# Computers Are Your Future

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## Chapter 8

## Networks: Communicating and Sharing Resources

# What You Will Learn About

- ✓ Basic networking concepts
- ✓ Advantages and disadvantages of networks
- ✓ Peer-to-peer and client/server LANs
- ✓ Importance of network protocols
- ✓ Most widely used LAN protocol
- ✓ Special components of a WAN
- ✓ The difference between circuit-switching and packet switching networks

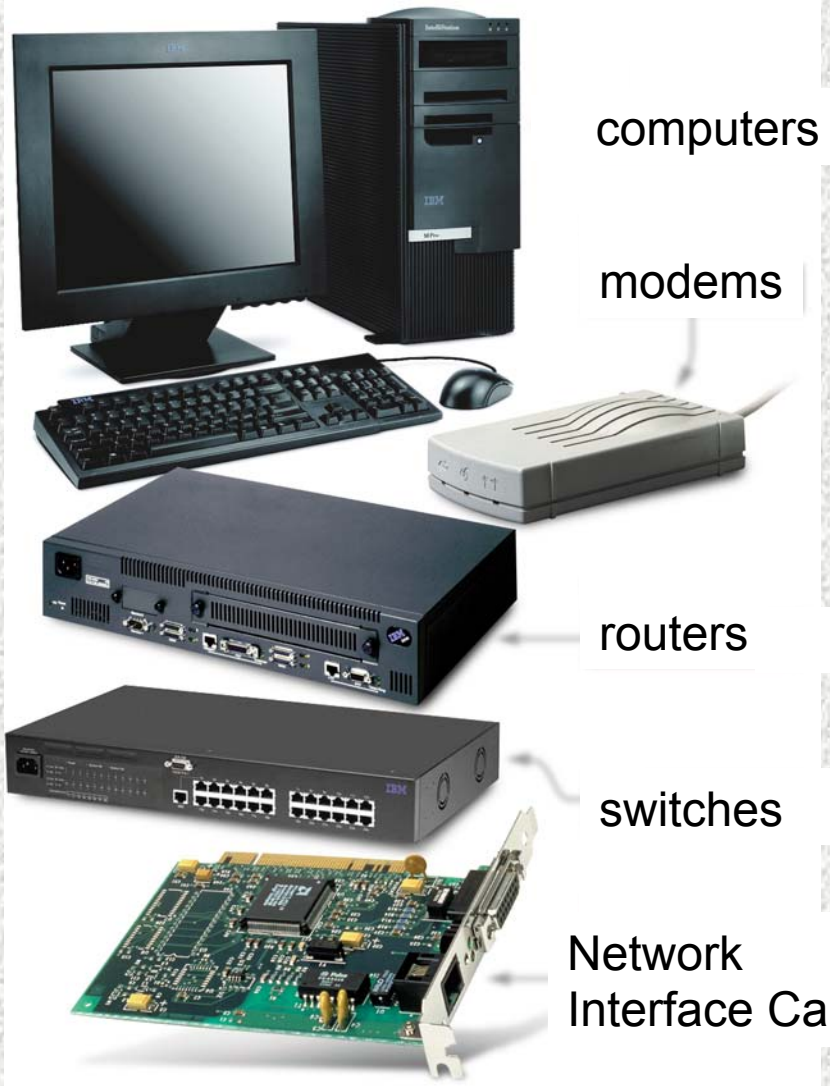


# Network Fundamentals

- A computer **network** consists of two or more computers linked together to exchange data and share resources
  - **LAN – local area network (small geographic area)**
  - **WAN – wide area network (large geographic area)**

