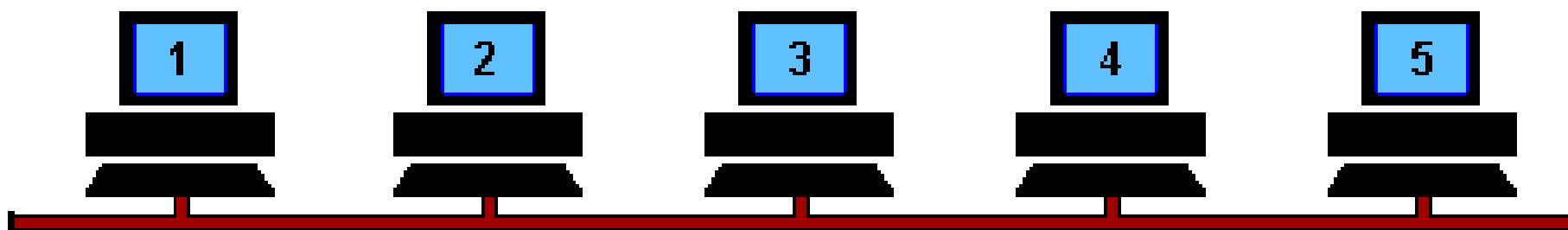
- any workstation wish to transmit must first listen for existing traffic on the line. (check for a voltage).
- if no voltage detected, the line is considered idle and transmission is initiated.
- CSMA cuts down on the number of collisions but does not eliminate them.

Evolution of CSMA/CD (*continue*)

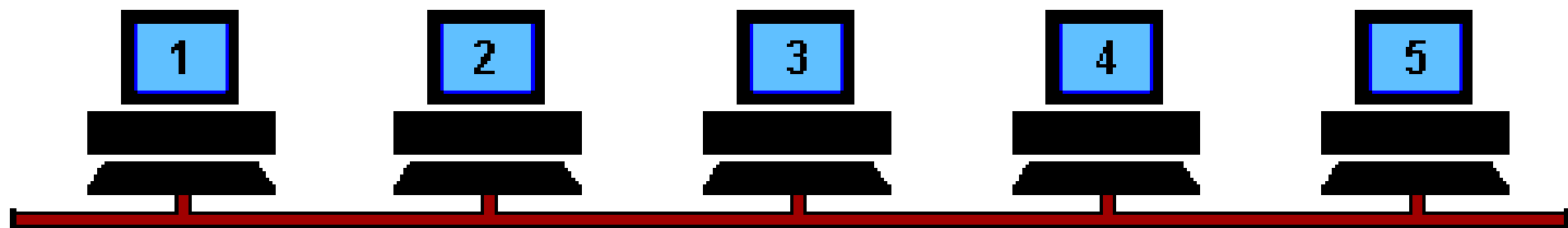
■ CSMA/CD:

- Station wish to transmit:
 - First listen to make certain link is free
 - Then transmits its data
 - Then listens again
- During transmission:
 - Station checks the line for the extremely high voltages that indicate a collision.
 - If collision detected, the station quits the current transmission and wait for the line to clear.
 - Then sends its data again

THE BASIC ETHERNET BUS



COLLISIONS



8.4 TOKEN RING (IEEE 802.5)

- A LAN using a ring topology & token-passing access method.
- In CSMA/CD, stations may attempt to send data multiple times before a transmission makes it onto the link.
- Token ring allows stations take turn sending data.
- Each station may transmit only during its turn & may send only one frame during each turn.

Access Method: Token Passing

- An access method in which a token is circulated in the network.
- The station that captures the token can send data.

Token is traveling along the ring.

