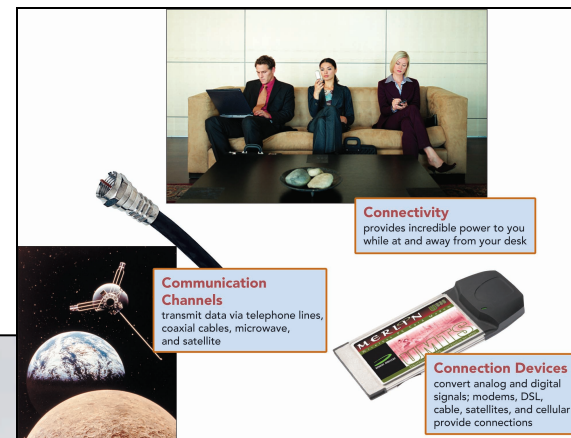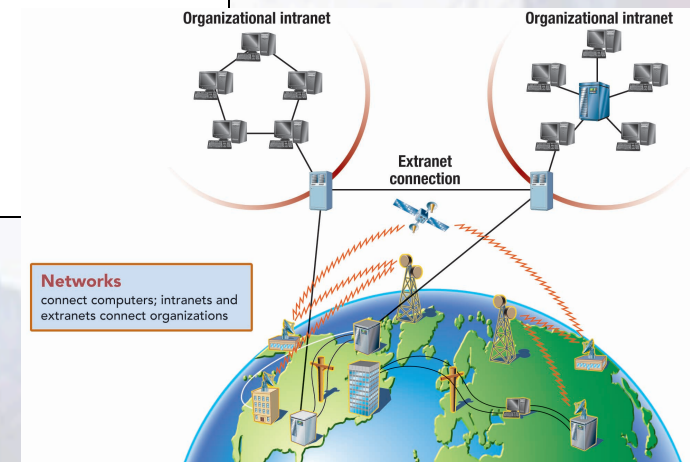# Chapter 9

Communications and Networks

Competencies (Page 1 of 2)

- **Discuss connectivity, the wireless revolution, and communication systems**

- **Describe physical and wireless communications channels**

- **Discuss connection devices, including modems, T1, DSL, cable modem, satellite, and cellular connections**

- **Describe data transmission factors, including bandwidths and protocols**

Connectivity
provides incredible power to you while at and away from your desk

Communication Channels
transmit data via telephone lines, coaxial cables, microwave, and satellite

Connection Devices
convert analog and digital signals; modems, DSL, cable, satellites, and cellular provide connections

9-2

Competencies (Page 2 of 2)

- **Discuss networks and key network terminologies.**

- **Describe different types of networks, including local area, metropolitan area, and wide area networks.**

- **Describe network architectures, including configurations and strategies.**

- **Describe organizational uses of Internet technologies, including intranets, extranets, and firewalls.**

Organizational intranet   Organizational intranet

Extranet connection

Networks
connect computers; intranets and extranets connect organizations

Introduction

Cell phones and other wireless technologies are allowing us to stay connected in today's world like never before.

Increased connectivity potentially means increased productivity especially in the business world.

You will learn more about the concept of connectivity and the impact of the wireless revolution in this chapter.

