LAN Topologies

- Because many LAN technologies have been invented,
  - it is important to know how specific technologies are similar and how they differ
- Each network is classified into a category according to its topology or general shape
- This section describes the three topologies used most often with LANs

Star Topology

A network uses a star topology if all computers attach to a central point

- Hubs are used to connect computer together

A hub is an electronic device that accepts data from a sending computer and delivers it to all connected.

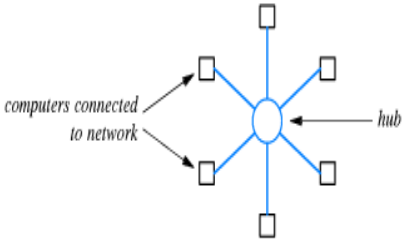


Figure 8.3 Illustration of the star topology in which each computer attaches to a central point called a *hub*.

- In practice, star network seldom have a symmetric shape in which the hub is located an equal distance from all computers. Instead, a hub often resides in a location separate from the computers attached to it

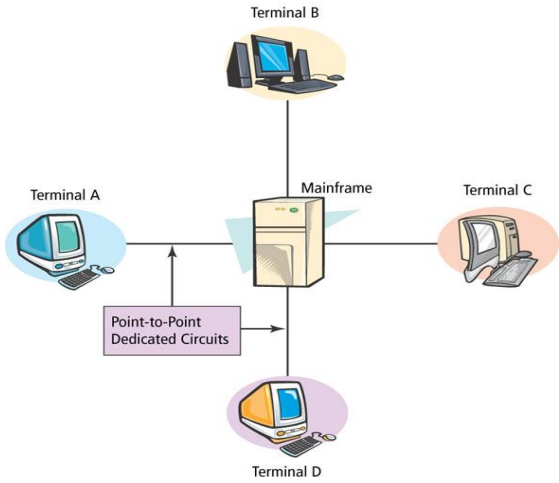


Figure 4.3
Standard Star Topology

Ring Topology

- A network that uses a topology ring arranges for computers to be connected in a closed loop
  - a cable connects the first computer to a second computer, another cable connects the second computer to a third, and so on, until a cable connects the final computer back to the first

- Ring refers to logical connections among computers, not physical orientation
  - computers in a ring need not be arranged in a circle
- Developed by IBM
  - IBM also developed the Token Ring Protocol, later formalized as the 802.5 by the IEEE
- Uses a single cable such that a closed loop is created, hence the term “ring”
- Circling the ring, in one direction, is a token:
  - Used by networked devices that need to communicate
  - Either free or busy
- Performs well in networks with heavy traffic
- Not widely implemented due to cost and complexity

