Technology in Action

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Eleventh Edition

Technology in Action

Chapter 5

Networking:

Connecting Computing Devices

Chapter Topics

- Networking Fundamentals

- Network Architectures and Components

- Connecting to the Internet

- Installing and Configuring Home Networks

- Securing Wireless Networks

How Networks Function

- Networking Fundamentals
- Network Architectures and Components
- Connecting to the Internet

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Networking Fundamentals

- Computer network

- Node
  - Computer
  - Peripheral
  - Network device

Networking Fundamentals

- Benefits to Networking Computers:

- Resource sharing

  – High-speed Internet connection

  – Peripheral devices

  – Files

- Common communications

Networking Fundamentals

Jackie watches a video she took while on vacation

Andy plays PlayStation online and uploads a video he made for school

Mom watches a lecture from her online course while she prepares a snack

Dad watches a streaming movie and checks fantasy football scores on his iPad

Andrea takes pictures of her dog and uploads them directly to Facebook

Networking Fundamentals

- Drawbacks of large networks
  - Purchase of equipment
  - Network administration
- Benefits usually outweigh disadvantages

# Networking Fundamentals

- Data transfer rate (bandwidth)

  – Maximum rate of data transfer *possible*

- Throughput

  – Maximum rate *achieved*

- Measured in megabits per second (Mbps) or gigabits per second (Gbps)

Network Architectures

- Classified by:
    - Distance between nodes
    - How they are managed
    - Rules used to exchange data between nodes
    - Communications medium used

Network Architectures:
Defined by Distance

- Distance between nodes
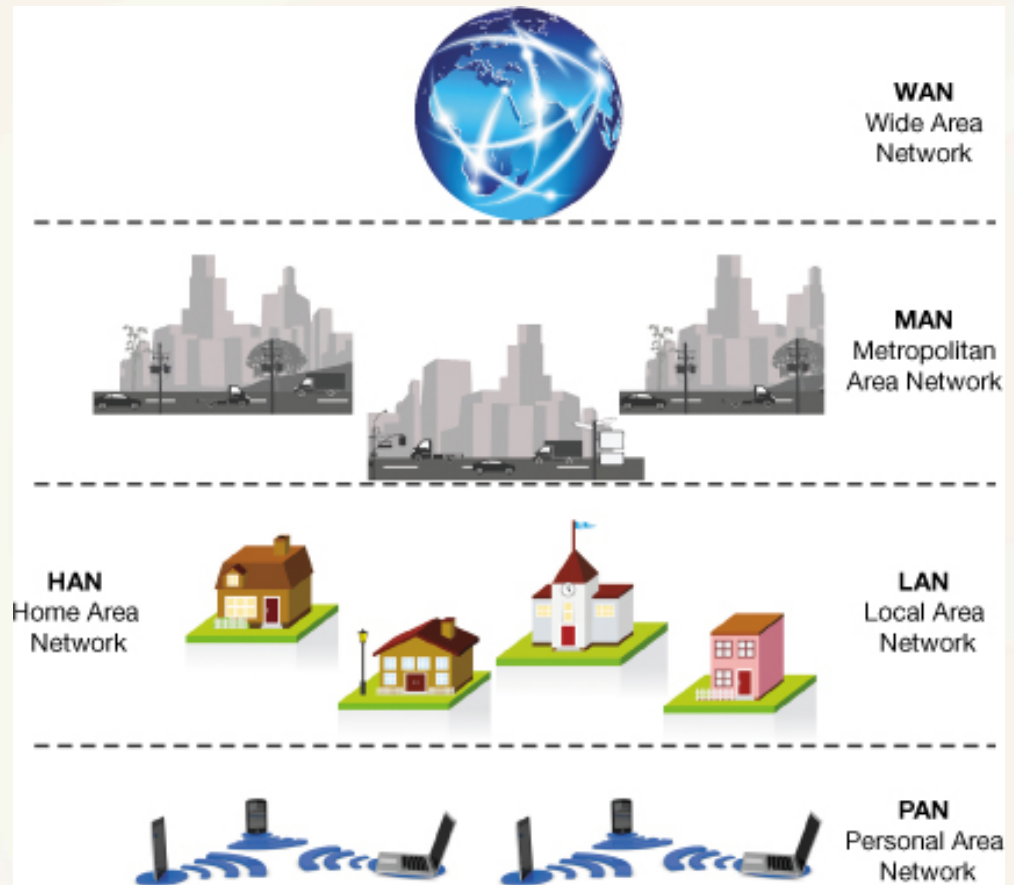
Network Architectures:
Defined by Distance

Network Architectures:
Defined by Level of Administration

- ## Central Administration

- ## Local Administration

Client/Server Network

Server

Client

Client

Client

Peer-to-Peer (P2P) Network

Peer (node)

Peer (node)

Peer (node)

Peer (node)