Communications
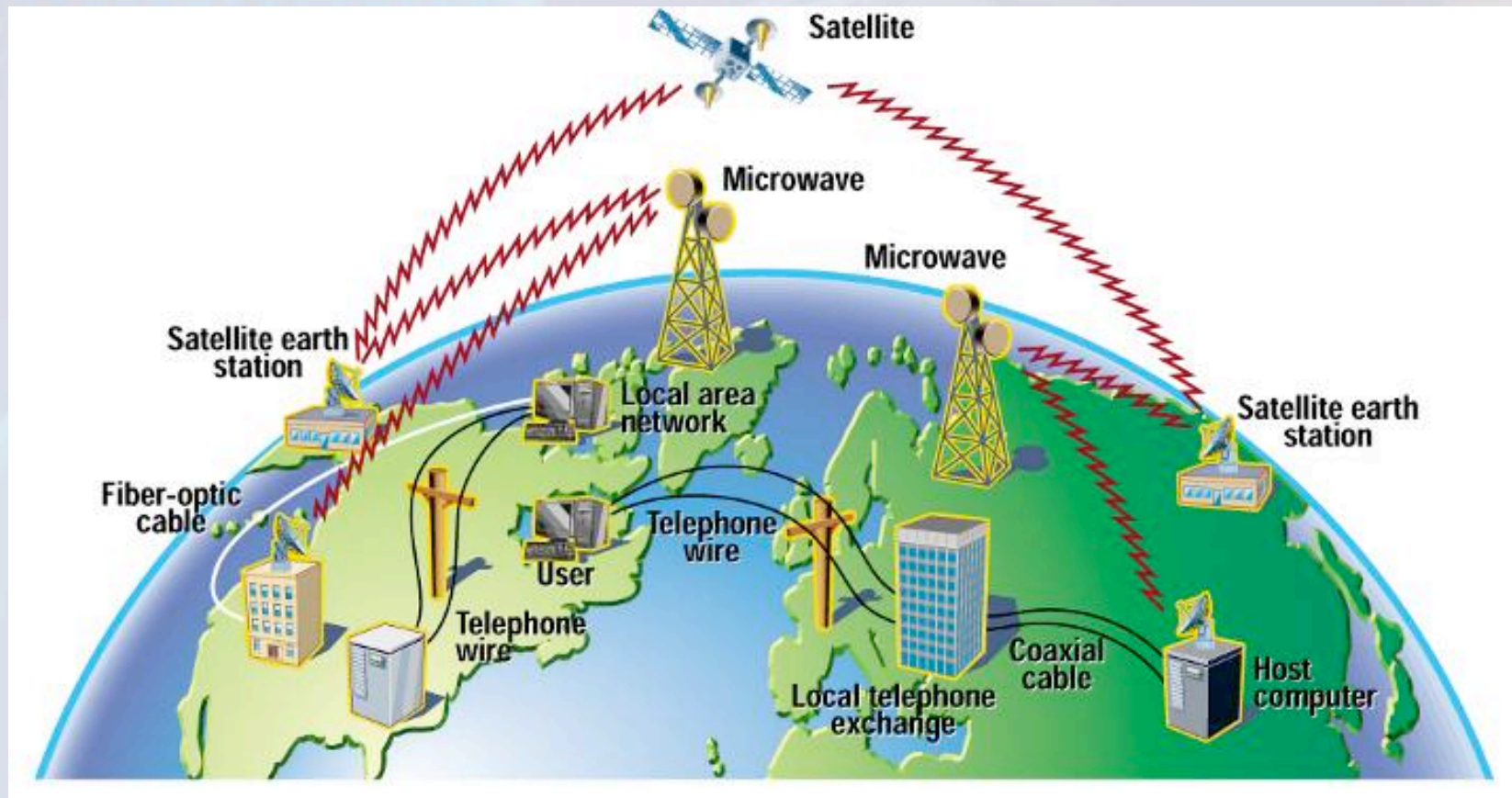
**The process of sharing data, programs, and information between two or more computers**

Communications Today

- **Numerous applications depend on communication systems—E-mail, Instant messaging (IM), Internet telephone, and Electronic commerce**

- **Connectivity uses computer networks to link people and resources**

- **Going wireless has been the most dramatic change**

9-6

Communication Systems

- **Four basic elements**
  - **Sending and receiving devices**
  - **Communication channel**
  - **Connection devices**
  - **Data transmission specifications**

Sending device → Message → Connection device → Communication channel → Connection device → Message → Receiving device