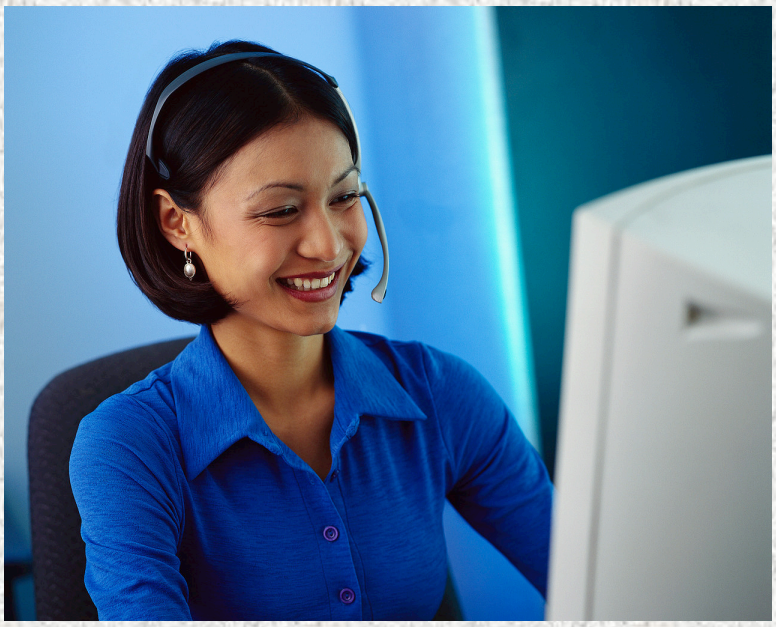
# Communication Devices

- ✓ Convert data into signals
- ✓ Transform data from analog into digital signals and back
- ✓ Computers, modems, routers, switches, wireless access points, network interface cards



# Communication Devices

- Workstations – computer connected to a network
  - Called clients
  - Contains a network interface card (NIC)



# Communication Devices

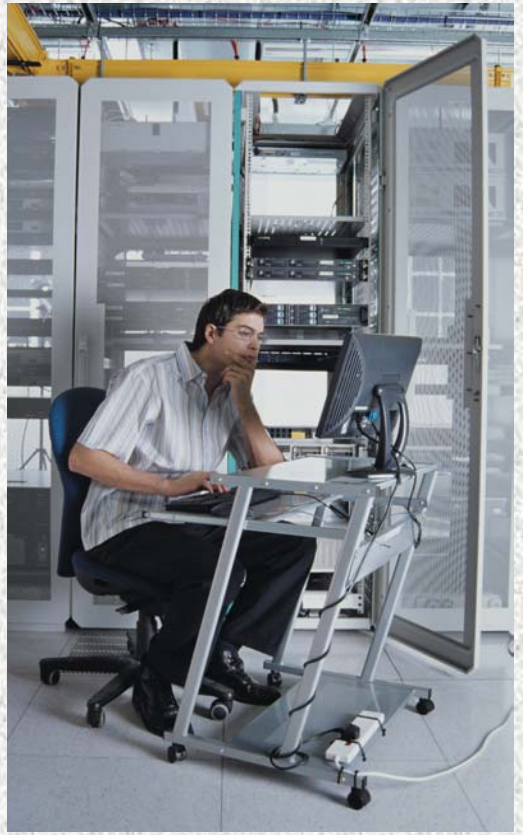
- Routers – connect two or more LANs or WANs
  - Can determine the best path to route data
  - LANs often use switches which are similar to routers

# Communication Devices

- File server
  - High capacity, high speed computer
  - Large hard drive
  - Contains a network operating system (NOS)

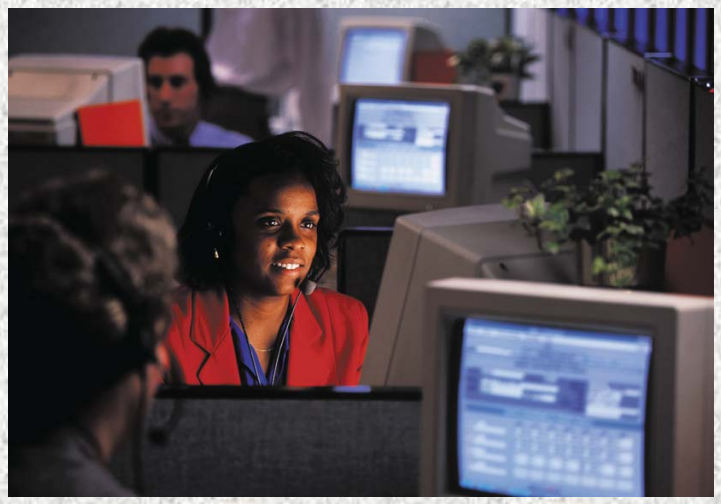
# Network Fundamentals

- Network administrators
  - Install
  - Maintain
  - Support
  - Interact with users
  - Troubleshoot problems



