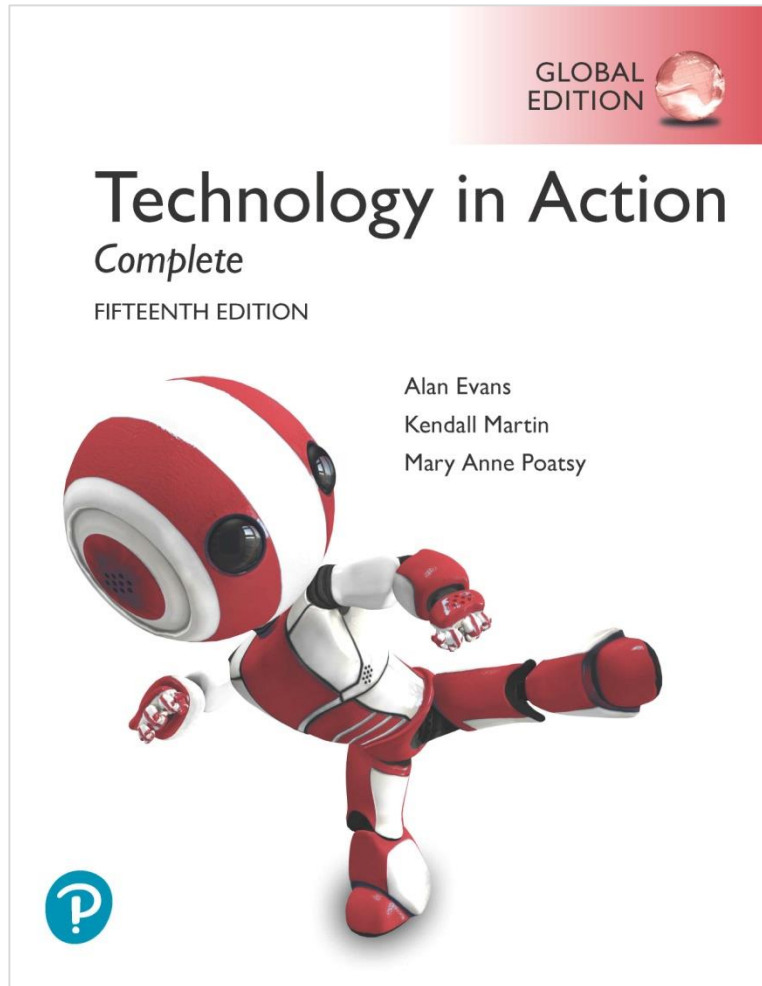# Technology in Action

15th Edition, Global Edition

Chapter 7
Networking: Connecting Computing Devices

Learning Objectives (1 of 2)

7.1 Describe computer networks and their pros and cons.

7.2 Explain the different ways networks are defined.

7.3 Describe the types of transmission media used in networks.

7.4 Describe the basic hardware devices necessary for networks.

7.5 Describe the type of software necessary for networks.

7.6 Summarize the broadband options available to access the Internet.

Learning Objectives (2 of 2)

7.7 Summarize how to access the Internet wirelessly.

7.8 Explain what should be considered before creating a home network.

7.9 Describe how to set up a home network.

7.10 Summarize how to configure home network software.

7.11 Describe the potential problems with wireless networks and means to avoid them.

7.12 Describe how to secure wireless home networks.

- Computer network:

    simply two or more computers that are connected via software and hardware so that they can communicate with each other.

- Each device connected to a network is called **Node**:

    – Computer

    – Peripheral

    – Network device

Jackie watches a video she took while on vacation.

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

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

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.

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Networking Fundamentals Understanding Networks (2 of 4)
(Objective 7.1)

- Benefits of networks
  - Sharing a high-speed Internet connection
  - Sharing printers and peripheral devices
  - Sharing files
  - Online gaming and home entertainment.
  - Telephone: Voice over IP (VoIP) services.
  - Common communications

- Disadvantage of networks
  - Setup and administration

- Network administration involves tasks such as:

    – Installing new computers and devices

    – Monitoring the network to ensure it is performing efficiently

    – Updating and installing new software on the network

    – Configuring, or setting up, proper security for a network

Networking Fundamentals Understanding Networks (4 of 4)
(Objective 7.1)

- How fast does data move through networks

  - Data transfer rate (bandwidth): is the maximum speed data can be transmitted between two nodes on a network.

  - Throughput: is the actual speed data is transferred

  - Remember throughput is always <u>less than or equal</u> to the data transfer rate.