Packets

Data transmission specifications coordinate sending and receiving devices
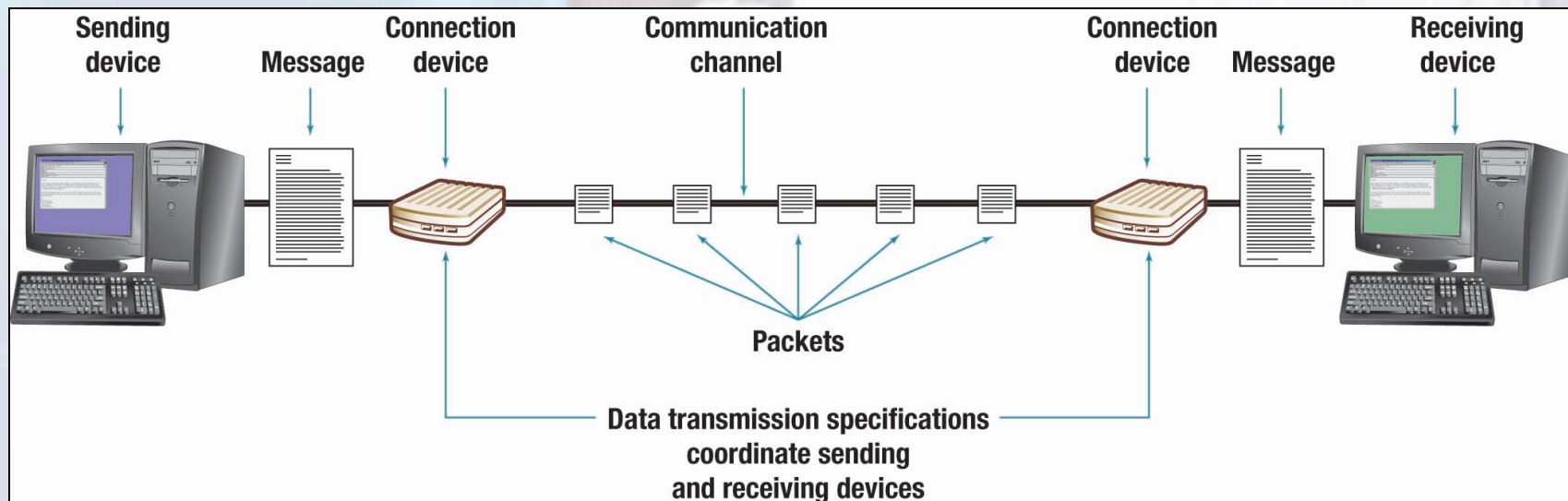
Communication Channels

- **Channels carry data from one computer to another**

- **Two categories of communication channels**

  - **Physical connection**

  - **Wireless connection**

Physical Connections

- **Telephone lines (Twisted pair cables)**

- **Coaxial cable**

- **Fiber-optic cable**

Wireless Connections

Microwave dish

Satellite

GPS

- **Infrared**
- **Broadcast radio**
  - **Wi-FI (wireless fidelity) 802.11**
- **Microwave**
  - **Stations**
  - **Bluetooth**
- **Satellite**
  - **GPS**

9-10

Communication Channels Summary

| Channel	Description
Twisted pair	Copper wire, standard voice telephone line
Coaxial cable	Solid copper core, more than 80 times the capacity of twisted pair
Fiber-optic cable	Light carries data, more than 26,000 times the capacity of twisted pair
Infrared	Infrared light travels in a straight line
Broadcast radio	Radio waves used by cellular telephones and other wireless devices
Microwave	High-frequency radio waves, travels in straight line through the air
Satellite	Microwave relay station in the sky, used by GPS devices

Connection Device Signals
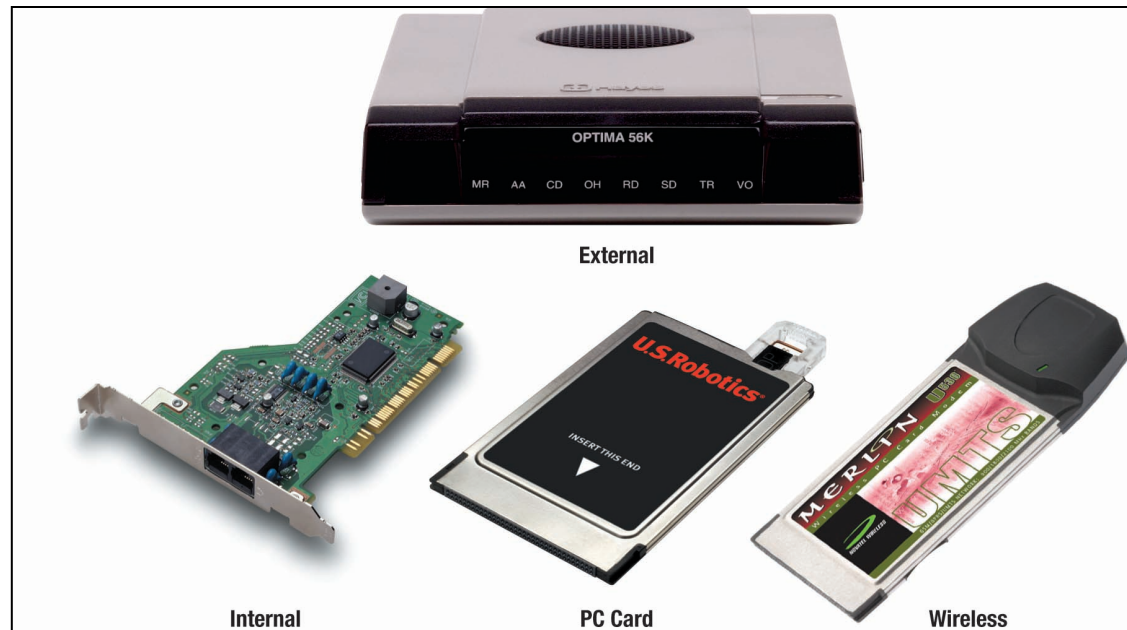
- **Types of signals**