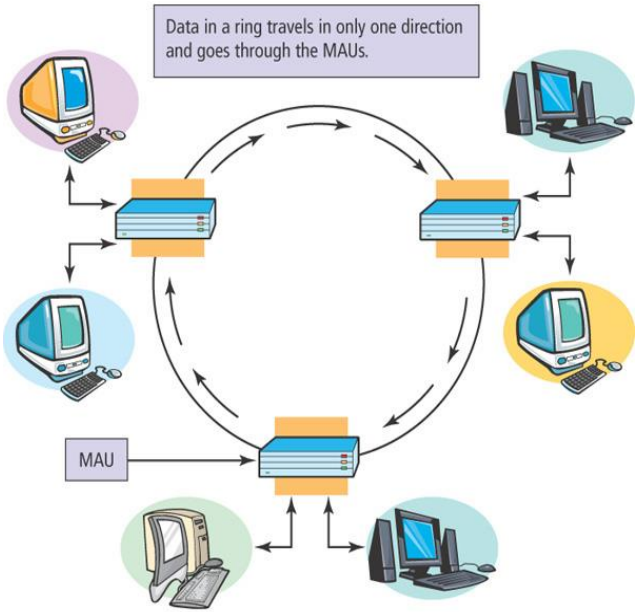
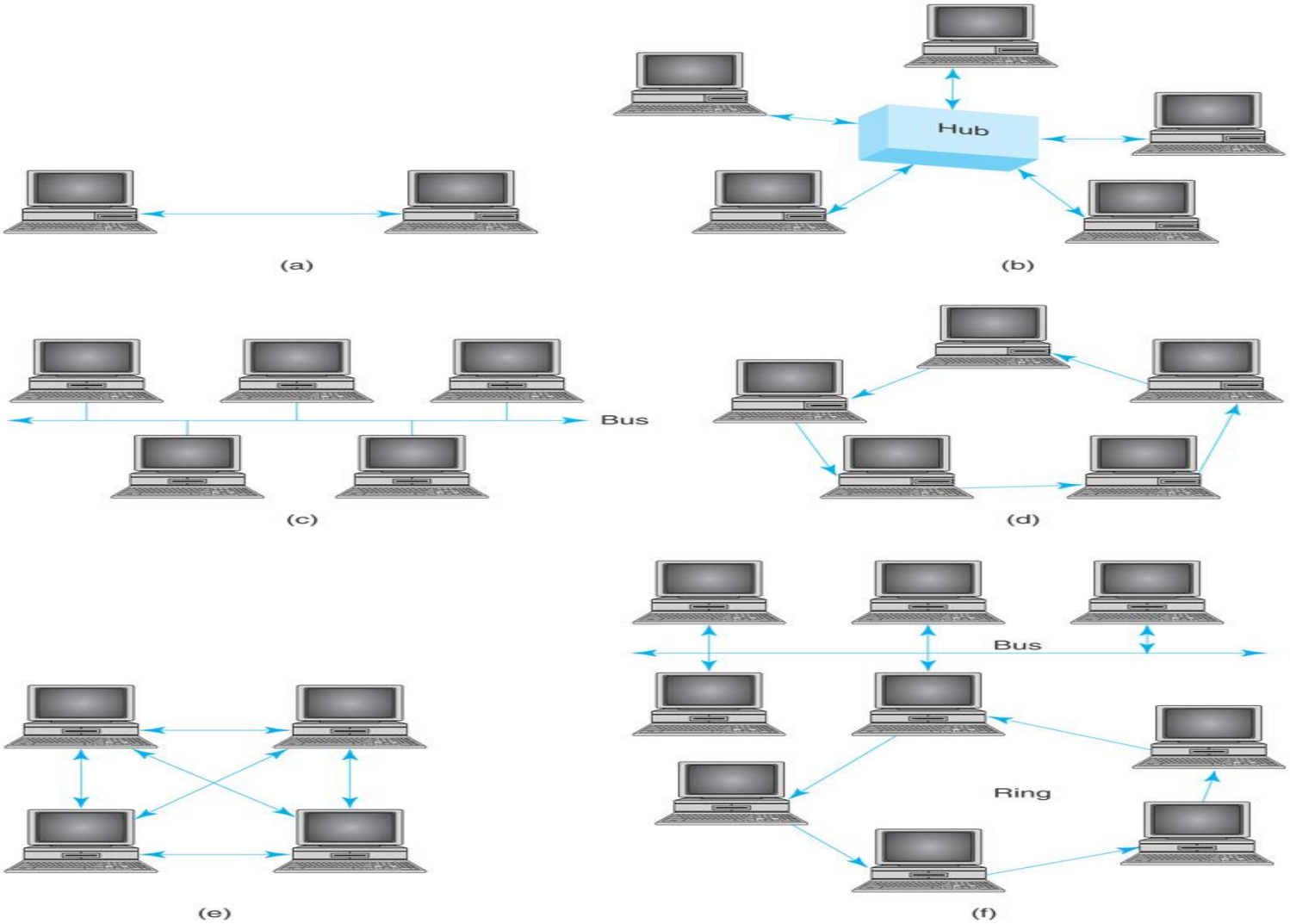


Figure 4.4
Standard Ring Topology with Media Access Units (MAUs)

Network topologies: (a) point to point; (b) star; (c) bus; (d) ring; (e) mesh; (f) hybrid



Bus Topology

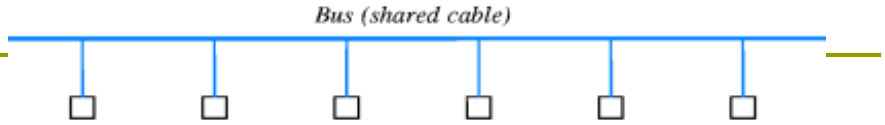


Figure 8.5 Illustration of a bus topology in which all computers attach to a single cable.