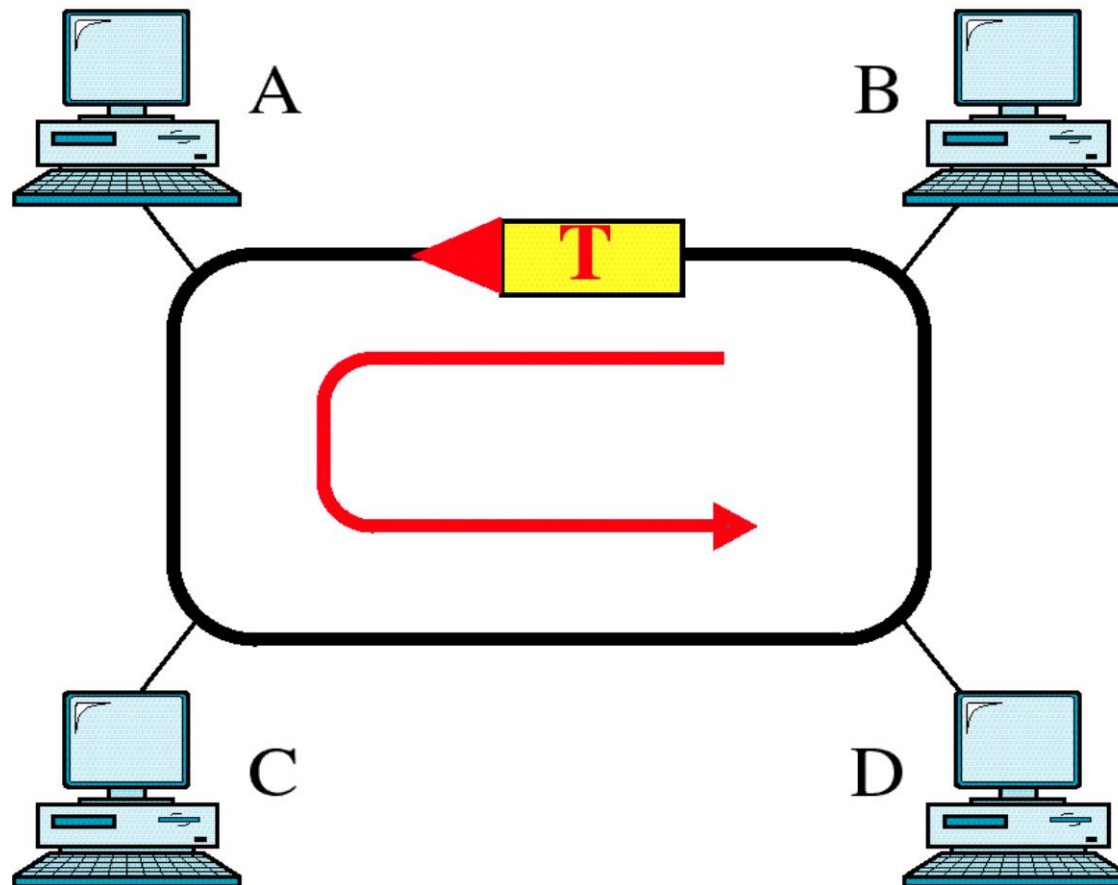


Figure (i): Token Passing

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Station A captures the token and sends its data to D.