Peer (node)
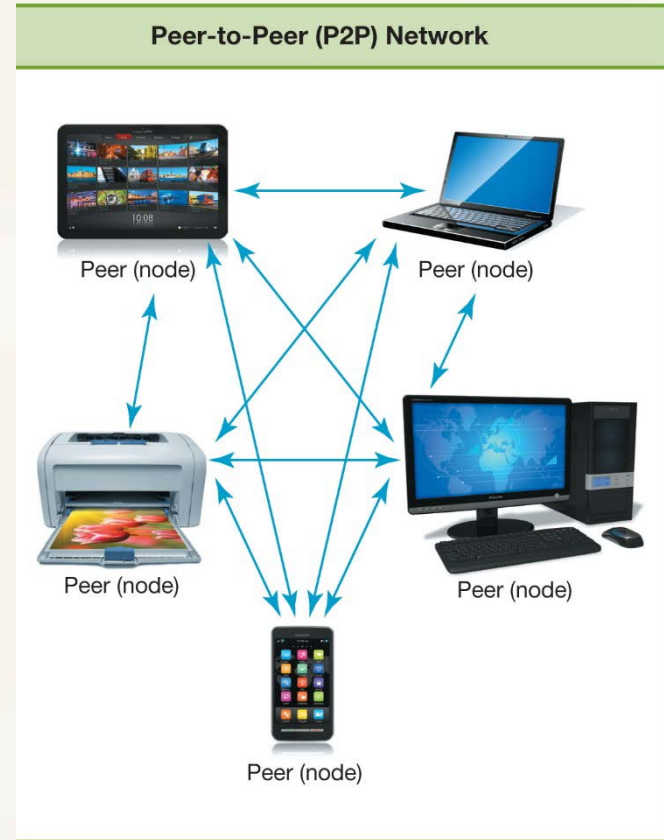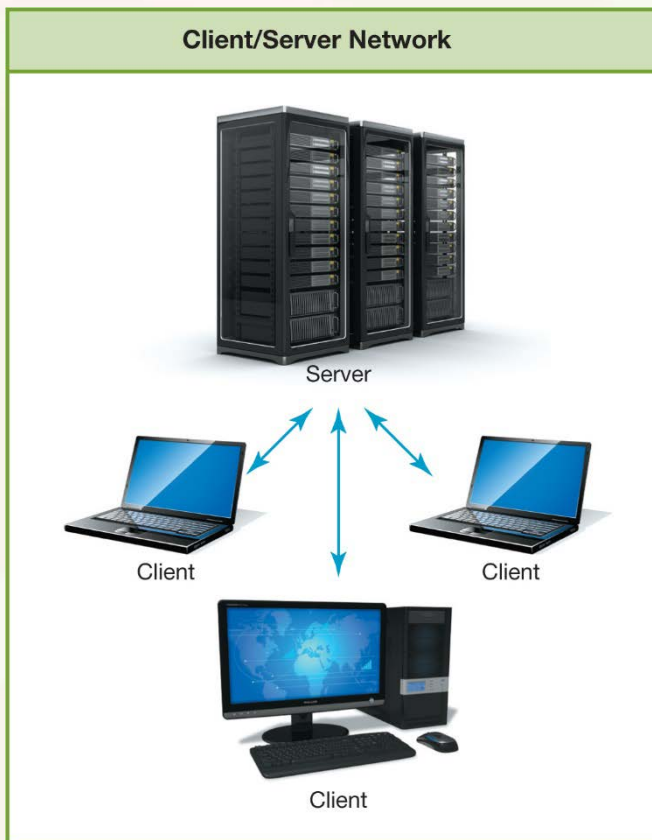
Network Architectures:
Ethernet Protocols

- Ethernet network

  - Ethernet protocol for communication

  - Developed by the Institute of Electrical and Electronics Engineers (IEEE)

  - 802.3: Wired

  - 802.11: Wireless

- Backward compatibility

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, but mostly used for business
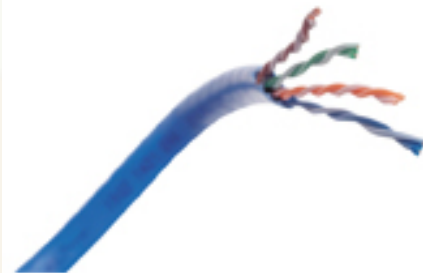
Network Components
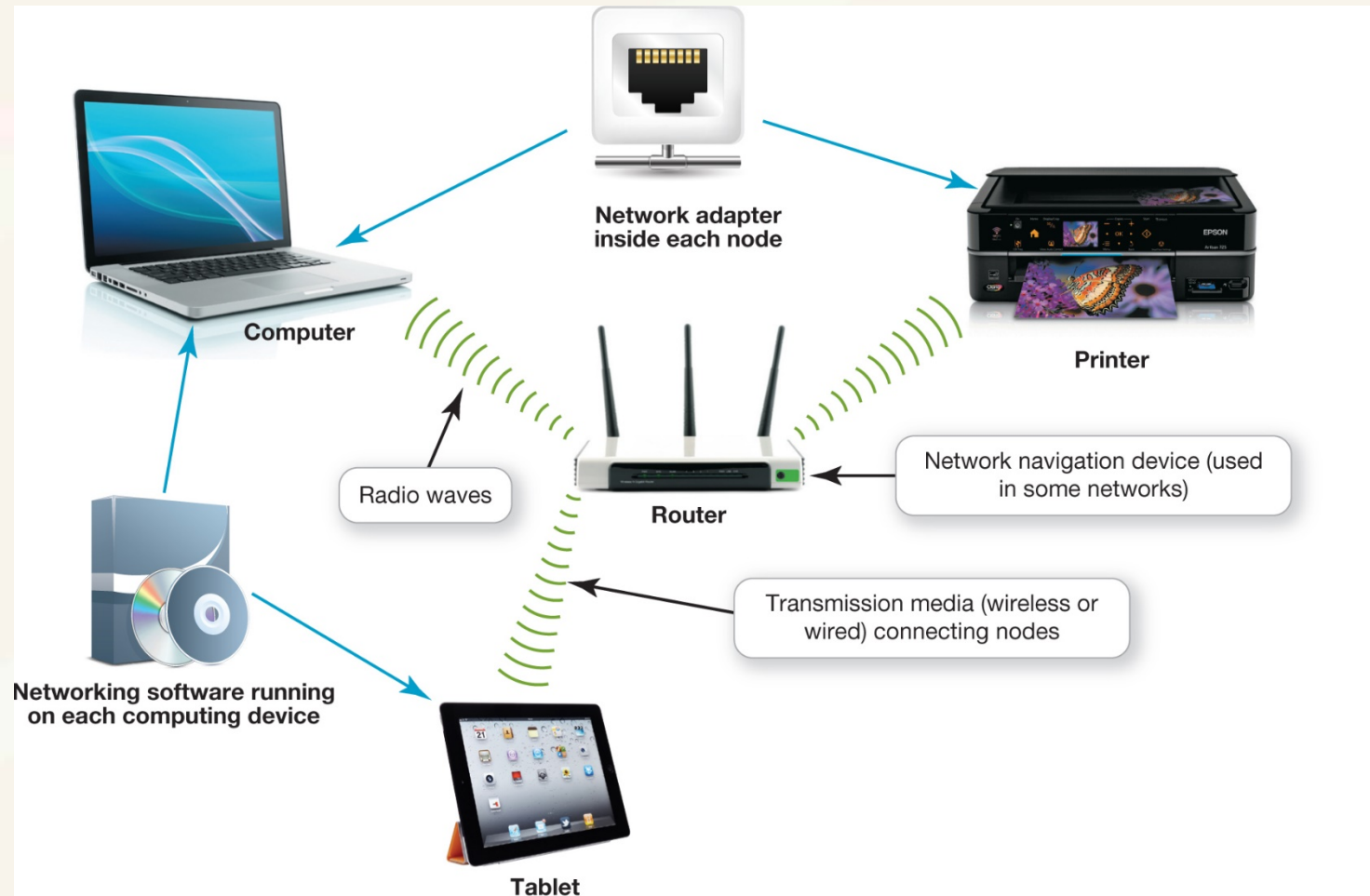
Network Components:
Transmission Media