  - Both are measured in megabits per second (Mbps) or gigabits (Gbps)

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Network Architectures
Network Designs (1 of 3)
(Objective 7.2)

- Networks can differ greatly in term of size, structure, and cost. Ex: Home vs University network.

- What are the ways that networks can be classified or defined?

  – The distance between nodes

  – The way in which the network is managed (or administered)

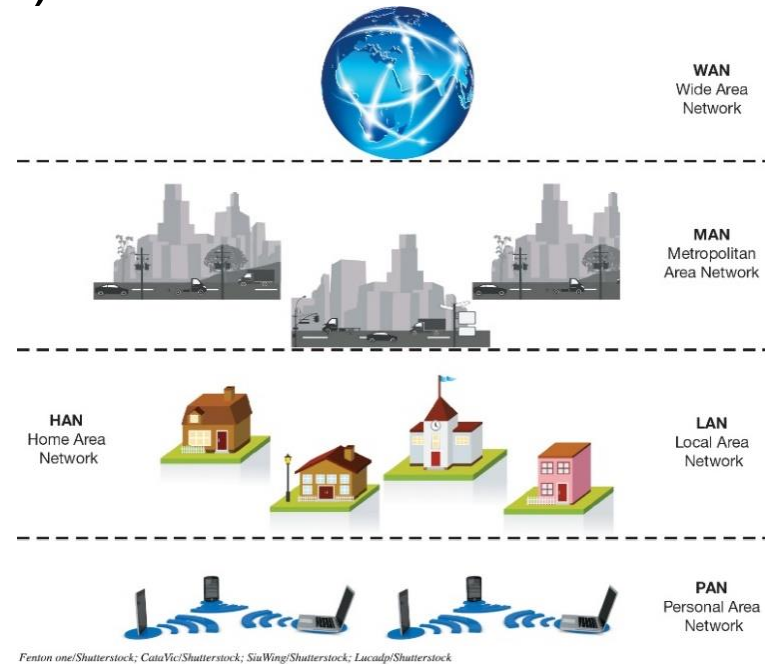 – The set of rules (or protocol) used to exchange data between network nodes

Network Architectures
Network Designs (1 of 3)
(Objective 7.2)

- Networks can be classified by distance
  - Personal area network (PAN)
  - Local area network (LAN)
  - Home area network (HAN)
  - Metropolitan area network (MAN)
 - Wide area network (WAN)

WAN
Wide Area
Network

MAN
Metropolitan
Area Network

HAN
Home Area
Network

LAN
Local Area
Network

PAN
Personal Area
Network

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Network Architectures
Network Designs (2 of 3)
(Objective 7.2)

- Networks can be classified by levels of administration

  - Central administration: Client/server network

  - Local administration: Peer-to-peer (P2P) network
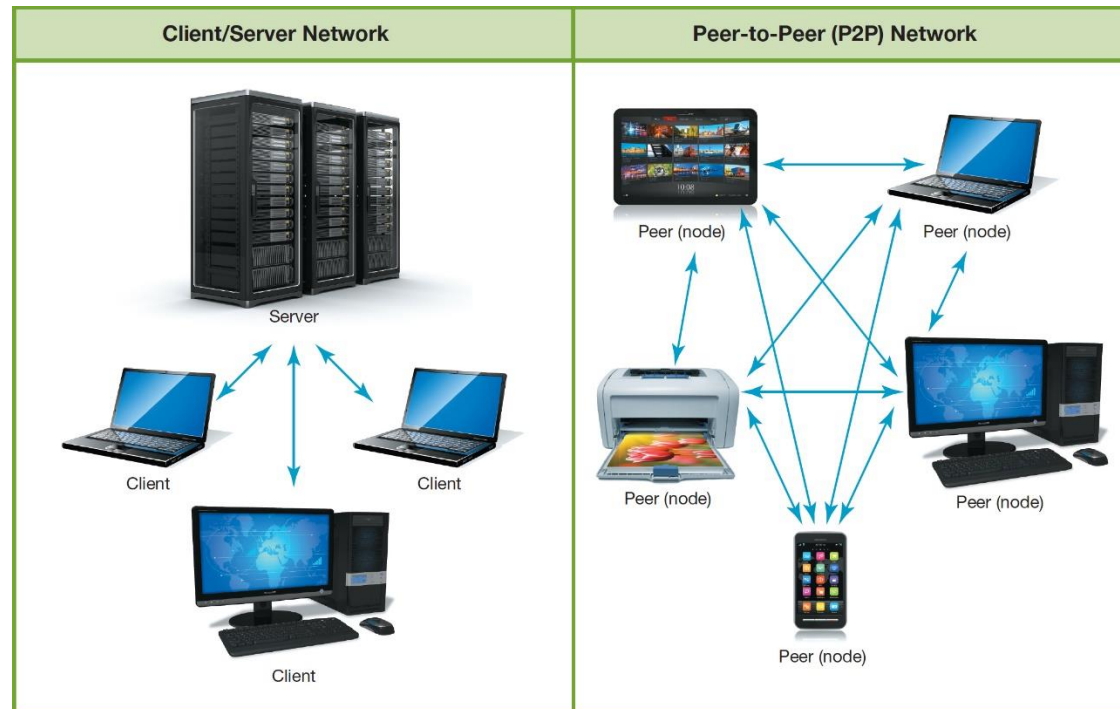
Sashkin/Fotolia, Tuulijumala/Fotolia, Scanrail/Fotolia, Scanrail/Fotolia, Maksym Dykha/Fotolia, Scanrail/Fotolia