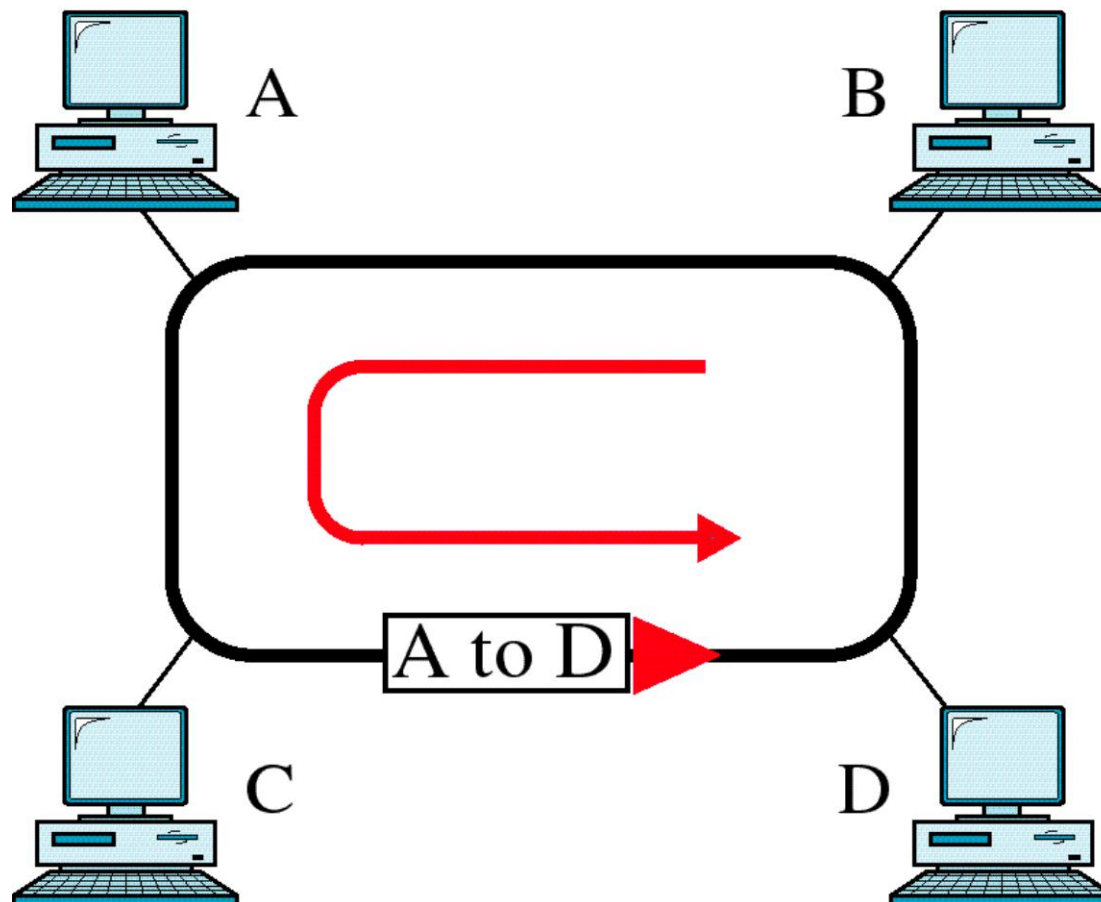


Figure (ii): Token Passing

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Station D copies the frame and sends the data back to the ring.

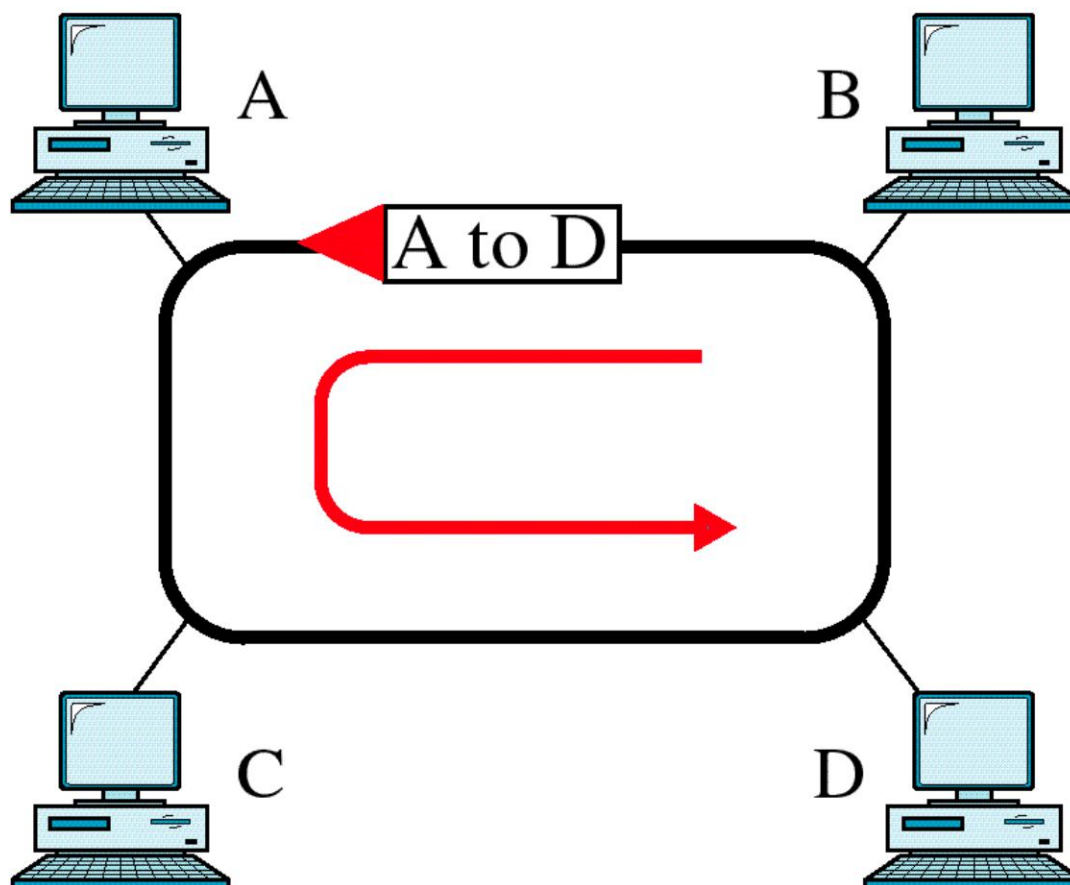


Figure (iii): Token Passing

Station A receives the frame
and releases the token.