- Communications channel between nodes
  - Wireless networks
    - Radio waves
  - Wired networks
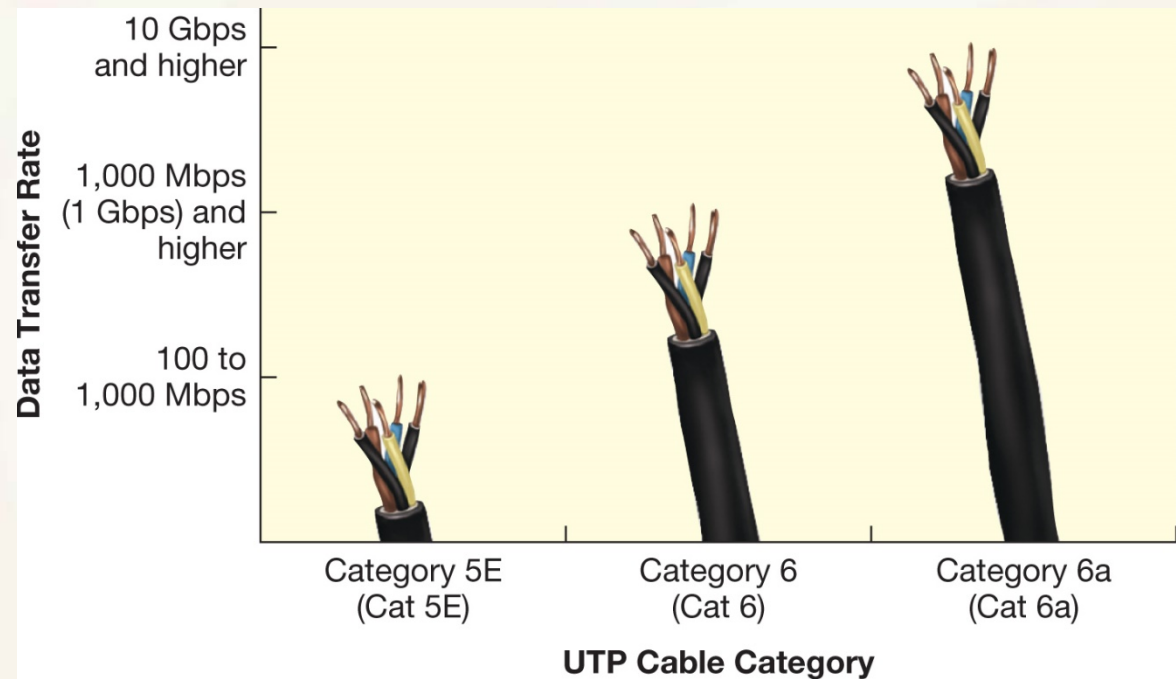   - Cables

Wired Transmission Media

Twisted-pair cable   Coaxial cable   Fiber-optic cable

Network Components:
Transmission Media

- UTP cable

- Types of UTP cable
  - Cat 5E
  - Cat 6
  - Cat 6a

Network Components: Transmission Media

- Decreased throughput in wireless networks
    - Magnetic and electrical sources
    - Other wireless networks
    - Buildings and metal
    - Distance
    - Signal coding