# Advantages of Networks

- ✓ Reduced hardware costs
- ✓ Application sharing
- ✓ Sharing information resources
- ✓ Centralized data management
- ✓ Connecting people



# Disadvantages of Networks

- ✓ Loss of autonomy
- ✓ Lack of privacy
- ✓ Security threats
- ✓ Loss of productivity

# Local Area Networks (LANs)

- ✓ Network access is controlled by a network administrator
- ✓ Users can access software, data, and peripherals
- ✓ LANs require special hardware and software
- ✓ Computers connected to a LAN are called **workstations** or **nodes**
- ✓ Types of LANs:
  - ➢ Peer-to-peer
  - ➢ Client-server



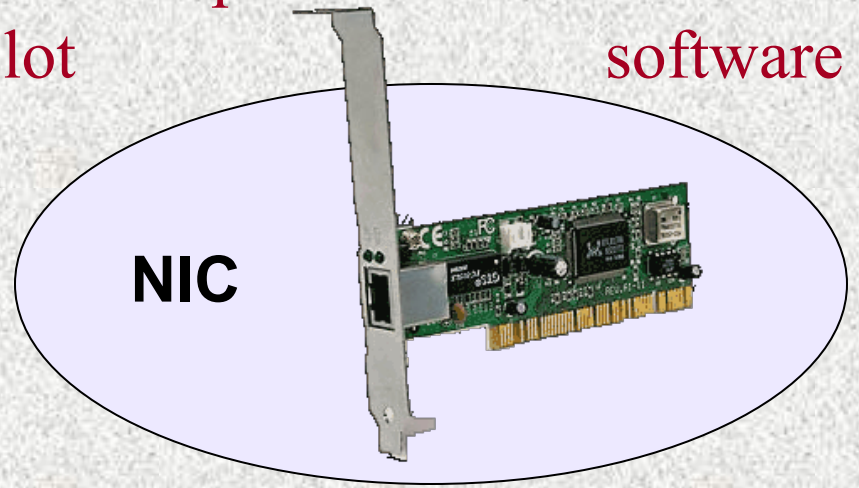
# LAN Hardware and Software

## Networking Hardware

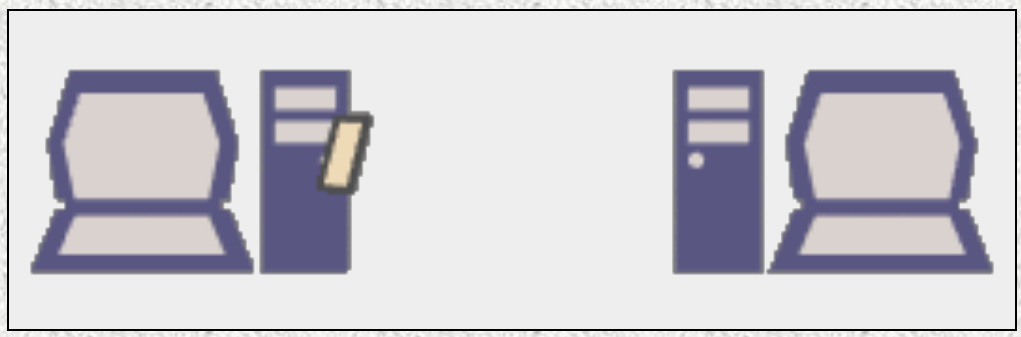
- ✓**Network interface card (NIC)** – Provides the connection between the computer and the network
- ✓Inserted into a computer's expansion slot

## Networking Software

- ✓Operating system that supports networking (Unix, Linux, Windows, Mac OS)
- ✓Additional system software