  - **Analog**
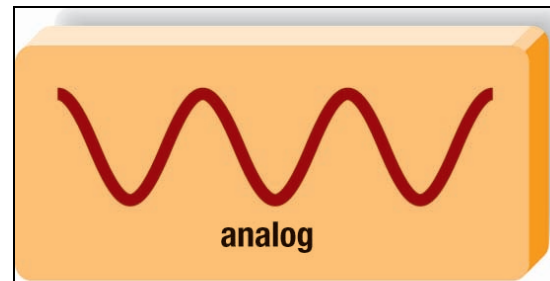
  - **Digital**
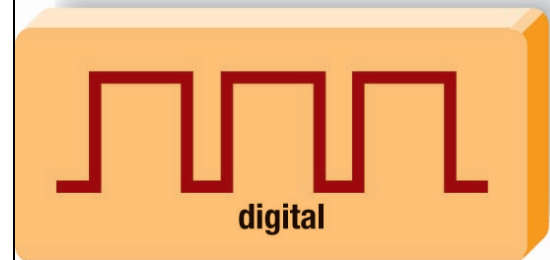
Modulation: *Turning digital signals into analog waves*

Connection Device Types

- ## Types of modems
  - ### External
  - ### Internal
  - ### PC Card
  - ### Wireless

External

Internal   PC Card   Wireless

Transfer Speeds

Unit	Speed
bps	bits per second
kbps	thousand bits per second
mbps	million bits per second
gbps	billion bits per second

Types of Connection Service

- **Dial-Up services**
- **Leased lines** – T1, T2, T3 and T4
- **Digital subscriber line** (DSL)
  - Uses existing phone lines
  - One type widely used is **ADSL**
- **Cable modems**
  - Uses existing TV cable
  - Provides speeds as fast as DSL at a lower cost
- **Satellite/air connection services**
  - Seven times faster than dial-up
  - Slower than DSL & cable modem
- **Cellular Services**
  - Alternative for mobile devices and laptops
  - Current service areas limited

Typical User Connection Costs & Speeds

Type	Monthly Fee	Speed	Seconds to Receive Image
Dial-up	$10	56 kbps	45.0 seconds
DSL	30	30 mbps	0.85 second
Cable modem	40	40 mbps	0.65 second
Satellite	75	900 kbps	2.8 seconds
Cellular	55	550/50 kbps	4.6/51.0 seconds

9-16

Bandwidth

- **Measurement of the capacity of the channel**

- **Categories**
  - **Voiceband also known as low bandwidth**
  - **Medium band**
  - **Broadband**
    - **Used for high capacity transmission**
    - **Used by DSL, cable, and satellite**

9-17

Protocols

- **Set of communication rules**
- **Standard for Internet: TCP/IP (Transmission Control Protocol / Internet Protocol)**
  - **Identification**
  - **Reformatting**
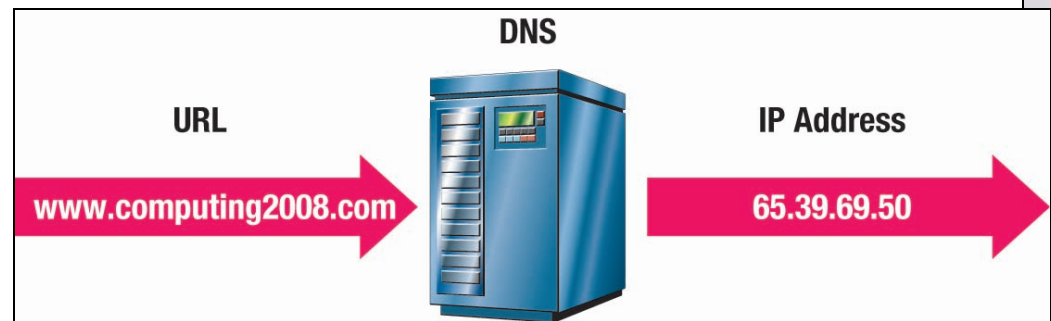
Networks

