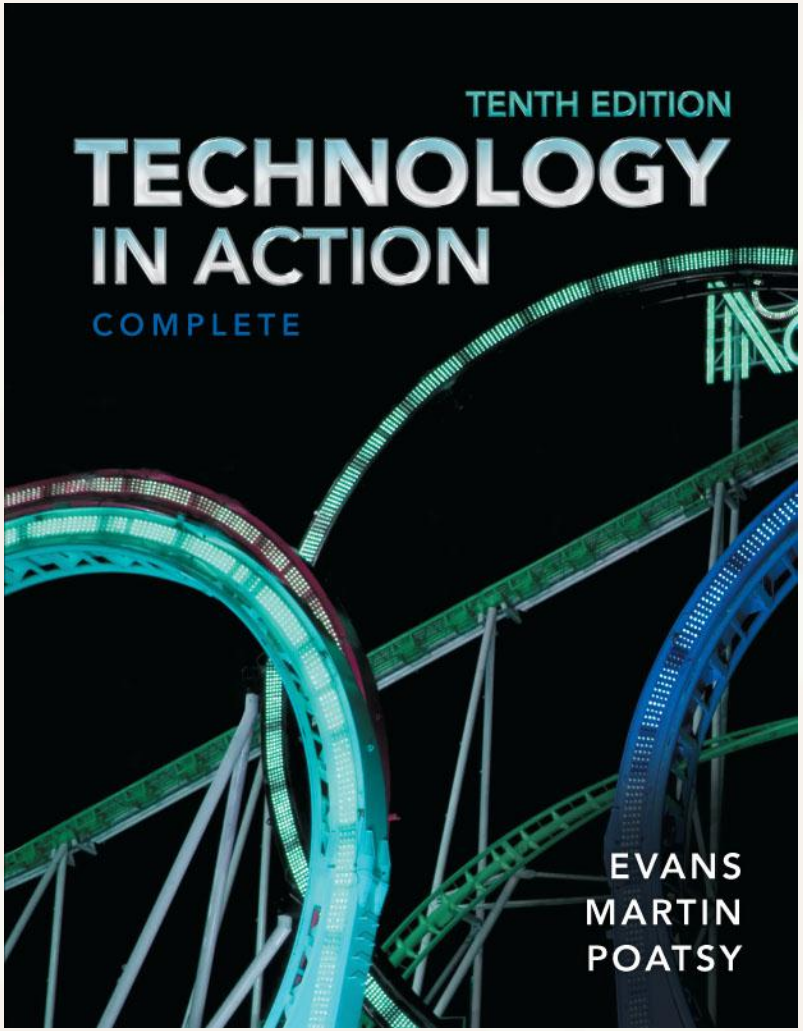



# *Technology in Action*

Alan Evans • Kendall Martin

Mary Anne Poatsy

Tenth Edition

# *Technology in Action*

Chapter 5

Networking:

Connecting Computing Devices

# Chapter Topics

- Networking Fundamentals
- Network Architecture and Components
- Connecting to the Internet
- Installing and Configuring Home Networks
- Securing Wireless Networks

# Networking Fundamentals

- A computer network is two or more computers connected via hardware and software
- A node is any device connected to a network
  - Computer
  - Peripheral (i.e., a printer)
  - Network device (i.e., a router)

# Networking Fundamentals

- Facilitates resource sharing
  - Sharing high-speed Internet connection
  - Sharing peripheral devices such as printers
  - Sharing files
  - Common communications

# Networking Fundamentals

# Networking Fundamentals

- Home networks: After installation, easy to maintain
- Large networks need to be administered
  - Involve initial purchase of equipment
  - Require network administration
    - Installing new computers and devices
    - Monitoring the network's performance
    - Updating and installing new software
    - Configuring network security
  - Benefits usually outweigh disadvantages

# Networking Fundamentals

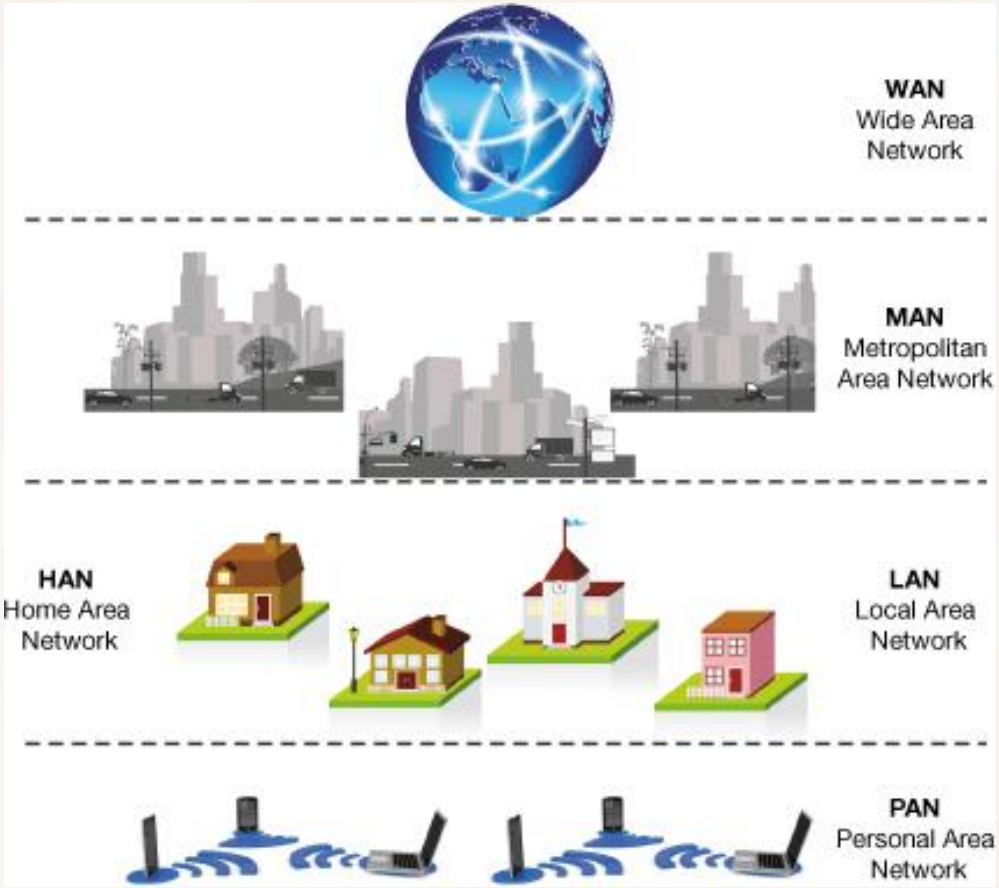
- Data transfer rate (bandwidth): Maximum speed at which data can be transmitted between two nodes
- Throughput: Actual speed of data transfer achieved
- Measured in megabits per second (Mbps)