Network Components:
Transmission Media

- Network can be both wireless and wired

  - Portable devices: wireless

  - Stationary devices: usually wired

- Wired connections are faster

Network Components:
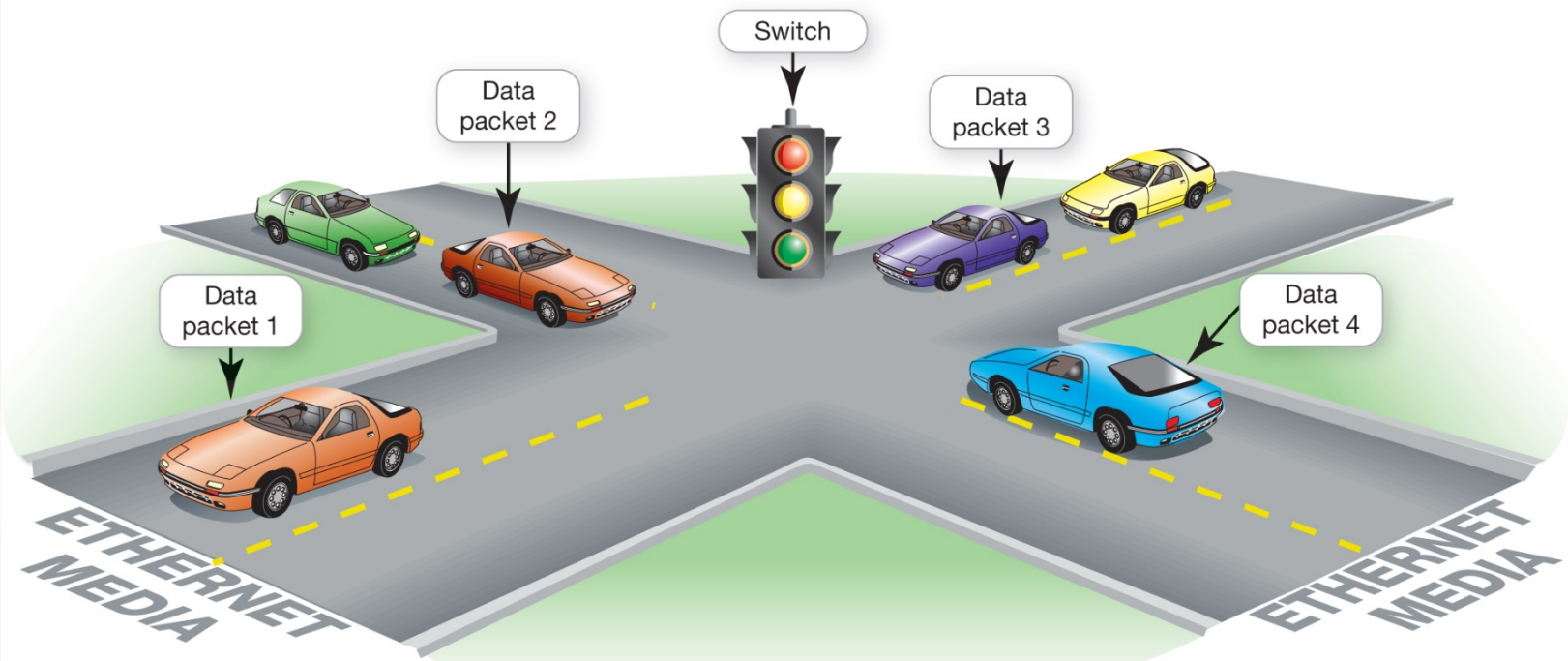# Basic Network Hardware

- Network adapter

- Network interface card (NIC)

- Broadband Modem

  - Cable or DSL

  - Translates the broadband signal
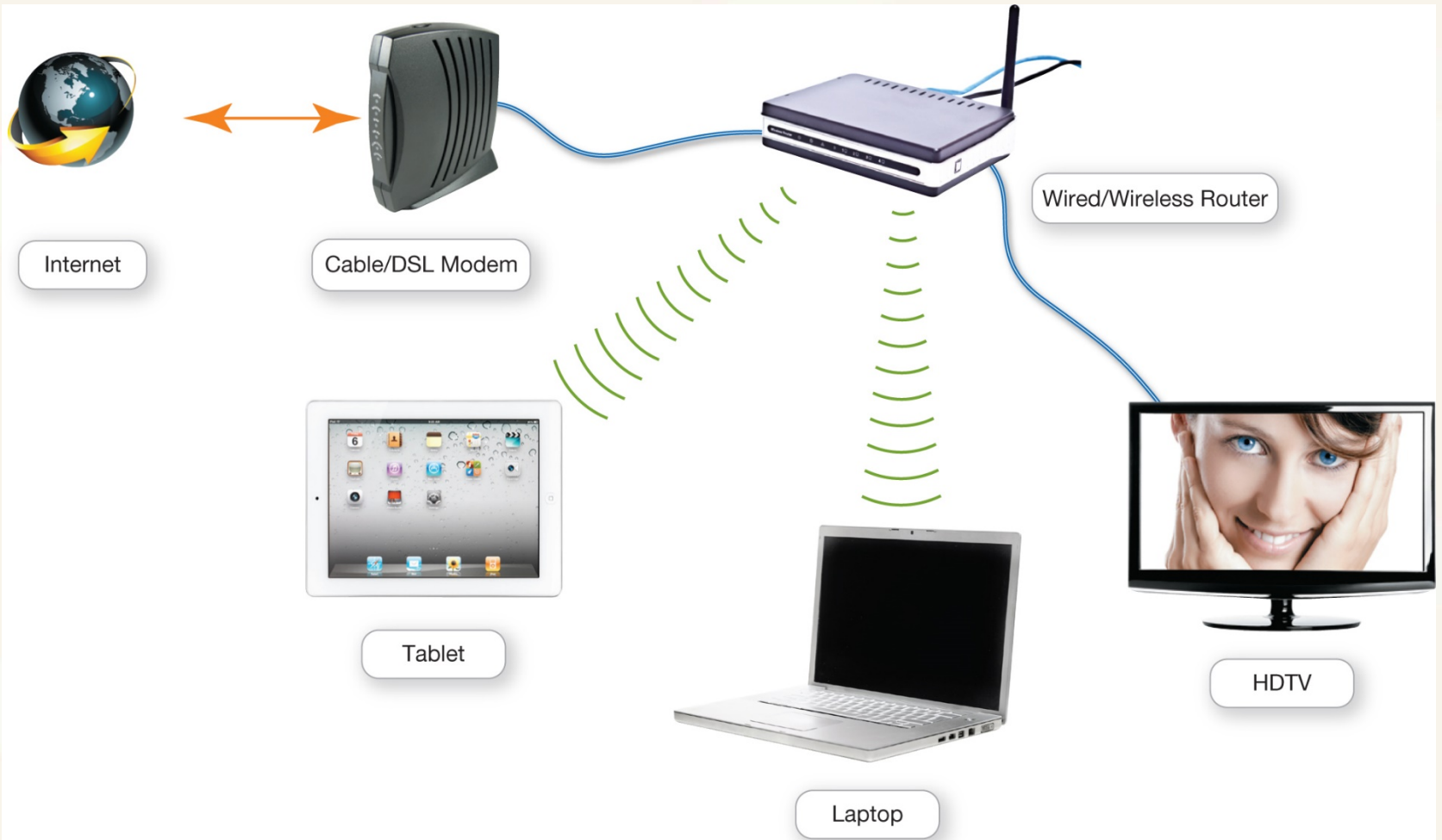
Network Components:
Basic Network Hardware