- **A computer network is a communication system**
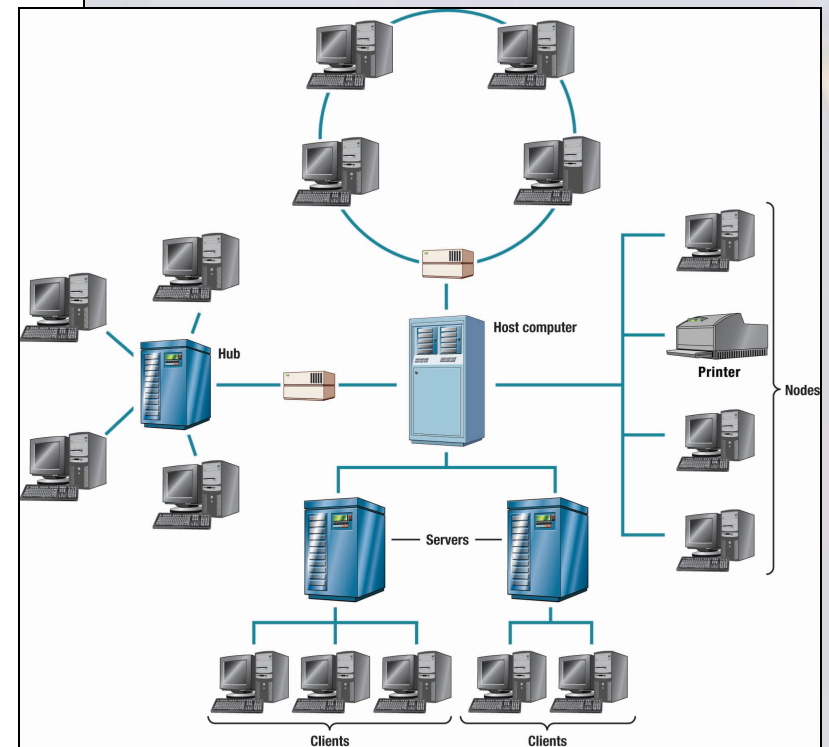- **Connects two or more computers**
- **Allows information exchange**

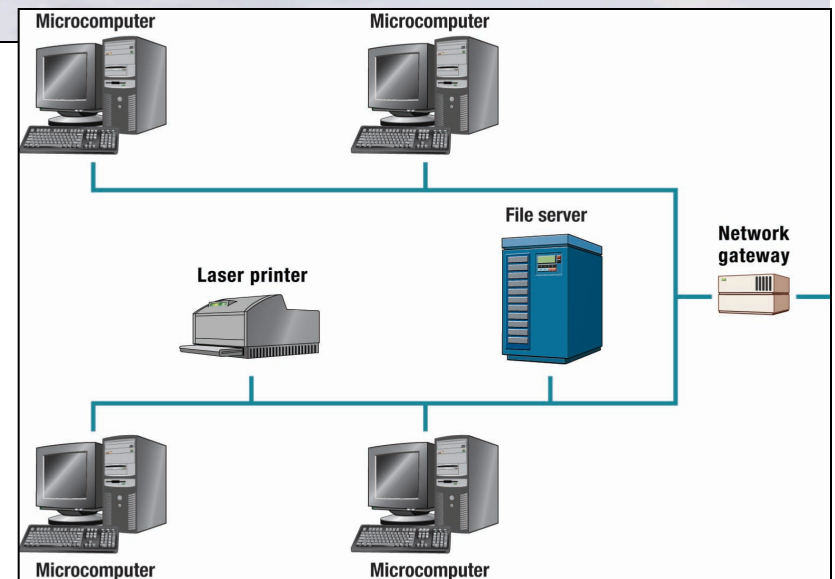# Computer Networks

Computer Networks Connect Computers

Common network terms

- **Node**
- **Client**
- **Server**
- **Hub**
- **Network interface cards (NIC)**
- **Network operating system (NOS)**
- **Distributed processing**
- **Host computer**
- **Network administrator**

9-20

Network Types

- **Local area networks**

- **Home networks**
  - **WLAN**

- **Metropolitan networks**

- **Wide area networks**

LAN

| Type	Description
LAN	Local area network; licated within close proximity
Home	Local area network for home and apartment use; typically wireless
MAN	Metropolitan area network; typically spans cities with coveraage up to 100 miles
WAN	Wide area networkfor countrywide or worldwide coverage; internet is largest WAN