# Network Architectures

- Network architecture refers to the design of a network
- Classified according to
  - Distance between their nodes
  - How they are managed
  - The set of rules used to exchange data between nodes
  - The communications medium used to transport data

# Network Architectures Defined by Distance

- Networks can be classified by the distance between their nodes



# Network Architectures Defined by Distance

- Personal area network (PAN)
  - One person
  - Connects smartphones, notebooks, and tablets using Bluetooth and WiFi
- Local area network (LAN)
  - Nodes located in small geographic area
  - Computer lab or fast-food restaurants
- Home area network (HAN)
  - Connects all digital devices in a home

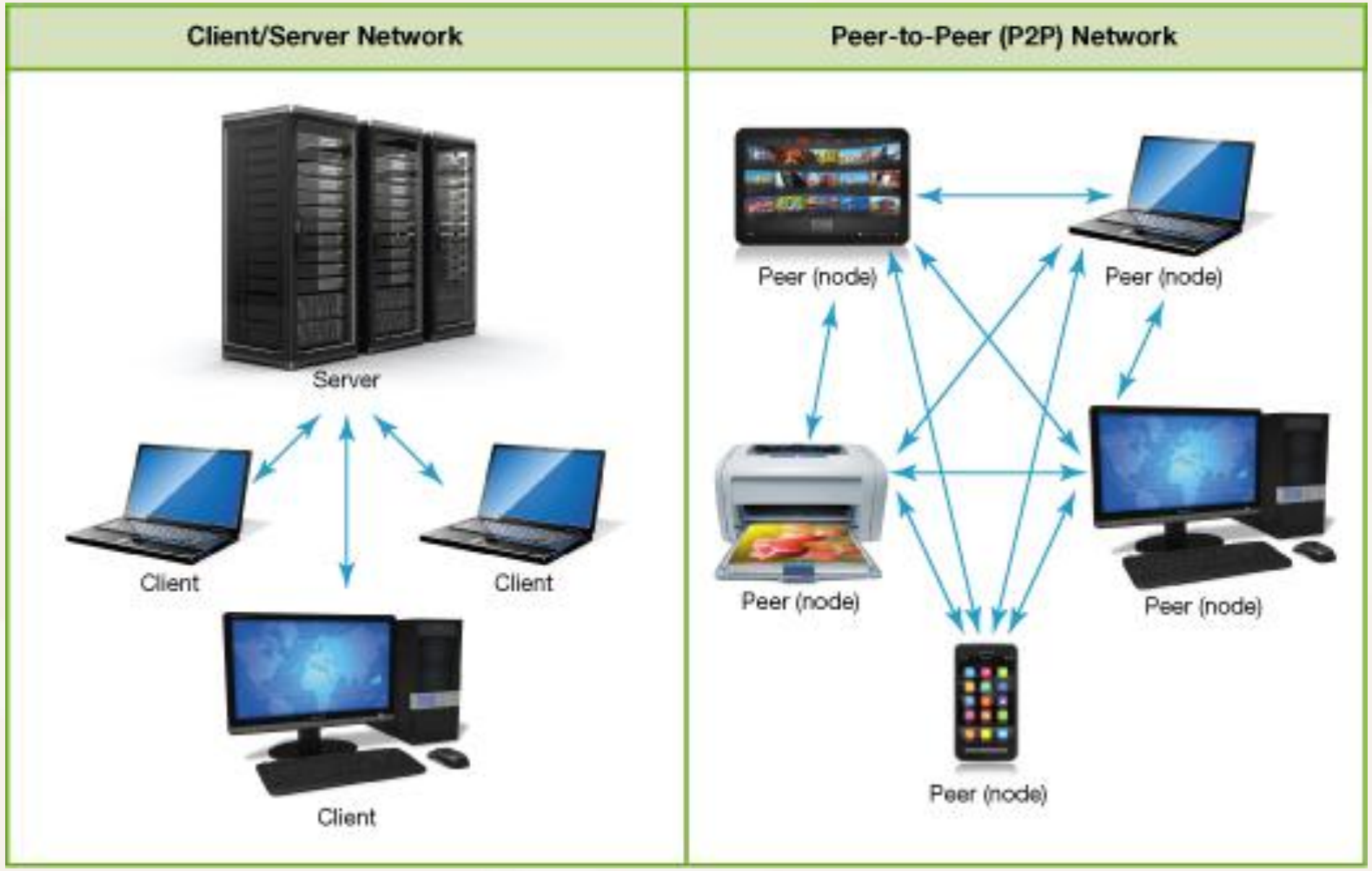
# Network Architectures Defined by Distance

- Metropolitan area network (MAN)
  - Large network
  - Covers large area such as an entire city
- Wide area network (WAN)
  - Spans large physical distance
  - The Internet is the largest WAN
  - Also a networked collection of LANs