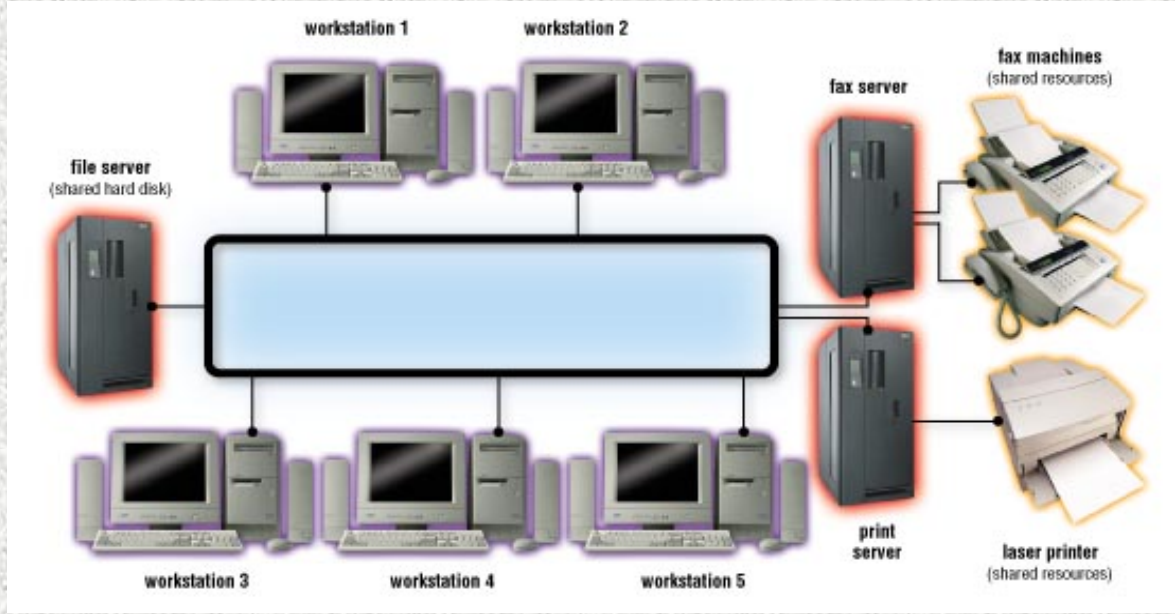


# Peer-to-Peer Networks



- ✓ All computers on the network are treated as equal
- ✓ There are no file servers
- ✓ Users decide which files and peripherals to share
- ✓ Peer-to peer is not suited for networks with many computers
- ✓ Peer-to-peer is easy to set up; example: home networks

# Client-Server Networks




- ✓ Typical corporate networks are **client-server**
- ✓ Client-server requires various topologies or physical layouts
- ✓ The network requires file servers, networked computers (clients), and a network operating system (NOS)
- ✓ Clients send requests to servers for programs and data, and to access peripherals

# LAN Topologies

- The physical layout of a LAN is called its **topology**
- Topologies resolve the problem of **contention**, which occurs when multiple users try to access the LAN at the same time
  - Collisions or corrupt data occur when different computers use the network at the same time