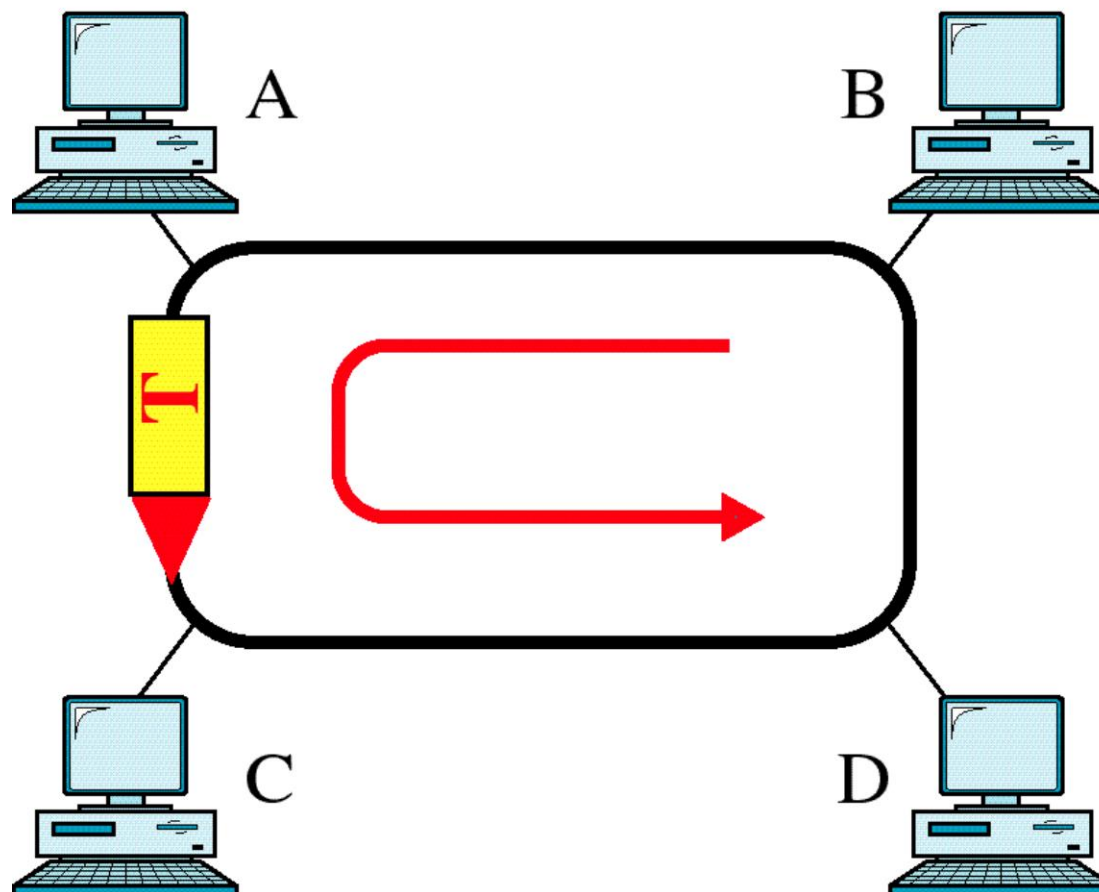
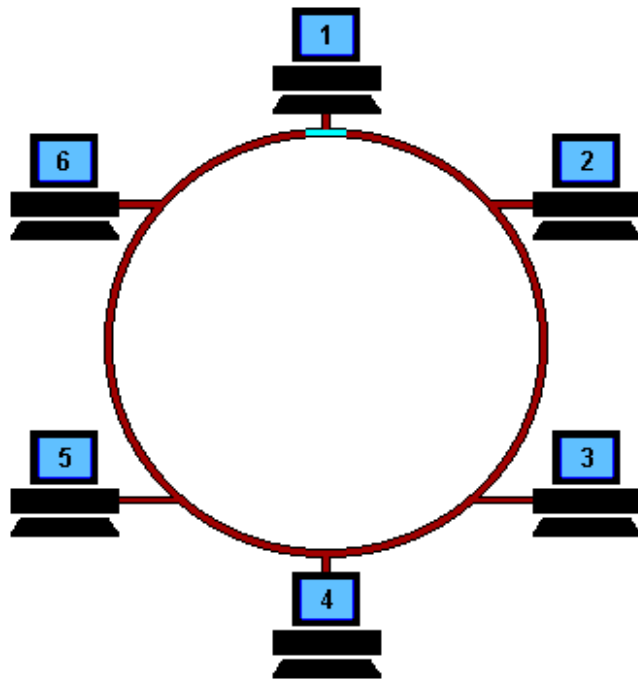