Network Architecture

- **Architecture describes how a network is arranged**

- **Arrangement is called topology**

- **Types of network topology**
  - **Star**
  - **Bus**
  - **Ring**
  - **Hierarchical**
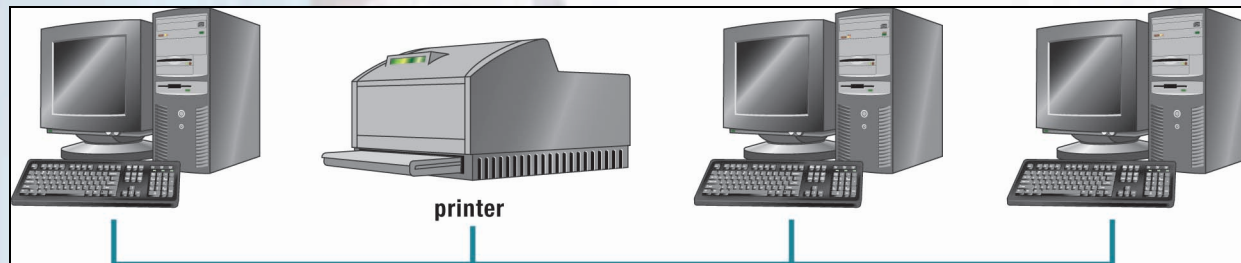
9-22

Star Network

- **Smaller computers linked to a central unit**

- **Central unit is called the network hub**
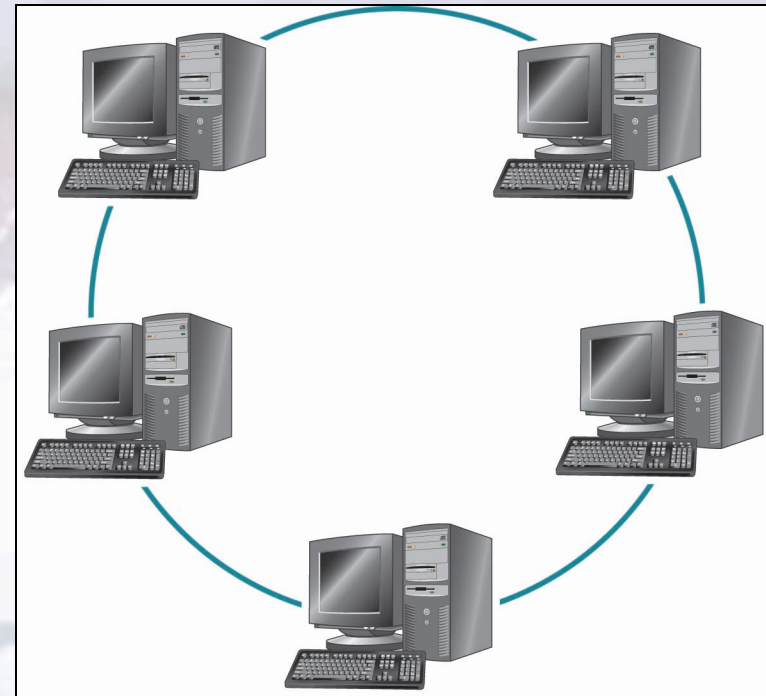
- **Control is maintained by polling**