# Network Architectures Defined by Level of Administration

- Administered in one of two ways
  - Central administration
    - Tasks can be performed from one computer and affect other computers on the network
    - Client/server network
  - Local administration
    - Configuration and maintenance must be performed on each individual computer attached to network
    - Peer-to-peer network

# Network Architectures Defined by Level of Administration



# Network Architectures Ethernet Protocols

- Ethernet network
  - Uses the Ethernet protocol for communication
  - Developed by the Institute of Electrical and Electronics Engineers (IEEE)
  - 802.3: Standard for wired Ethernet networks
  - 802.11: Standard for wireless Ethernet networks
    - 802.11n: Current version
    - 802.11ac: Newer standard currently being

# Network Architectures Ethernet Protocols

- 802.11g devices will work with 802.11n networks
  - Slower data transfer rates
  - Some frequency interference
- Backward compatibility: Ability of current devices to use earlier standards

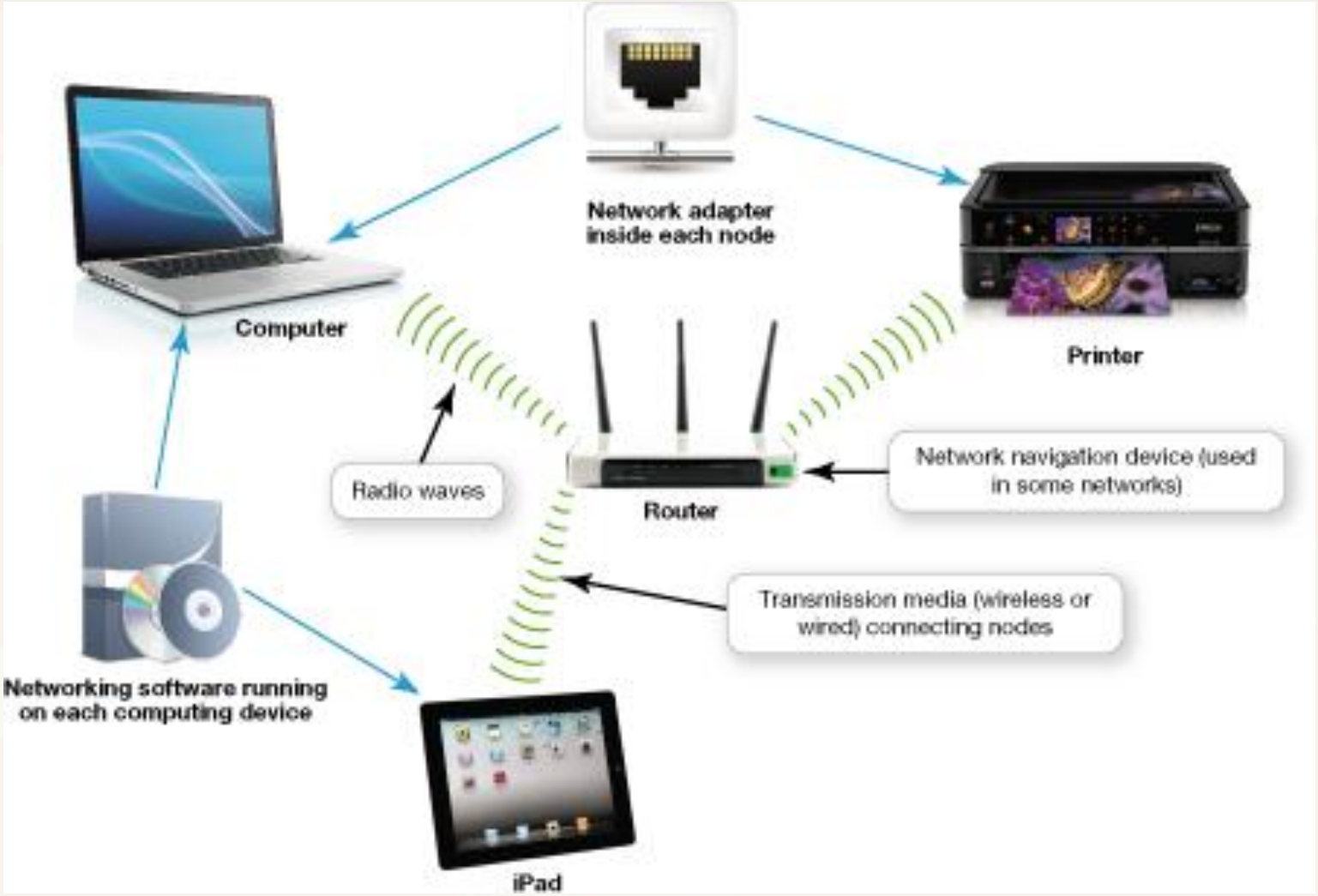
# Network Architectures Ethernet Protocols

- Gigabit Ethernet Standard: Most commonly used wired Ethernet standard for home networks
  - Up to 1 gigabit per second (Gbps) data transfer rate
  - 10 gigabit Ethernet is available

# Network Components

- All networks must include
  - Means of connecting nodes to network (cables or wireless technology)
  - Special devices that allow nodes to communicate with each other
  - Software that allows network to run

# Network Components



# Network Components Transmission Media

- Establish a communications channel between nodes on network
  - Wireless networks use radio waves
  - Wired networks use cables to connect nodes
    - Unshielded twisted pair (UTP) cable is used for networks
      - Composed of four pairs of wires twisted around each other to reduce electrical interference