Figure (iv): Token Passing

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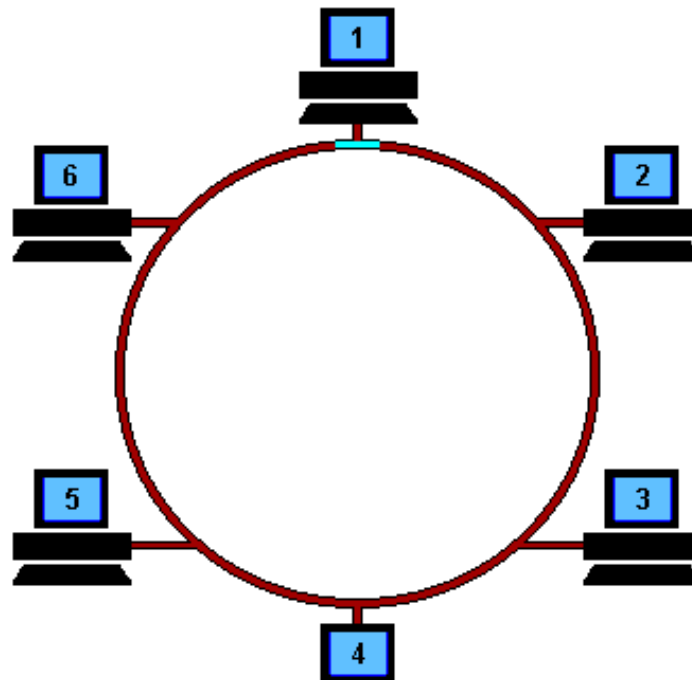


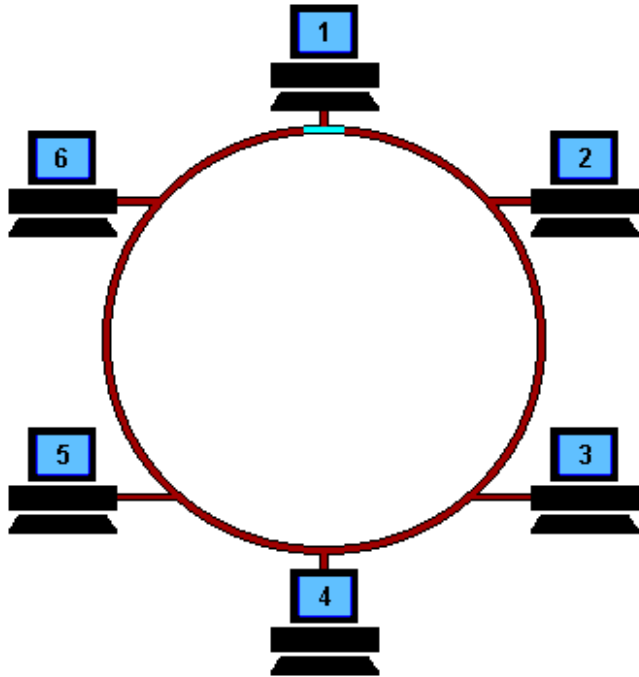
TOKEN RING SIMULATION



- ❑ A free Token is circulating on the ring for transporting data.
- ❑ To use the network, a machine first has to capture the free Token and replace the data with its own message.
- ❑ Machine 1 wants to send some data to machine 4, so it first has to capture the free Token.
- ❑ It then writes its data and the recipient's address onto the Token (represented by the yellow flashing screen.)
- ❑ The packet of data is then sent to machine 2 who reads the address, realizes it is not its own, so passes it on to machine 3.
- ❑ Machine 3 does the same and passes the Token on to machine 4.