9-23
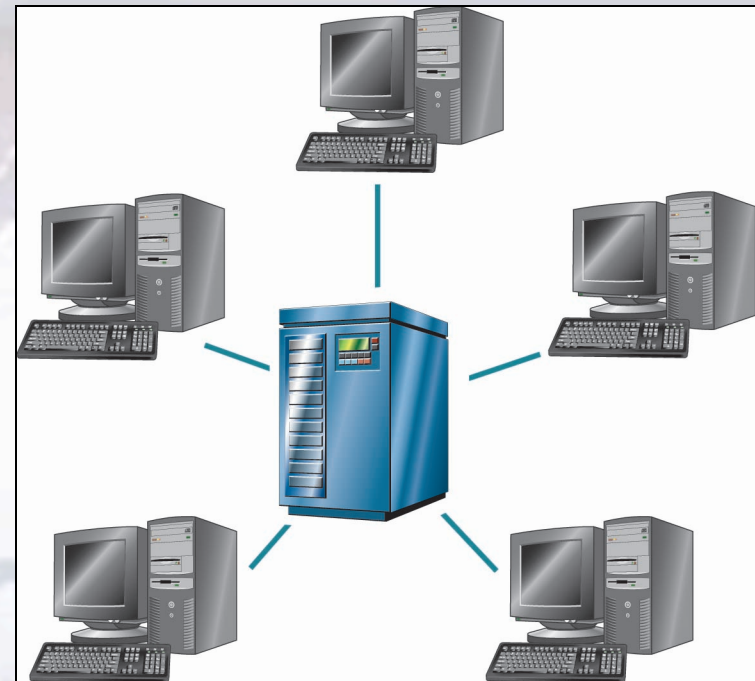
Bus Network

- **Each device handles its own communication control**

- **There is no host computer**

- **Has a common connecting cable called a backbone**
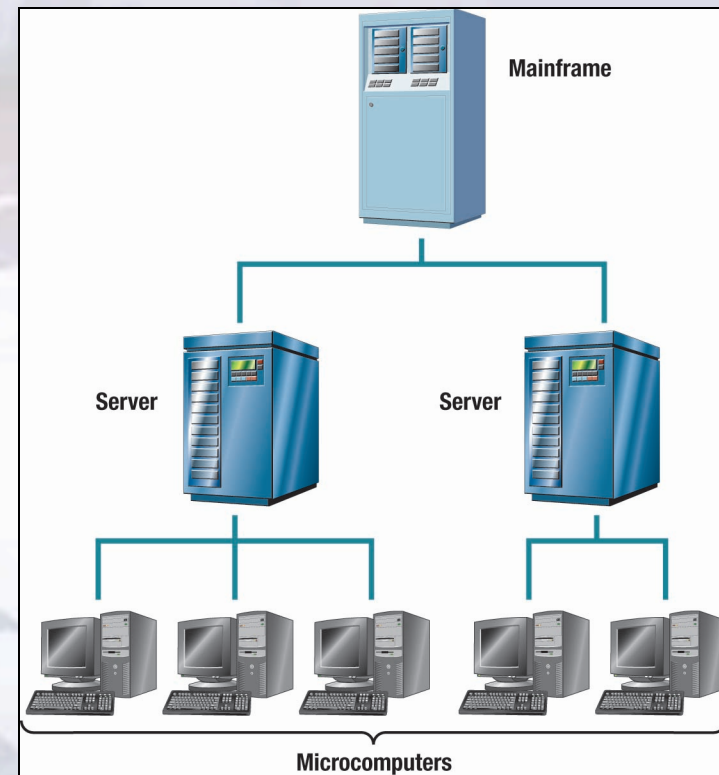

printer

Ring Network

- **Each device is connected to two other devices**

- **No central file server or computer**

- **Useful in a decentralized environment**

Hierarchical Network

- **Several computers linked to a central host**

- **Computers are hosts to other computers**

- **Useful in centralized organizations**

Principal Network Configurations

| Topology	Description
Star	Several computers connected to a central server or host; all communications travel through central server; good for sharing common resources
Bus	Computers connected by a common line; communication travels along this common line; less expensive than star
Ring	Each computer connected to two others, forming a ring; communications travel around ring; often used to link mainframe computers in decentralized organizations
Hierarchical	One top-level host computer connected to next-level computers, which are connected to third-level computers; often used in centralized organizations