Network Architectures
Network Designs (3 of 3)
(Objective 7.2)

- Networks can be classified by the protocols used
  - Ethernet protocol
    - Developed by the Institute of Electrical and Electronics Engineers (IEEE)
    - There are different standards for wired and wireless Ethernet networks:
      - Wired networks: such as IEEE 802.3, also known as gigabit Ethernet (GbE). A data transfer rate of up to 1 Gbps is possible using this standard. There are also standards for even faster data transfer speeds
      - Wireless networks (Wi-Fi): based on IEEE 802.11 standard, which is available in different version such: 802.11ac (Wi-Fi 5), 802.11n (Wi-Fi 4), 802.11g (Wi-Fi 3), 802.11a (Wi-Fi 3), and Wi-Fi 1 would refer to 802.11b
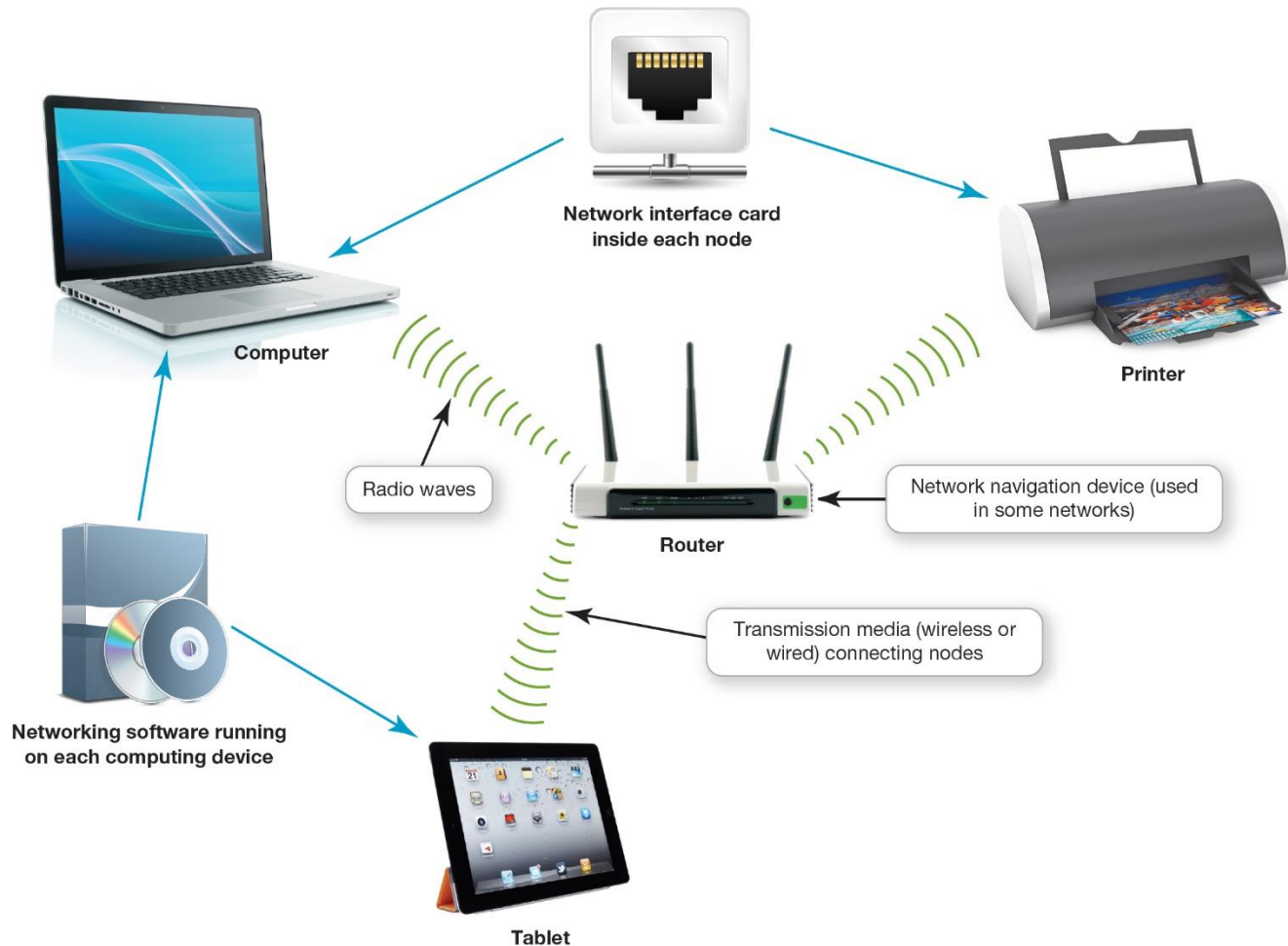 - Backwards compatibility