- ❑ This time it is the correct address and so number 4 reads the message (represented by the yellow flashing screen).
- ❑ It cannot, release a free Token on to the ring, it must first send the message back to number 1 with an acknowledgement to say that it has received the data (represented by the purple flashing screen).





- ❑ The receipt is then sent to machine 5 who checks the address, realizes that it is not its own and so forwards it on to the next machine in the ring, number 6.
- ❑ Machine 6 does the same and forwards the data to number 1, who sent the original message.
- ❑ Machine 1 recognizes the address, reads the acknowledgement from number 4 (represented by the purple flashing screen) and then releases the free Token back on to the ring for the next machine to use.

Priority and Reservation

- ❑ The next station on the ring with data to send has the right to take charge of the ring.
- ❑ The busy token can be reserved – use priority code by each station.
- ❑ Among stations of equal priority, the process is first-come, first-served.

Signaling

- ❑ Uses differential Manchester encoding.

Data Rate

- ❑ Token Ring supports data rates up to 16 Mbps.

8.6 WIRELESS LAN (IEEE 802.11b)

- Wireless LAN is a local area network that uses high frequency radio signals to transmit and receive data over distances of a few hundred feet; uses Ethernet protocol.
- 2 wireless LAN solutions:
 1. HomeRF
 2. Wi-Fi (IEEE 802.11b)

Advantages

■ **Mobility:**

- provide users access to real-time information anywhere within the organization.

■ **Flexibility & Scalability:**

- eliminates the need to pull wires or cables through walls and ceilings.

■ **Cost Savings:**

- save network management costs related to adds, moves and changes.

Comparison of Wireless LAN Technologies

HomeRF

- Designed exclusively for the home environment

IEEE802.11b

- Being deployed in homes, small and medium businesses and large enterprises and in a growing number of public wireless networking hot spots.

	IEEE 802.11b	HomeRF
Major Industry Support	Cisco, Lucent, 3Com WECA	Apple, Compaq, HomeRF Working Group
Range	50 – 300 feet	150 feet
Speed	11 Mbps	1, 2, 10 Mbps
Use	Home, Small Office, Campus, Enterprise	Home

Wireless LAN Topologies

- **Access Point (Infrastructure) Mode Network:**
 - extends an existing wired LAN to wireless devices by providing a base station (access point).
 - access point bridges the wireless and wired LAN and acts as a central controller.