Strategies

- **Strategy** is a way of coordinating the sharing of information and resources

- Common network strategies
  - Terminal
  - Client/server
  - Peer-to-peer
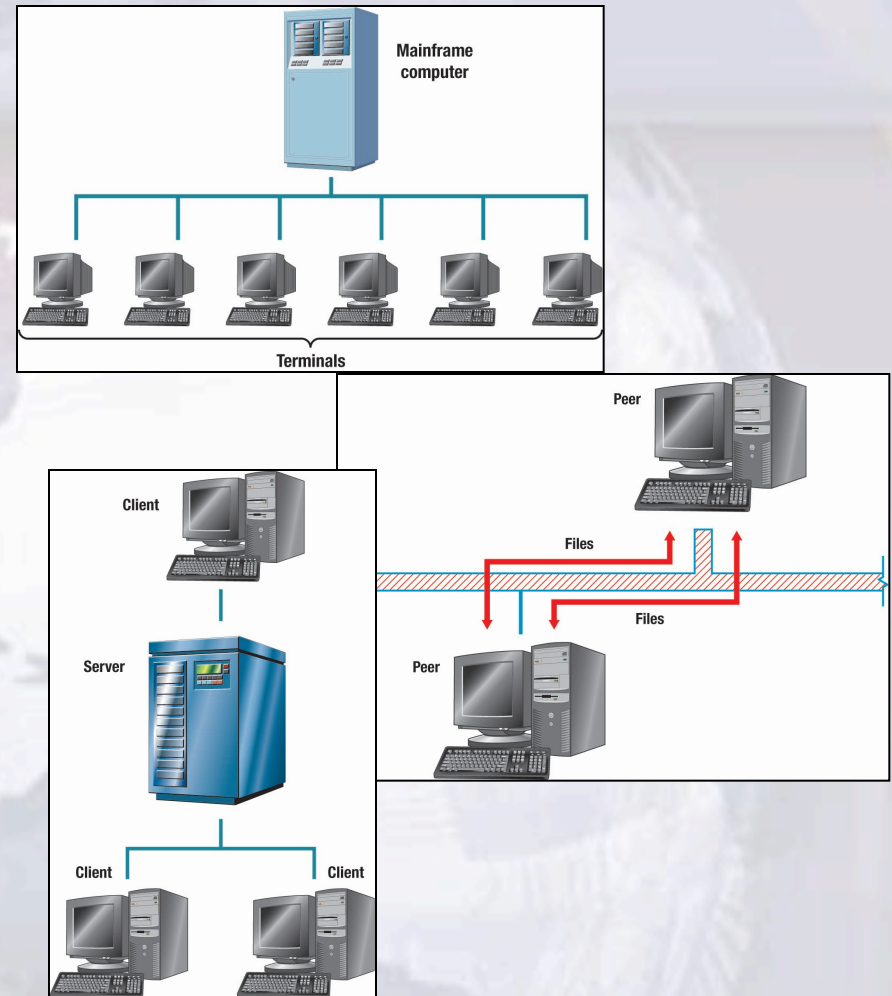
Organizational Internets

- ## Intranets
  - ### Private network within an organization
  - ### Provides information to employees

- ## Extranets
  - ### Private network that connects organizations
  - ### Used to allow suppliers and others access

Organizational intranet   Organizational intranet

Extranet connection

Firewall   Firewall

Proxy server   Proxy server
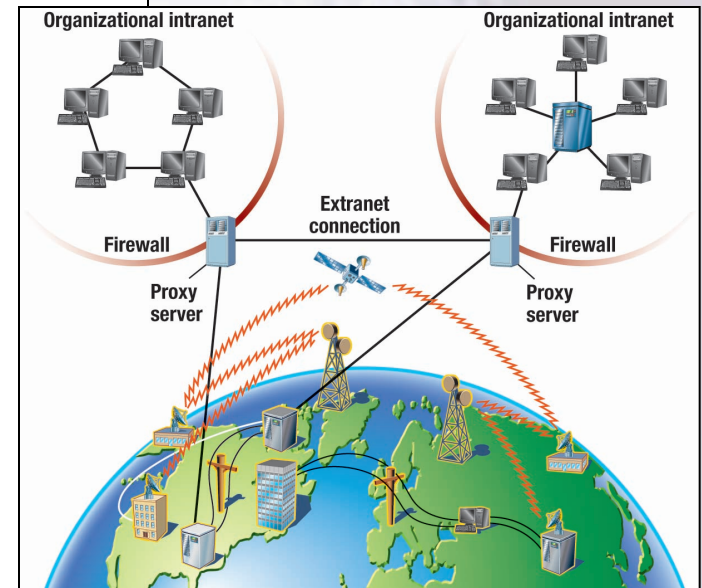
Firewalls

Goals:

Protect against external threats

Monitor all communication
   into and out-of a computer (or LAN)

Identify and block "bad" traffic

Act as a "gatekeeper"

Can be installed on individual computers

Can also be installed where LAN connects to WAN

"Proxy Server"

Clients applications think they are talking to servers

Clients really talk to proxy, which talks to server

Proxy acts as a gatekeeper

Proxy decides whether to pass messages through

Careers In IT

- **Network Administrator**
  - Manage a company's LAN and WAN networks
  - Maintain hardware and software
  - Diagnose and repair problems
  - Candidates usually have a bachelor's degree in computer science and practical experience
  - Annual salary is typically between $43,000 and $68,000

A Look to the Future
Cars that Monitor and Respond

- **Pod car (Personalization on Demand)**
- **Predicts and responds**
- **Designed to learn and adapt to an individual's driving needs and habits**

Discussion Questions (1 of 2)

- **Define and discuss connectivity, the wireless revolution, and communications.**

- **Identify and describe the various physical and wireless communication channels.**

- **Identify the standard Internet protocol and discuss its essential features.**

Discussion Questions

- **Define and discuss the four principal network topologies.**

- **Define and discuss the three most common network strategies.**