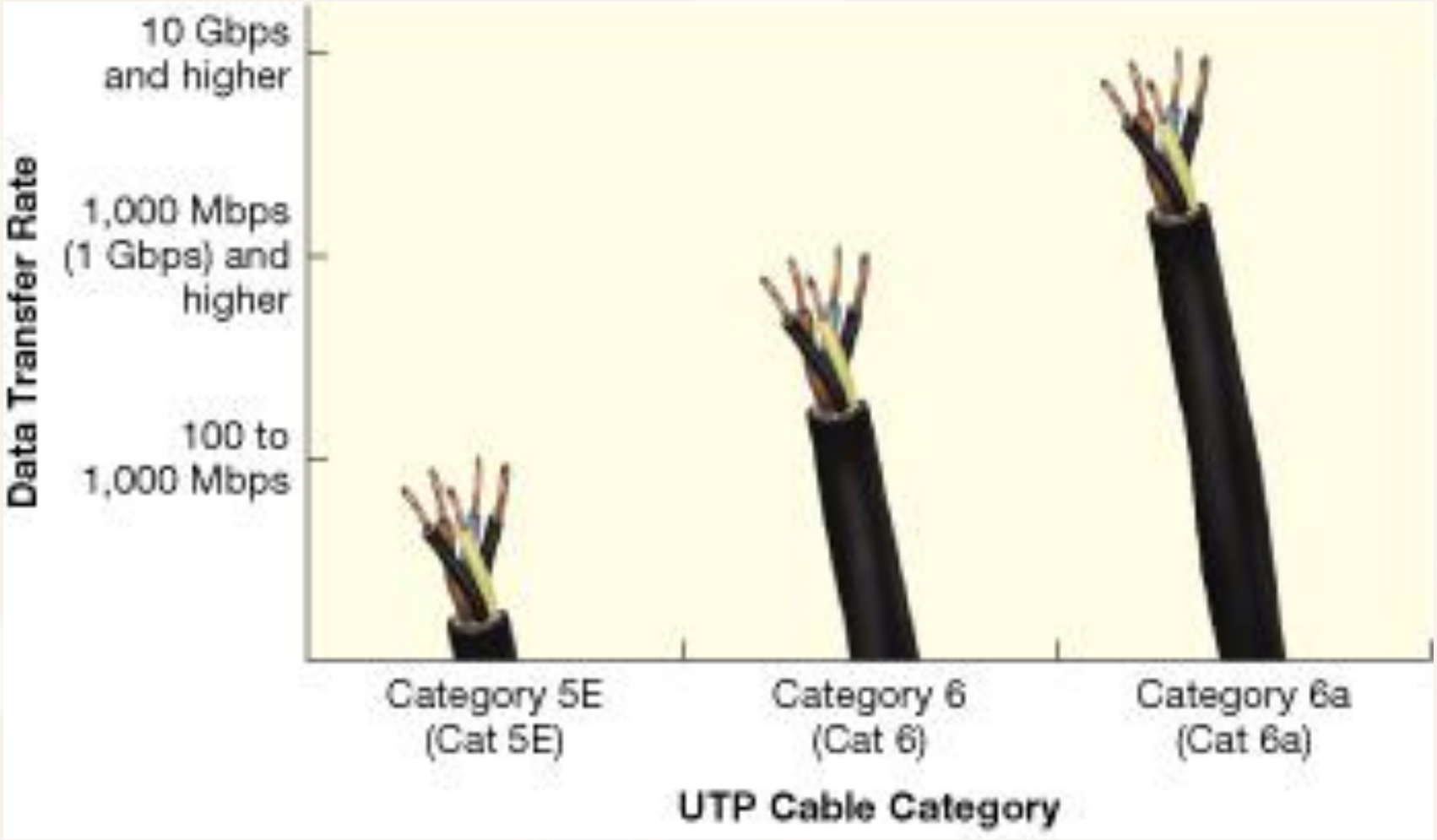
# Network Components
# Transmission Media

- Wired networks use cables to connect nodes (cont.)
  - Coaxial cable consists of single copper wire surrounded by layers of plastic
  - Fiber-optic cable is made up of plastic or glass fibers that transmit data extremely fast

# Network Components Transmission Media (cont.)

- UTP cable: Most popular for wired Ethernet networks
- Types of UTP cable
  - Cat 5E: Cheapest, designed for 100 Mbps
  - Cat 6: Designed to support gigabit Ethernet network
  - Cat 6a: Designed for ultra-fast Ethernet networks

# Network Components
# Transmission Media (cont.)



# Network Components Transmission Media (cont.)

- Wireless fidelity (WiFi): Standard for wireless transmissions using radio waves used to connect computing devices to wireless networks and the Internet

# Network Components Transmission Media (cont.)

- Wireless networks generally have decreased throughput
  - More susceptible to interference from magnetic and electrical sources
  - Other wireless networks can interfere
  - Buildings and metal can decrease throughput
  - The distance between networking equipment
  - Signal coding

# Network Components
# Basic Network Hardware

- Network adapter: Each node on a network needs an adapter to communicate
- Network interface card (NIC): Network adapter installed inside a device
- Broadband Internet requires a modem
  - Cable or DSL
  - Translates the broadband signal

# Network Components
# Basic Network Hardware (cont.)

- Packets: Bundles of data sent through a network
  - For computers to communicate packets must flow between network nodes