- A network that uses a bus usually consists of a single, long cable to which computers attach
- The ends of a bus network must be terminated to prevent electrical signals from reflecting back along the bus

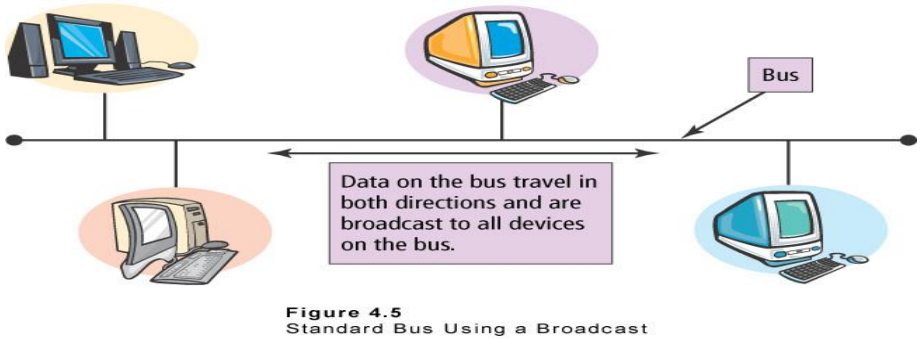


Figure 4.5
Standard Bus Using a Broadcast

- Any computer can send a signal down the cable and all computers receive the signal - Figure 8.5 illustrates the topology. All computers attached to the cable can sense signals. Any computer can send data to any other computer

- The computers attached to a bus network must coordinate
  - to ensure that only one computer sends a signal at any time
  - otherwise chaos results

Pros and cons

- Each topology has advantages and disadvantages
- A ring topology
  - makes it easy for computers to coordinate access and to detect whether the network is operating correctly
  - However, an entire ring network is disabled if one of the cables is cut
- A star topology
  - helps protect the network from damage to a single cable because each cable connects only one machine
- A bus topology
  - requires fewer wires than a star,
  - but has the same disadvantage as a ring
    - a network is disabled if someone accidentally cuts the main cable

LAN Standards

- Ethernet (IEEE 802.3)
- Token Bus (IEEE 802.4)
- Token Ring (IEEE 802.5)
- DQDB (IEEE 802.6)

(Refer the class notes)

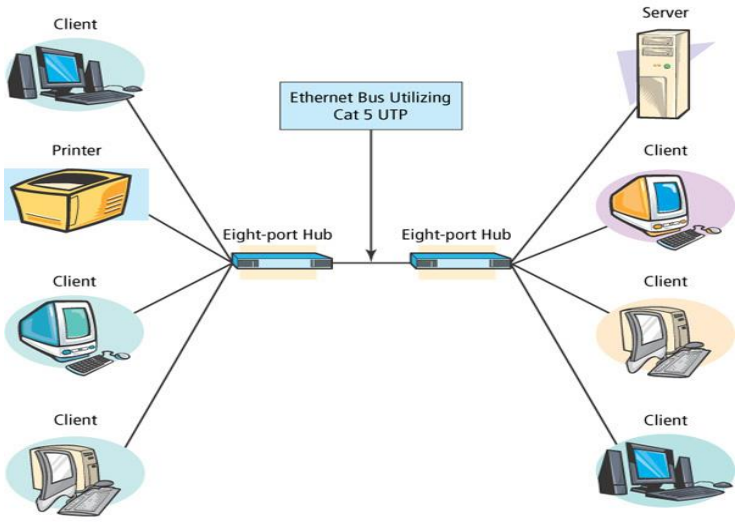


Figure 3.7
Simple 803.3 Ethernet LAN.

Media Access Control (MAC)

Falls into one of two categories:

Contention (802.3, Ethernet, for example)

Controlled access (802.5, Token Ring, for example)

FDDI, another form of controlled access, is an ANSI/ITU-T standard

Collision Detection and Backoff With CSMA/CD

- If the computers begin to transmit as soon as the ether becomes idle, another collision will occur
  - To avoid multiple collisions, each computer to delay after a collision before attempting to retransmit
  - A maximum delay, **d** , and forces each computer to choose a random delay less than **d**
- To avoid a sequence of collisions
  - stations double the range after each collision
    - A random delay from **0** to **d** after 1st collision
    - A random delay between **0** and **2d** after 2nd collision,
    - A random delay between **0** and **4d** after 3rd , and so on
  - After a few collisions, the range from which a random value is chosen becomes large
- This technique is known as binary exponential backoff