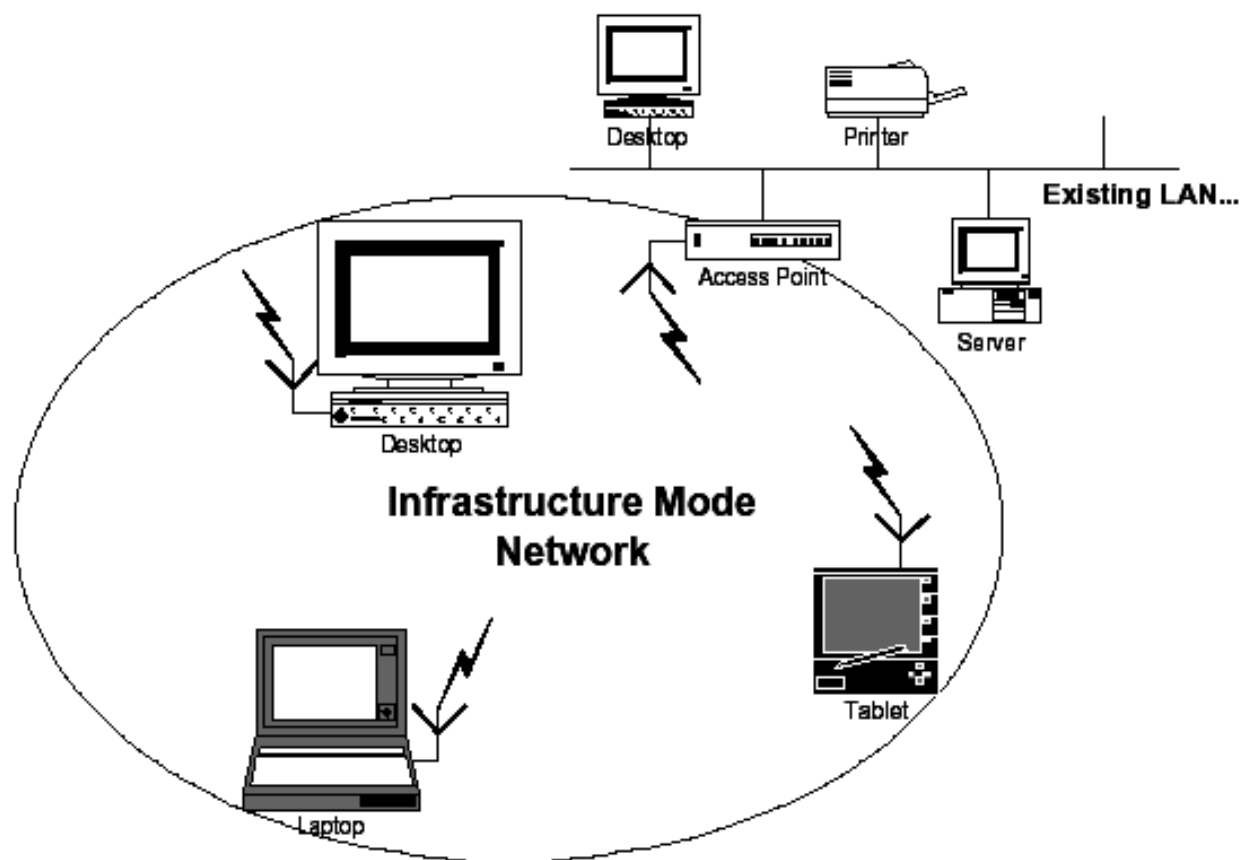


Figure 1: An Infrastructure Mode Network

■ Ad Hoc Network

- A LAN is created solely by the wireless devices themselves with no central controller or access point.
- Each device communicates directly with other devices in the network rather than through a central controller.

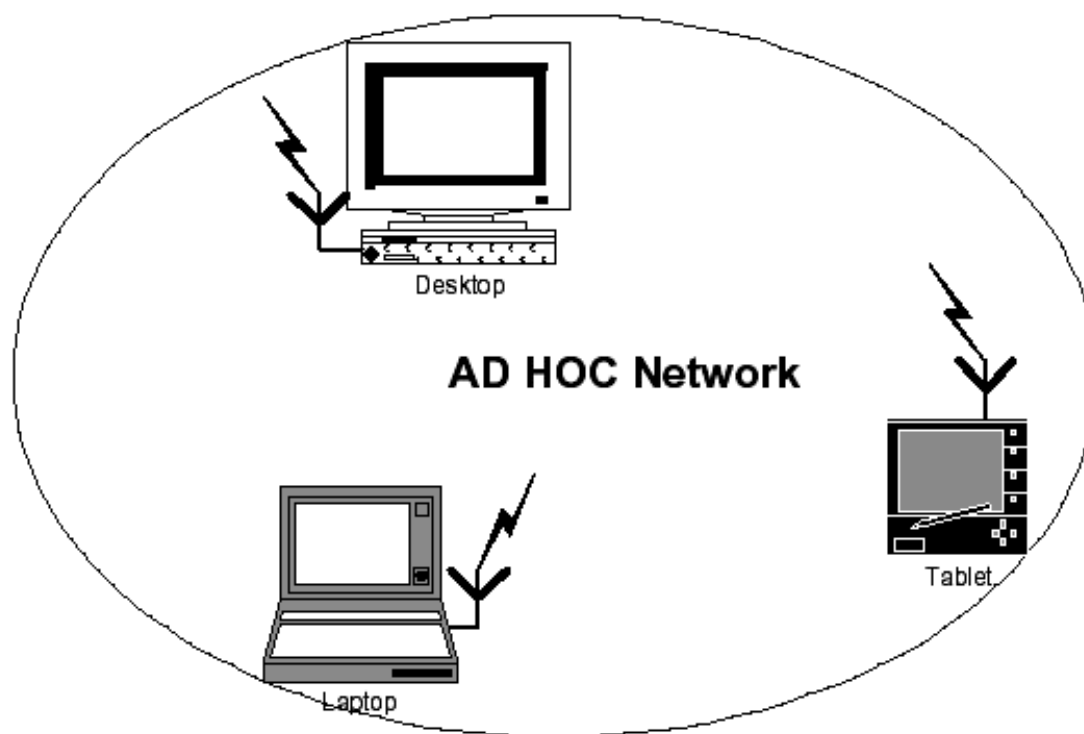


Figure 2: An Ad Hoc Network