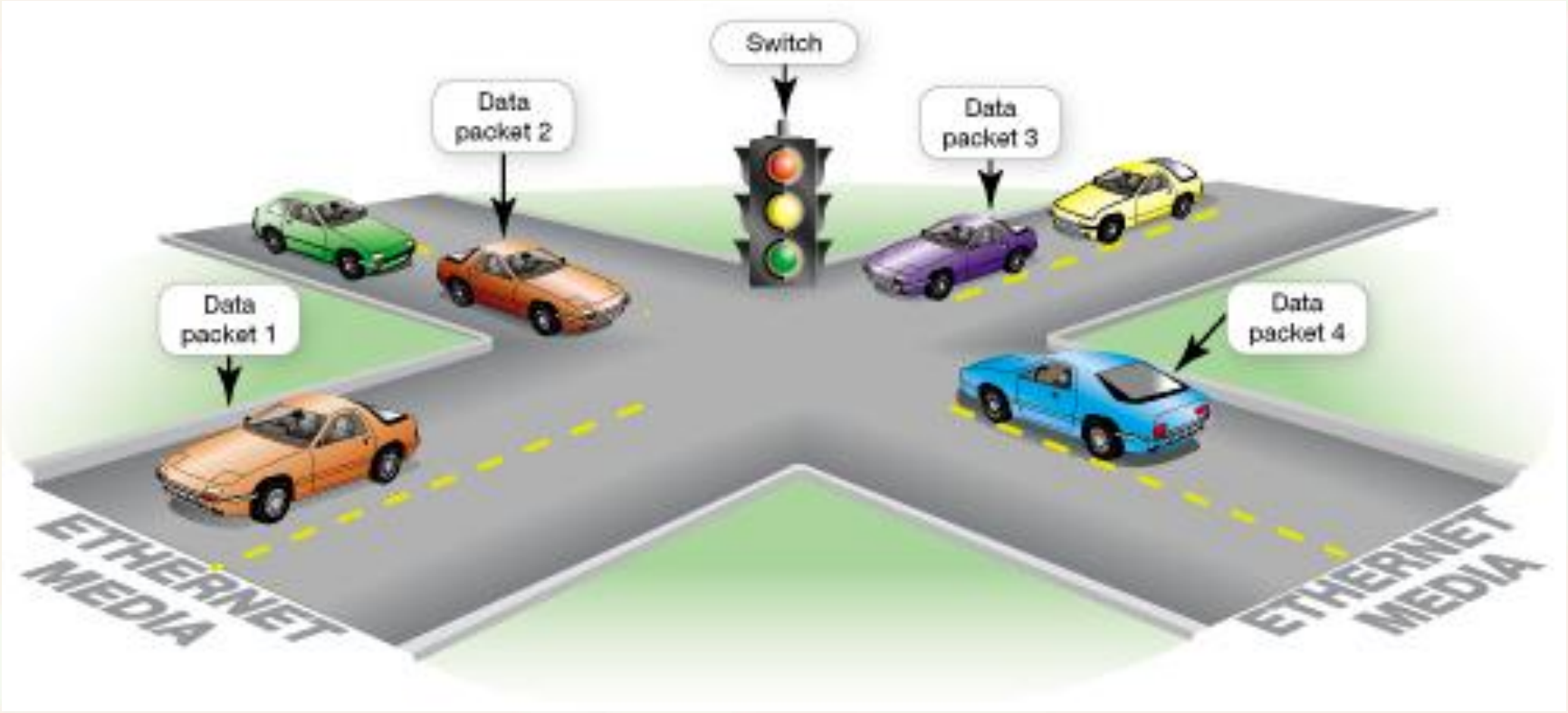
# Network Components
# Basic Network Hardware (cont.)

- Routers and switches facilitate and control the flow of data
  - Router: Transfers packets of data between two or more networks
  - Switch: Receives data packets and sends them to intended nodes on the same network

# Network Components
# Basic Network Hardware (cont.)

- Router is connected directly to the broadband modem
- All other computing devices are connected to the router
  - Wired or wireless

# Network Components
# Basic Network Hardware (cont.)



# Network Components
# Network Software

- Home networks need operating software that supports P2P networking
- Client/server network
  - Communicate through centralized server
  - Specialized network operating system (NOS) software
    - Handles requests for information, Internet access, and peripherals
    - Windows Server and SUSE Linux Enterprise Server

# Network Components
# Network Software

# Connecting to the Internet

- Main reason for home network is to share an Internet connection
- Must purchase Internet access from Internet service providers (ISPs)
  - Specialized providers
  - Companies that provide other services

# Connecting to the Internet (cont.)

- Connection choices
  - Broadband uses high-speed data access
  - Dial-up uses conventional phone lines

# Connecting to the Internet
# Wired Broadband Connections

- Broadband
  - High-speed Internet
  - Data transmission rate of 5 Mbps or greater
- Standard wired broadband technologies
  - Cable
  - Digital subscriber line (DSL)
  - Fiber-optic service

# Connecting to the Internet
# Wired Broadband Connections

- Satellite broadband used in rural and mountain areas
- Mobile broadband is offered by cell-phone service providers

# Connecting to the Internet
# Wired Broadband Connections (cont.)

- Cable Internet: Broadband service that transmits over coaxial cable
- DSL: Uses twisted-pair cable, same as telephones
- Fiber-optic service: Uses fiber-optic lines, strands of optically pure glass or plastic, thin as human hair, can transmit enormous amount of data superfast

# Connecting to the Internet
# Wired Broadband Connections (cont.)

- Satellite Internet: Need a satellite dish connected to your computer

# Connecting to the Internet
# Wireless Internet Access

- Wireless Internet at home
  - Router with wireless capabilities
  - Right equipment on mobile device
  - Virtually all laptops, smartphones, game systems, and personal media players have WiFi built in

# Connecting to the Internet
# Wireless Internet Access (cont.)

- Use a WiFi hotspot
  - WiFi is standard for wireless transmissions using radio waves
- Wireless in-flight Internet is available
  - Gogo

# Connecting to the Internet Wireless Internet Access (cont.)

- Mobile broadband: Connect to Internet through cellular network to get 3G or 4G access
  - Many devices such as iPads and notebooks are available with 3G or 4G capabilities

# Connecting to the Internet Wireless Internet Access (cont.)

- 3G or 4G capabilities
  - Built in on many devices (iPad, Kindle Fire, Chromebook)
  - USB modem is available
  - Mobile hotspot: Connect more than one device to the Internet with either WiFi or mobile broadband, requires data plan