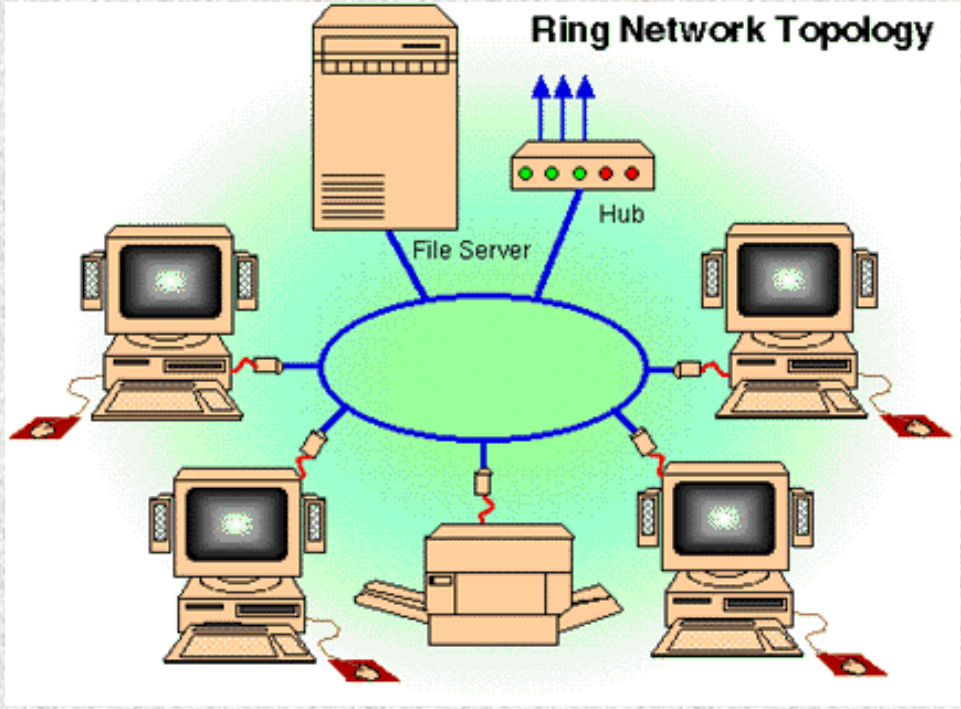
## Type of Topologies

- Ring
- Star
- Bus



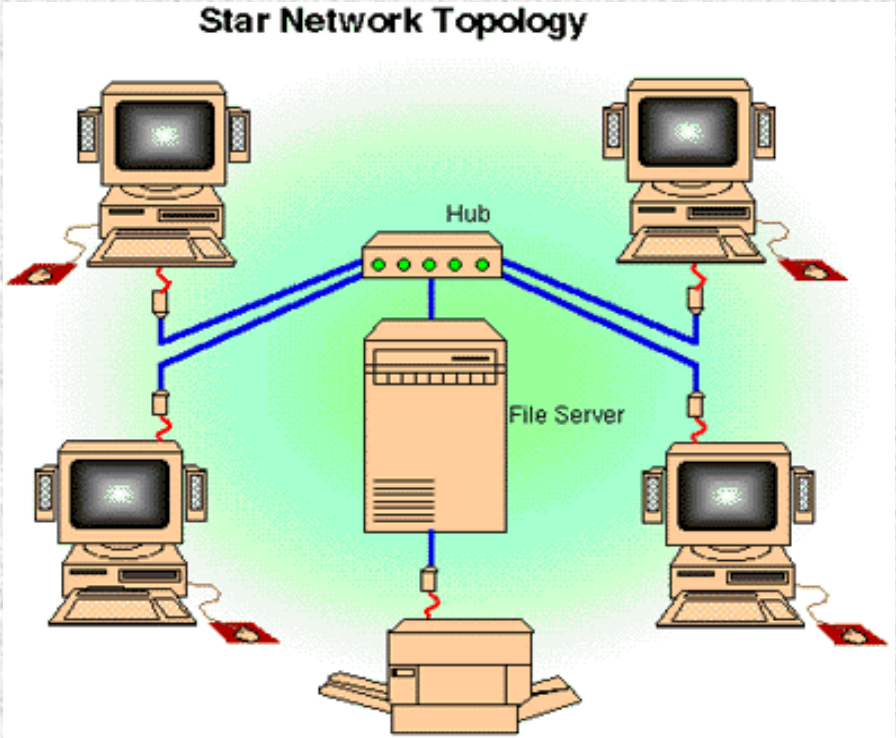
# Ring Topology

- All workstations are attached in a circular arrangement
- A special unit of data called a **token** travels around the ring
- Workstations can only transmit data when they possess a token