- Packets
  - Communication
  - Flow between network nodes

Network Components:
Basic Network Hardware

- Router

- Switch

Network Components:
Basic Network Hardware

Internet

Cable/DSL Modem

Wired/Wireless Router

Tablet

Laptop

HDTV

Network Components:
Network Software

- Operating software for P2P networking

- Client/server network

  - Communicate through centralized server

  - Specialized network operating system (NOS) software

Connecting to the Internet

- Home network

  – Share an Internet connection

- Must purchase Internet access from ISP

  – Specialized providers

  – Companies that provide other services

- Broadband

- Dial-Up

Connecting to the Internet Broadband Connections

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

Connecting to the Internet:
Wired Broadband Connections

- Cable Internet
- DSL (Digital Subscriber Line)
- Fiber optic service

Comparing Common Wired Broadband Internet Connection Options

BROADBAND TYPE	TRANSMISSION MEDIUM	SPEED CONSIDERATIONS	AVERAGE AND MAXIMUM DOWNLOAD SPEEDS
Cable	Coaxial cable, similar to cable TV wire	Cable connections are shared, so speed can drop during high-usage periods	Average speed of 10 Mbps, with maximum of 30 Mbps
DSL (Digital Subscriber Line)	Copper wire phone line	Speed drops as distance from the main signal source increases	Average speed of 3.7 Mbps, with maximum of 15 Mbps
Fiber-Optic	Strands of optically pure glass or plastic	Transmits data via light signals, which do not degrade over long distances	Average speed of 50 Mbps, with maximum of 500 Mbps

Connecting to the Internet:
Wired Broadband Connections

- Satellite Internet

Connecting to the Internet:
Wireless Internet Access

- ## Wireless Internet at home

  - ### Router with wireless capabilities

  - ### Built in WiFi on devices

    - #### Laptops, smartphones, game systems, and personal media players

Connecting to the Internet:
Wireless Internet Access

- WiFi hotspot

- Wireless in-flight Internet

  – Gogo

- Mobile broadband

  – 3G or 4G

Connecting to the Internet:
Wireless Internet Access

- Mobile Broadband 3G

  - 3 Mbps

- 4G from a fixed location

  - 1 Gbps

- 4G LTE

  - Support less than 1 Gbps

Connecting to the Internet:
Dial-Up Connections

- High-speed
  - 70% of Internet users

- Dial-up connection
  - No high-speed service available
  - Least costly
  - Slow speed

Check Your Understanding

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

A computer network is simply two or more computers that are connected using software and hardware so they can communicate.
Advantages of networks include allowing users to:

- Share an Internet connection
- Share printers and other peripheral devices
- Share files
- Communicate with computers regardless of their operating system

Disadvantages for larger networks are that they require administration and that they may require costly equipment.

Check Your Understanding

2. What are the different ways to classify networks?

Networks can be defined by the distance between nodes: (1) A personal area network (PAN) is used for communication among personal mobile devices using Bluetooth or WiFi wireless technologies. (2) A local area network (LAN) connects nodes that are located in a small geographic area. (3) A home area network (HAN) is a specific type of LAN located in a home. (4) A metropolitan area network (MAN) is a large network in a specific geographic area. (5) A wide area network (WAN) spans a large physical distance.

Networks are classified by administration: (1) Central: A client/server network contains two types of computers: a client computer on which users perform specific tasks and a server computer that provides resources to the clients and central control for the network. Most networks that have 10 or more nodes are client/server networks. (2) Local: Peer-to-peer (P2P) networks enable each node connected to the network to communicate directly with every other node. Most home networks are P2P networks.

Check Your Understanding

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

Ethernet networks are the most common networks used in home networking. Most Ethernet networks use a combination of wired and wireless connections, depending on the data throughput required. Wired connections usually achieve higher throughput than wireless connections. Wired Ethernet home networks use the gigabit Ethernet standard. Wireless Ethernet networks are identified by a protocol standard: 802.11 a/b/g/n/ac.