# Connecting to the Internet
# Dial-Up Connections

- About 70% of Internet users use high-speed
- Dial-up connection
  - No high-speed service available
  - Least costly
  - Slow speed

# Installing and Configuring Home Networks

- Home networks today are very different from those just a few years ago
- Support smartphones, gaming consoles, tablets, and smart TVs in addition to computers and printers

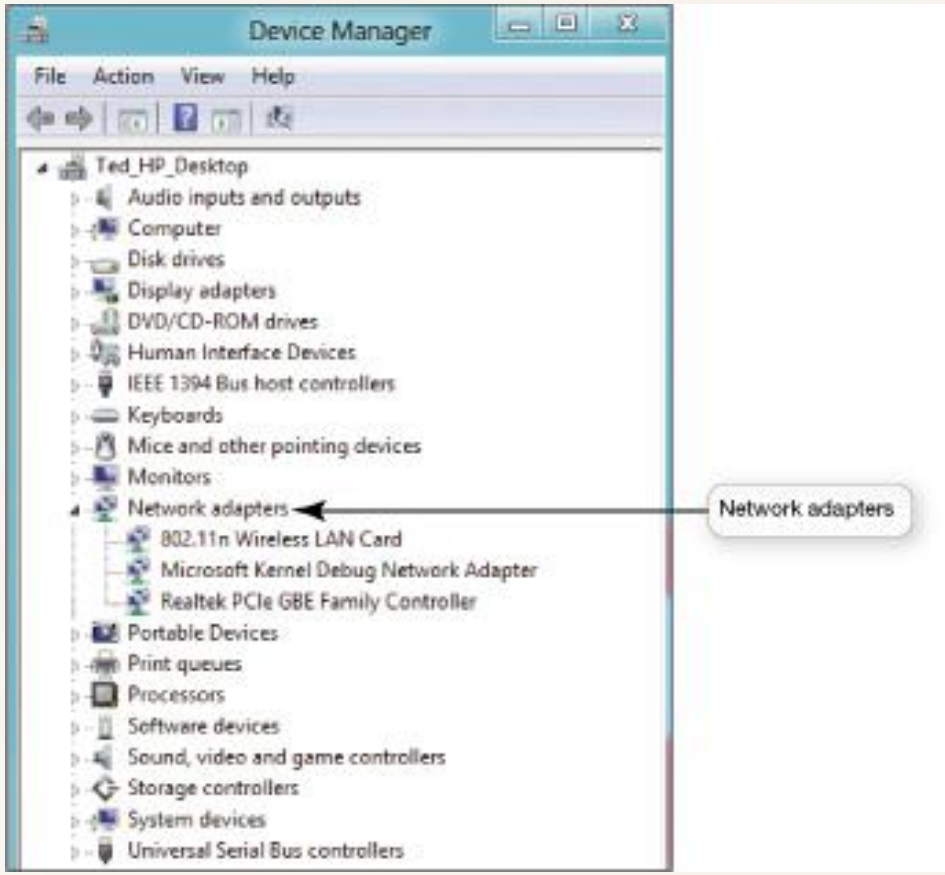
# Installing and Configuring Home Networks
## Planning Your Home Network

- Setting up a home network
  - First evaluate your current devices and future devices
  - Home networks run most efficiently and provide the fastest speeds when all nodes use the latest Ethernet standard
  - Current Ethernet standard: 802.11n

# Installing and Configuring Home Networks
## Planning Your Home Network

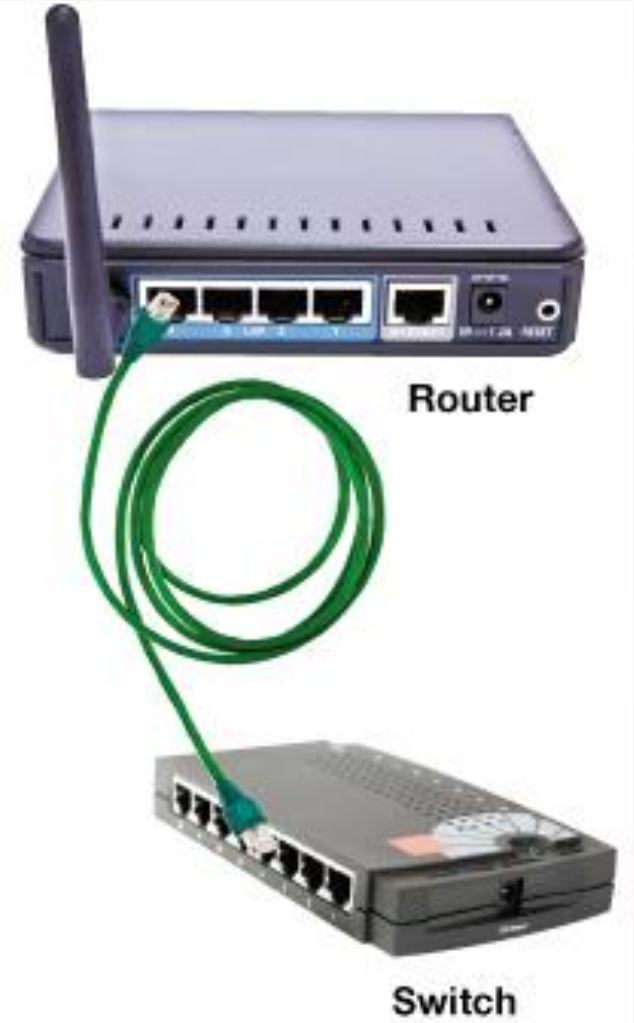
# Installing and Configuring Home Networks
## Planning Your Home Network (cont.)