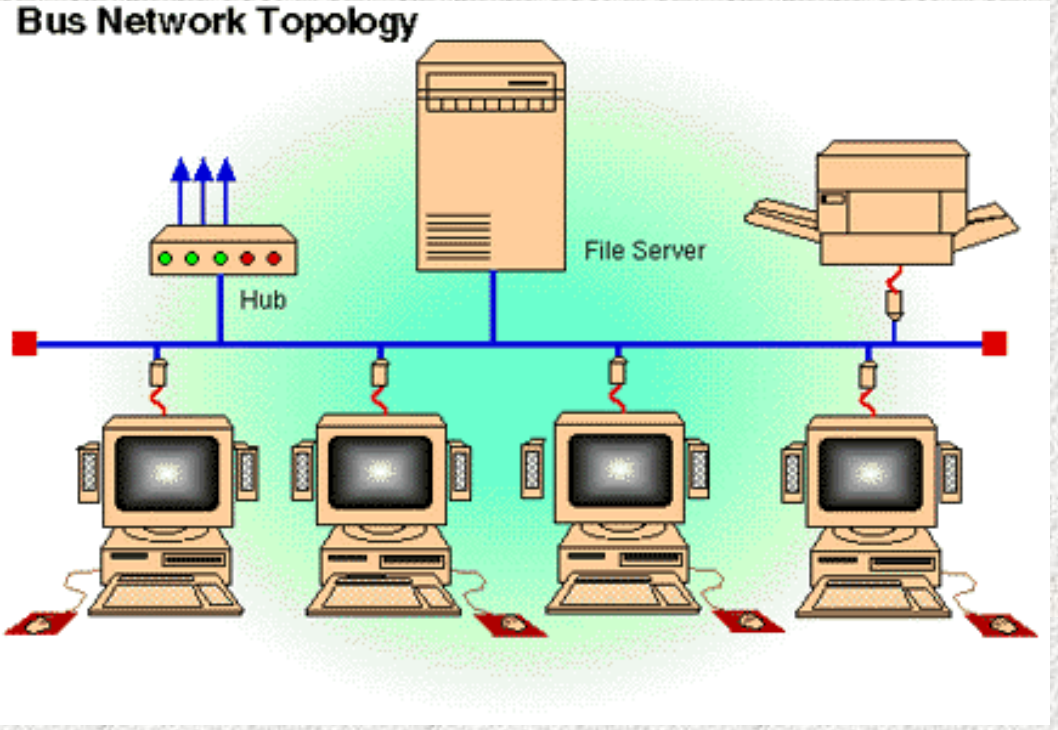
# Star Topology

- Contains a hub or central wiring concentrator
- Easy to add workstations
- Resolves collisions through contention management



# Bus Topology

- Called a daisy chain
- Every workstation is connected to a single cable
- Resolves collisions through contention management
- Difficult to add workstations



# Protocols

- **Protocols** are fixed, formalized standards that specify how computers can communicate over a network
- **Protocol suite –** The total package of protocols that specify how a network functions