- 802.11ac is the newest standard.
- WiGig (802.11ad) is a new wireless link between devices.
- WiGig is similar to but faster than Bluetooth.

Check Your Understanding

4. What are the main components of every network?

   To function, any network must contain a number of components: (1) a means of connecting the nodes on the network (cables or wireless technology); (2) special hardware devices that allow the nodes to communicate with each other and to send data; (3) software that allows the network to run.

Check Your Understanding

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

Wired networks use various types of cable to connect nodes. The type of network and the distance between the nodes determines the type of cable used. Broadband connections include the following types: (1) Cable transmits data over coaxial cable that is also used for cable television. (2) DSL uses twisted-pair wire, similar to that used for telephones. (3) Fiber optic cable uses glass or plastic strands to transmit data via light signals. (4) Satellite is a connection option for those who do not have access to faster broadband technologies. Data is transmitted between a satellite dish and a satellite that is in a geosynchronous orbit. (5) WiFi allows users to connect to the Internet wirelessly but is not as fast as a wired connection. (6) Mobile broadband is a 3G or 4G service delivered by cell-phone networks.
Dial-up is the cheapest means of accessing the Internet, but it is also the slowest.

Your Home Network

- Installing and Configuring Home Networks

- Securing Wireless Networks

Installing and Configuring Home Networks

- Devices Connecting to Home networks

    - Smartphones

    - Gaming consoles

    - Tablets

    - Smart TVs

    - Computers

    - Printers

Installing and Configuring Home Networks:
Planning Your Home Network

- Setting up a home network
    - Evaluate your devices
    - Use the latest wireless Ethernet standard
        - Current Ethernet standard: 802.11ac

Installing and Configuring Home Networks:
Planning Your Home Network

Installing and Configuring Home Networks:
Planning Your Home Network

• Device Manager

Installing and Configuring Home Networks:
Connecting Devices to a Router

Router

Switch
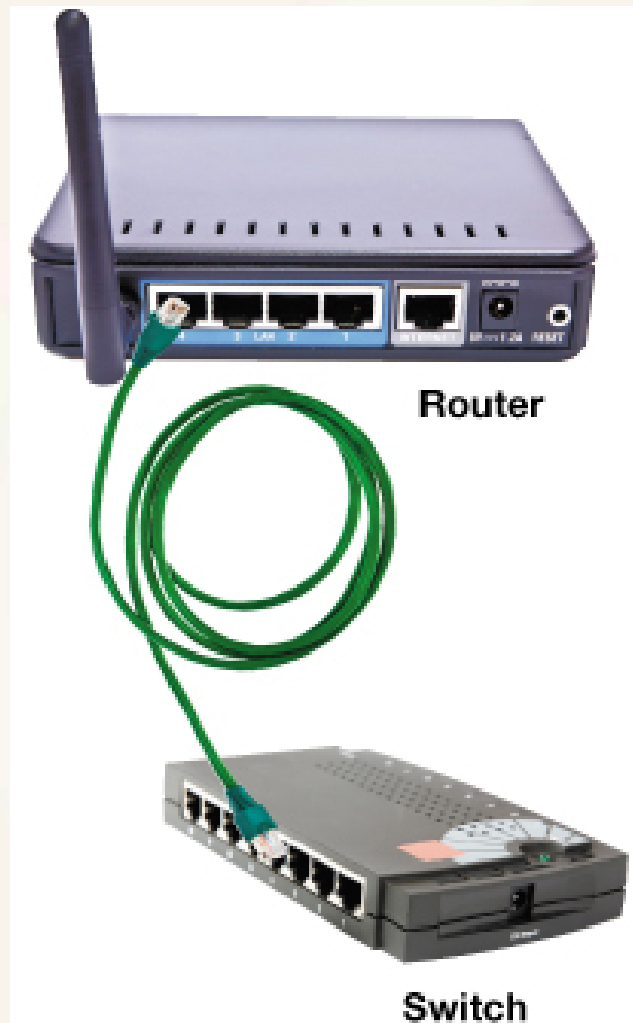
Installing and Configuring Home Networks: Connecting Devices to a Router

- All 802.11n routers should work with Windows or OS X

- Routers for Apple computers
  - AirPort Extreme router
  - Windows machines can also connect

Installing and Configuring Home Networks:
Connecting Devices to a Router

Installing and Configuring Home Networks:
Connecting Devices to a Router

My Network

	PC Name:	iPhone
	Connection Type:	Wireless
	IP Address:	192.168.1.6
	Status:	Active
	PC Name:	MaryAnne_PC
	Connection Type:	Ethernet
	IP Address:	192.168.1.7
	Status:	Active
	PC Name:	TIVO-748000019037AC64
	Connection Type:	Wireless
	IP Address:	192.168.1.2
	Status:	Active
	PC Name:	Ted_iPad
	Connection Type:	Wireless
	IP Address:	192.168.1.3
	Status:	Active
	PC Name:	MaryAnne_Laptop
	Connection Type:	Wireless
	IP Address:	192.168.1.8
	Status:	Inactive
	Remote Access:	Enabled
	PC Name:	Mary-Anne-GVH_iPad
	Connection Type:	Wireless
	IP Address:	192.168.1.4
	Status:	Active

Installing and Configuring Home Networks:
Network-Attached Storage Devices

- NAS devices

- Time Capsule

Installing and Configuring Home Networks:
Home Network Servers

- Home network server

- 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
    - Wired or wireless connection
    - Blu-ray players, DVRs, and smart TVs
- Connecting entertainment
    - Access and share digital data
    - Access Internet entertainment content
    - Play multiplayer games