- Device Manager: Lists all the adapters on your computer



# Installing and Configuring Home Networks
## Connecting Devices to a Router

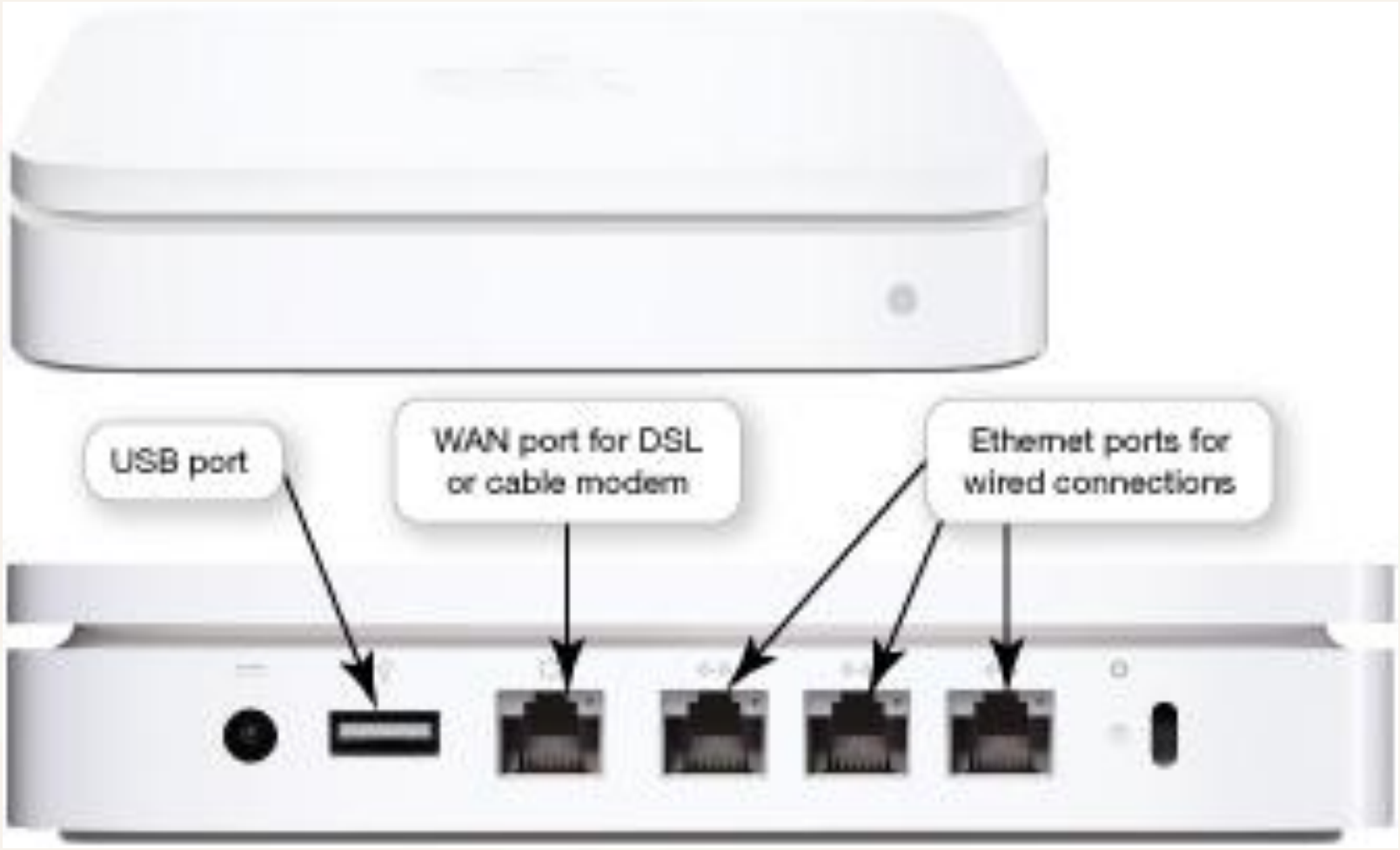
- Most routers have three or four Ethernet ports
- Add a switch if you need more



# Installing and Configuring Home Networks Connecting Devices to a Router (cont.)

- Most home wireless routers can support up to 253 wireless connections at one time
- All routers that support 802.11n should work with Windows or OS X
- Apple has designed routers for Apple computers
  - AirPort Extreme router
  - Windows machines can also connect

# Installing and Configuring Home Networks Connecting Devices to a Router (cont.)



# Installing and Configuring Home Networks Connecting Devices to a Router (cont.)

- To determine what's connected to your router, log in to the IP address

# Installing and Configuring Home Networks Network-Attached Storage Devices

- Network-attached storage (NAS) devices: Specialized devices designed to store and manage all network data
  - Specialized hard drives
  - Connect to the router or switch to connect to network
- Time Capsule: Wireless router and hard drive for Apple computers
  - Computer backup

# Installing and Configuring Home Networks
## Network-Attached Storage Devices

# Installing and Configuring Home Networks
## Home Network Servers

- Home network server: Specialized devices designed to store files, share files across the network, back up files, and allow access with a remote connection
- Configured with Windows Home Server
- Connect directly as a node

# Installing and Configuring Home Networks
## Home Network Servers

# Installing and Configuring Home Networks Digital Entertainment Devices on a Network

- Network-ready devices can be connected directly to a network
  - Wired or wireless connection
  - Blu-ray players, DVRs, and smart TVs
- Connecting entertainment devices lets you
  - Access and share digital data
  - Access Internet entertainment content
  - Play multiplayer games

# Installing and Configuring Home Networks
## Digital Entertainment Devices on a Network (cont.)

- Blu-ray players have many of the features of smart TVs
  - Integrated wireless
- LG Smart TV Upgrader: Set-top box that provides same types of connectivity as Blu-ray player

# Installing and Configuring Home Networks
## Digital Entertainment Devices on a Network (cont.)

- TiVo Premiere: Record TV and download directly form Netflix and Amazon
- PlayStation 3 can function as a total entertainment platform when connected to the Internet