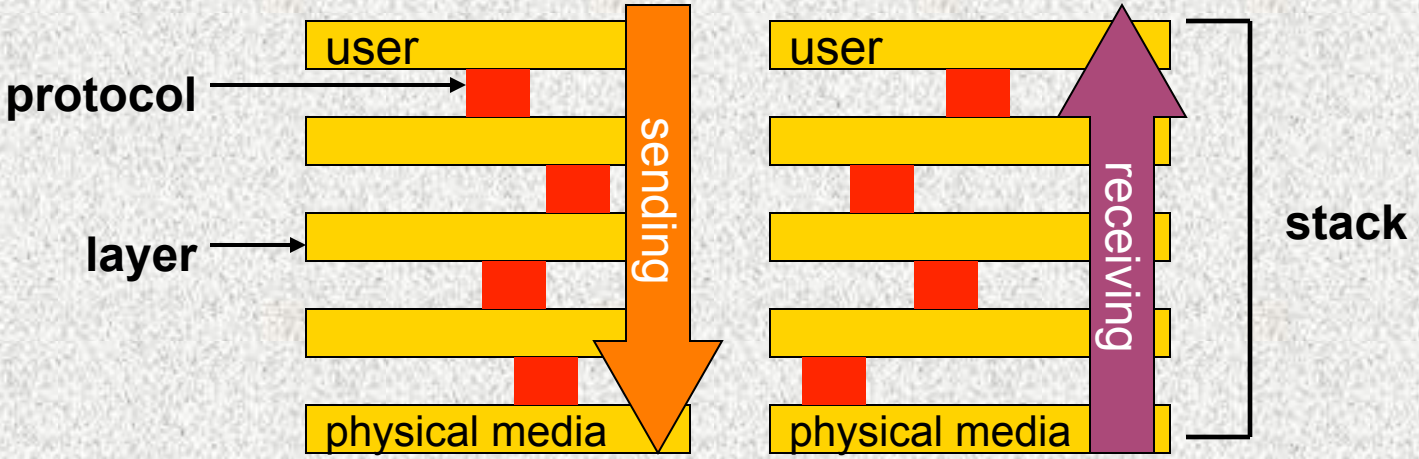



# Modulation Protocols

- **Modulation protocols** are communications standards that modems conform to
- **Data transfer rate** is the rate at which two modems can exchange data. It is measured in bits per second (bps)
- A modulation protocol called **V.90** enables modems to transfer data at 56 Kbps



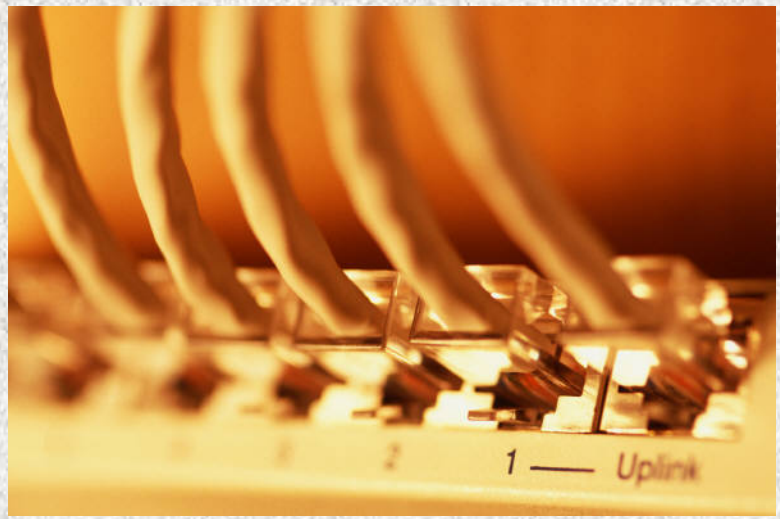
# Network Layers




- ✓ Network architecture is the overall design of a network
- ✓ The network design is divided into layers, each of which has a function separate from that of the other layers
- ✓ **Protocol stack** – The vertical (top to bottom) arrangement of the layers; each layer is governed by its own set of protocols

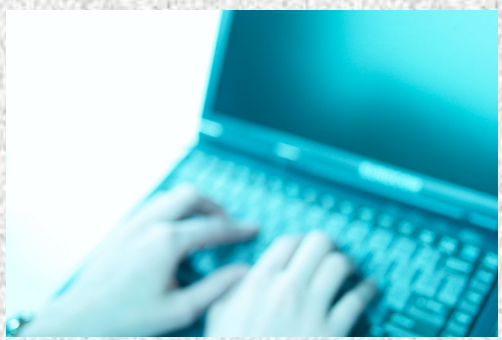
# LAN technologies

- ✓Ethernet – standard for large and small business
- ✓LocalTalk – simplest LAN technology
- ✓IBM Token Ring Network