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

- Blu-ray players
  - Integrated wireless
- LG Smart TV Upgrader
- Apple TV
- Google Chromecast

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

- TiVo Premiere
- PlayStation 4
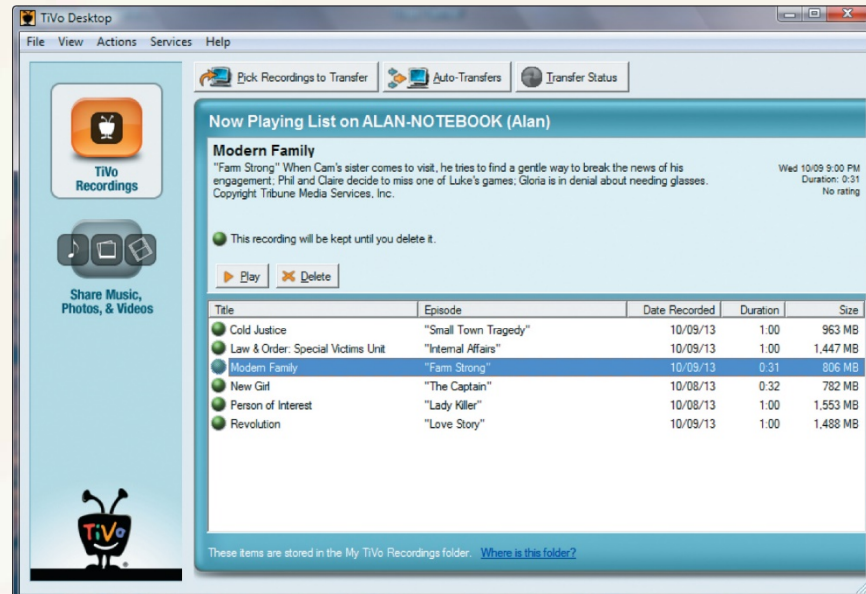
Installing and Configuring Home Networks: Specialized Home-Networking Devices

- New digital picture frames

  - Built-in wireless

  - Access network and online photos

  - Receive pictures via e-mail

- Security

  - Wireless monitoring cameras

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

- Before configuring your home network
  - Make sure all nodes have network adapters
  - Check wired connections
  - Connect the modem 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

Network and Sharing Center
View network status and tasks | Connect to a network | View network computers and devices

HomeGroup
Choose homegroup and sharing options

Internet Options
Change your homepage | Manage browser add-ons | Delete browsing history and cookies

Networks panel opens to display network options

Checkbox for automatic connection to WiFi after initial connection

Click Connect to a network

- Homegroup

## Creating a Homegroup in Windows 8

CREATING A HOMEGROUP IN WINDOWS 8

Step 1: Click **Create a homegroup** in the HomeGroup window...

Step 2: Choose the sharing options for computers that belong to the homegroup. You can choose to share pictures, music, videos, documents, and printers with other Windows computers that belong to the homegroup. Although these are global settings...

Step 3: Windows generates a password. All other computers added to the network will need this password to join the homegroup. Once you've created the homegroup on the first computer, it will belong to that homegroup. You can then begin connecting other Windows computers to the network and join them to the homegroup you created.
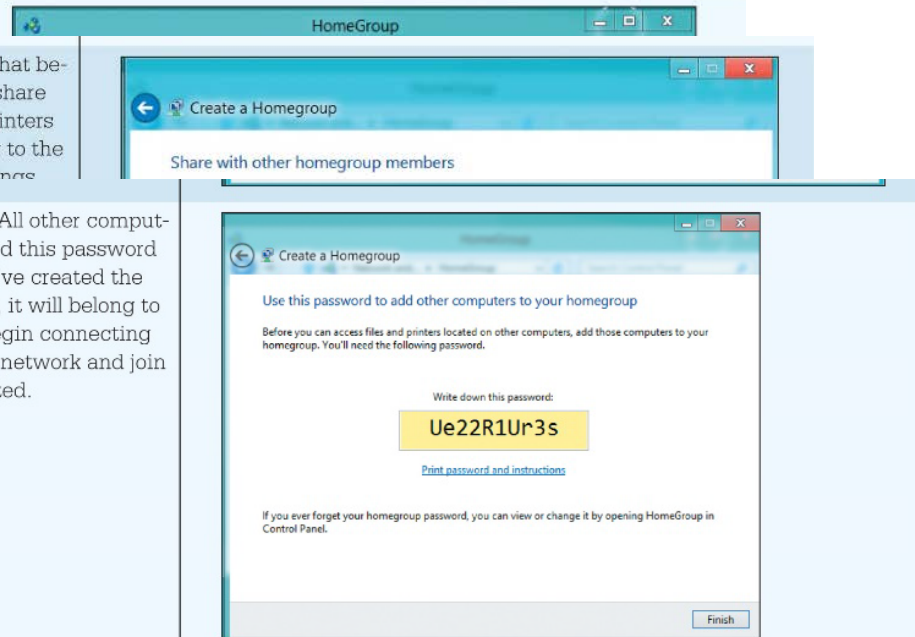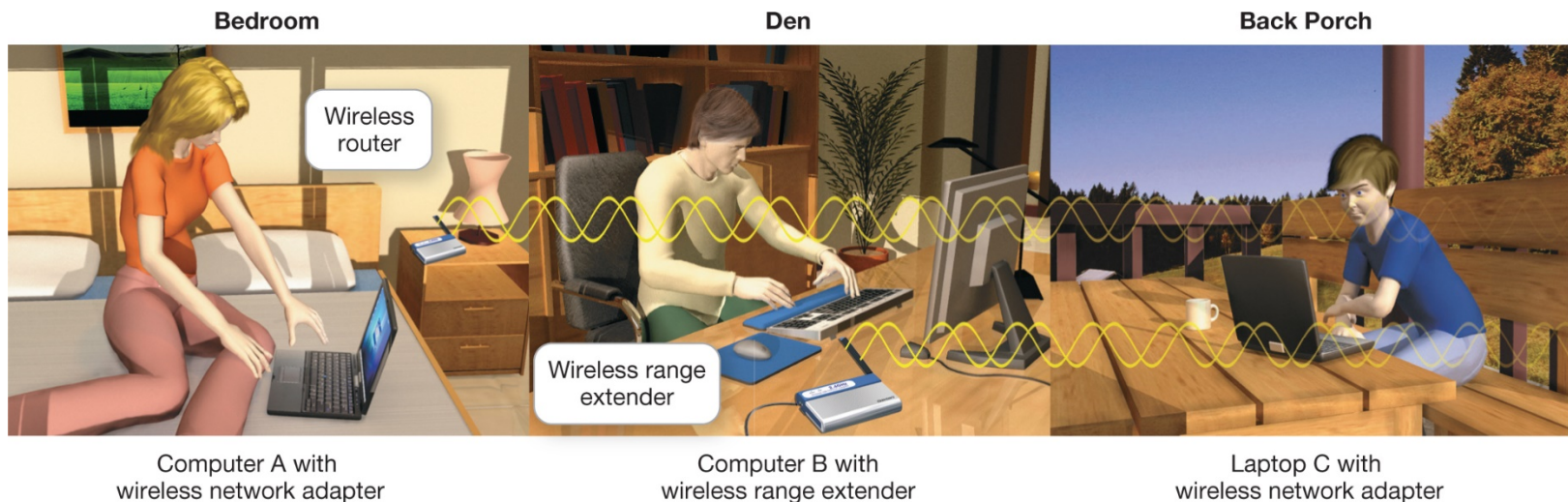
Installing and Configuring Home Networks: Configuring Software for Your Home Network