# Installing and Configuring Home Networks Specialized Home-Networking Devices

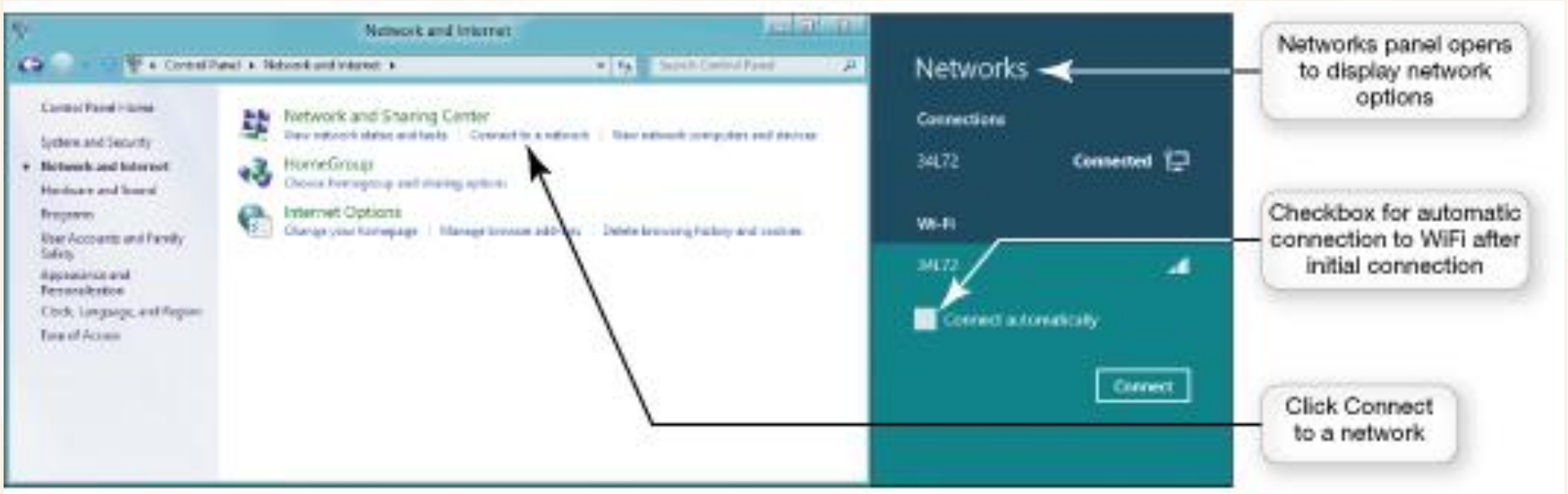
- New digital picture frames can connect to home networks
  - Built-in wireless
  - Can access network and online photos
  - Can receive pictures via e-mail
- Home networks can be used for security
  - Monitoring cameras with wireless connectivity

# Installing and Configuring Home Networks
## Configuring Software for Your Home Network

- Before configuring your home network do the following
  - Make sure all nodes have network adapters
  - Check all cables for wired connections
  - Make sure modem is connected to the router and to the Internet
  - Turn on your equipment
  - Open the Network and Sharing Center

# Installing and Configuring Home Networks
## Configuring Software for Your Home Network (cont.)

- Homegroup: Software device that makes it easier to allow computer on Windows 8 to share



# Installing and Configuring Home Networks
## Configuring Software for Your Home Network (cont.)

- Computers with various versions of Windows can coexist on same network
  - Set up computers running newest version of Windows first
- Connecting Macs to wireless networks
  - When you boot up wireless card should be on
  - Network login screen will appear
  - Enter network password if necessary
  - Click Join button

# Installing and Configuring Home Networks Troubleshooting Wireless Network Problems

- Maximum range of 802.11n is 350 feet
  - If a node is running slow
    - Reposition the node within the same room
    - Move the node closer to the router
    - Use a dual-band N router or wireless range extender
  - Dual-band N router allows for simultaneous support for both 2.4 GHz and 5 GHz
  - Wireless range extender: Amplifies wireless signal

# Installing and Configuring Home Networks
# Troubleshooting Wireless Network Problems

# Securing Wireless Networks

- Computers that connect to Internet must be secured from intruders
- Usually accomplished by using a firewall
  - Hardware or software solution
- Wireless networks present special vulnerabilities

# Securing Wireless Networks

- Configure network security before connecting nodes on your network
- Hacker: Someone who breaks into computer systems
- Piggybacking: Connecting to a wireless network without permission

# Securing Wireless Networks

- Precautions to secure a wireless network
  - Change your network name (SSID)
  - Disable SSID broadcast
  - Change the default password on your router
  - Turn on security protocols
  - Create a passphrase
  - Implement media access control
  - Limit your signal range
  - Apply firmware upgrades
    - Firmware is software written to read-only memory

# Securing Wireless Networks

# Chapter 7 Summary Questions

1. What is a network, and what are a network's advantages and disadvantages?

# Chapter 7 Summary Questions

2. What are the different ways to classify networks?

# Chapter 7 Summary Questions

3. Which type of network is most commonly found in the home?

# Chapter 7 Summary Questions

4. What are the main components of every network?

# Chapter 7 Summary Questions

5. What are my options for connecting to the Internet?

# Chapter 7 Summary Questions

6. How do I tell if my home network is up to date, and how do I identify the devices on the network?

# Chapter 7 Summary Questions

7. Besides computers, what other devices can I connect to a home network?

# Chapter 7 Summary Questions

8. How do I configure the software on my computer and set up the devices required to get my network up and running?

# Chapter 7 Summary Questions

9. What problems might I encounter when setting up a wireless network?

# Chapter 7 Summary Questions

10. Why are wireless networks more vulnerable to security risks than wired networks, and what special precautions are required to ensure my wireless network is secure?