# Wi-Fi

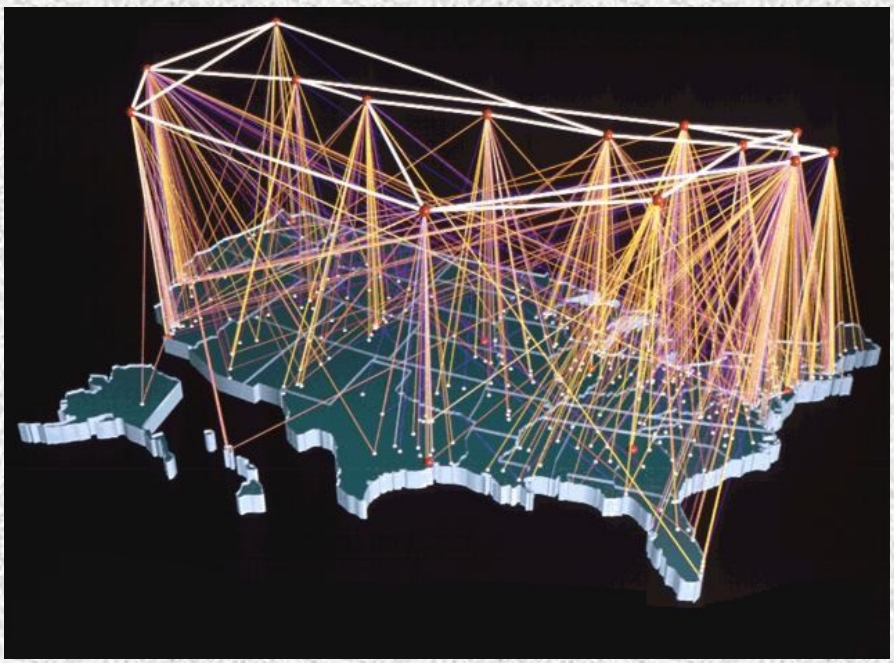
- ✓ Wireless-fidelity
- ✓ Wireless LAN
- ✓ Use central server or access point
- ✓ Advantages
  - ➢ Fast (11 Mbps)
  - ➢ Reliable
  - ➢ Long range
  - ➢ Integrates with existing networks



# Wide Area Networks (WANs)

- ✓ **WANs** are similar to long-distance telephone systems
  - ➢ They have a local access number called a **point of presence (POP)**
  - ➢ They contain long-distance trunk lines called **backbones**

# Backbones



- **Backbones**, high-capacity transmission lines, can be regional, continental, or transcontinental
- Internet backbones can carry 2.5 gigabits of data per second

# WAN Protocols

- **X.25** is the oldest packet switching protocol; it is used by automated teller machines and credit card authorization devices
- New protocols designed for digital lines and faster data transfer rates are:
  - **Switched Multimegabit Data Service (SMDS)**
  - **Asynchronous Transfer Mode (ATM)**



# Switching and Routing Techniques

## Circuit switching

- ✓ Networks create an end-to-end circuit between the sending and receiving computers
- ✓ Electronic switches establish and maintain the connection

## Packet switching

- ✓ Outgoing messages are divided into fixed-size data units called packets
- ✓ Packets are numbered and addressed to the receiving computer
- ✓ Routers examine the packets and send them to their destination



# Advantages and Disadvantages of Circuit and Packet Switching

| | Advantages | Disadvantages |
|---|---|---|
| Circuit switching | Voice and real-time transmission<br>No delivery delays | Costly<br>A direct electrical connection between the computers is required |
| Packet switching | Efficient, less expensive, and reliable<br>Will function if part of the network is down | Delays in receiving packets<br>Not ideal for real-time voice communication |



# WAN Applications

## LAN-to-LAN

- ✓ WANs are used to connect LANs at two or more geographic locations
- ✓ Companies use WANs to connect their branches to one network system

## Transaction Acquisition

- ✓ Information about transactions is instantly relayed to the corporate headquarters
- ✓ **Point-of-sale (POS)** terminals relay transactions to central computers through WANs



# Chapter 8 Summary

- Computer networks link two or more computers to exchange data and share resources
- Two types of computer networks:
  - Local area network (LAN)
  - Wide area network (WAN)
- Computer networks:
  - Reduce hardware costs
  - Enable users to share applications
  - Provide a means to pool an organization's data
  - Foster teamwork
- Peer-to-peer uses no file server



# Chapter 8 Summary continued

- Network topologies are the physical layout of a LAN
- LAN topologies include:
  - Bus topology
  - Star topology
  - Ring topology
- Protocols define how devices communicate with each other
- Ethernet is the most widely used LAN protocol



# Chapter 8 Summary continued

- Point of presence (POP) is a WAN connection point
- Circuit switching creates permanent end-to-end circuit that is optimal for voice and real-time data
- Packet switching does not require a permanent switched circuit