- Computers with various versions of Windows can coexist on same network

- Connecting mobile devices to a wireless network

  – NIC detects available networks

Installing and Configuring Home Networks:
Troubleshooting Wireless Network Problems

- Maximum range of 802.11n or 801.11ac is 350 feet
  - Dual-band N router
    - Simultaneous support for both 2.4 GHz and 5 GHz
  - Wireless range extender

Bedroom — Den — Back Porch

Wireless router

Wireless range extender

Computer A with wireless network adapter

Computer B with wireless range extender

Laptop C with wireless network adapter

Securing Wireless Networks

- Secure computers connected to Internet
  - Firewall
- Wireless networks have special vulnerabilities

Securing Wireless Networks

- Wired networks are more secure

- Wireless networks can extend beyond the walls of a residence

  - Piggybacking

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

Securing Wireless Networks

- Precautions to secure a wireless network
  - Create a passphrase
  - Implement media access control
  - Limit your signal range
  - Apply firmware upgrades

Securing Wireless Networks

Check Your Understanding

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

Most home network routers should support both wireless and wired access to the Internet. For a home network to run efficiently, all nodes such as NICs and routers should use the same Ethernet standard. The Device Manager utility in Windows lists all adapters installed on your computer.

Check Your Understanding

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

All devices are connected to your router, either wirelessly or with a wired connection. Wired connections deliver better throughput than wireless. To add ports to your network, you can connect a switch to your router. Network-attached storage (NAS) devices let you store and share data files such as movies and music, as well as provide a central place for file backups. Home network servers can be used instead of an NAS device if your needs require more sophisticated functionality than NAS devices. Connecting digital entertainment devices (such as gaming consoles) lets you stream movies and other entertainment directly from the Internet.

Check Your Understanding

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

All devices are connected to your router, either wirelessly or with a wired connection. Wired connections deliver better throughput than wireless. To add ports to your network, you can connect a switch to your router. Network-attached storage (NAS) devices let you store and share data files such as movies and music, as well as provide a central place for file backups. Home network servers can be used instead of an NAS device if your needs require more sophisticated functionality than NAS devices. Connecting digital entertainment devices (such as gaming consoles) lets you stream movies and other entertainment directly from the Internet.

Check Your Understanding

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

You may not get the throughput you need through a wireless connection. Therefore, you may need to consider a wired connection for certain devices. Distance from the router, as well as walls, floors, and large metal objects between a device and the router, can interfere with wireless connectivity. To solve connectivity problems, dual-band N routers allow for simultaneous support for devices running on both the 2.4 GHz and 5 GHz frequency bands for 802.11n standards. Wireless range extenders can amplify signals to improve connectivity in areas of poor signal strength.

Check Your Understanding

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?

Wireless networks are even more susceptible to hacking than wired networks because the signals of most wireless networks extend beyond the walls of your home. Neighbors may unintentionally (or intentionally) connect to the Internet through your wireless connection, and hackers may try to access it. To prevent unwanted intrusions into your network, you should change the default password on your router to make it tougher for hackers to gain access, use a hard-to-guess SSID (network name), disable SSID broadcasting to make it harder for outsiders to detect your network, enable security protocols such as WPA or WEP, create a network passphrase, implement media access control, limit your signal range, and apply firmware upgrades.