Network Architectures
Network Designs (3 of 3)
(Objective 7.2)

Standard	Frequency	Maximum Speed	Backwards compatibility
802.11	2.4 GHz	2 Mbps	-
802.11a	5 GHz	54 Mbps	-
802.11b	2.4 GHz	11 Mbps	-
802.11g	2.4 GHz	54 Mbps	802.11b
802.11n	2.4 and 5 GHz	600 Mbps	802.11a/b/g
802.11ac	5 GHz	1300 Mbps	802.11a/n
802.11ad	2.4 GHz, 5 GHz and 60 GHz	7 Gbps	802.11a/b/g/n/ac

Network Components

(Objective 7.3)

Network interface card inside each node

Computer

Printer

Radio waves

Router

Network navigation device (used in some networks)

Transmission media (wireless or wired) connecting nodes

Networking software running on each computing device

Tablet

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Network Components Transmission Media (1 of 2)
(Objective 7.3)

- Transmission media establish a communications channel between the nodes on a network.

  – Wired networks

  – Wireless networks (discussed previously)
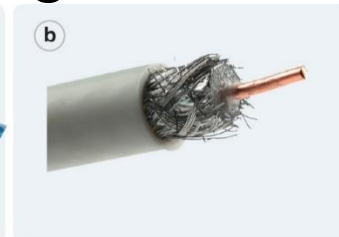
- Wired

  – Unshielded twisted-pair (UTP) cable (Most common)– twisted copper wires surrounded by a plastic jacket

  – Coaxial cable – single copper wire surrounded by layers of plastic

  – Fiber-optic cable – plastic or glass fibers
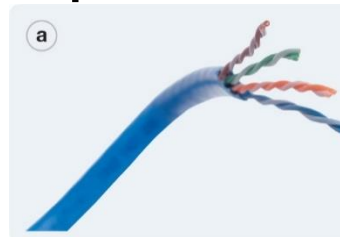
a	b	c
Unshielded twisted-pair cable	Coaxial cable	Fiber-optic cable

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Network Components
Transmission Media (2 of 2)
(Objective 7.3)

- There are several types of UTP cable commonly found in wired Ethernet networks

Table 7.1	UTP Cable Types
Cat 5e	Cat 5e cable is the cheapest and is sufficient for many home networking tasks. It is designed for 100 Mbps–wired Ethernet networks that were popular before gigabit Ethernet networks became the standard.
Cat 6	Cat 6 cable is designed to achieve data transfer rates that support a 1 GbE network. Although using Cat 5e cable is sufficient, using Cat 6 cable is probably the better choice for home networking cable, though it's slightly more expensive and more difficult to work with than Cat 5e cable.
Cat 6a	Cat 6a cable is designed for ultrafast Ethernet networks that run at speeds as fast as 10 Gbps and is the most expensive option. Installing a 10 GbE network in the home may be worth the added expense to accommodate the many Internet-dependent devices as well as the current and anticipated use of today's home applications such as gaming and streaming media.
Cat 7	Cat 7 cable supports 10 GbE networks, with the difference of offering greater through-put than Cat 6a.

Network Components
Basic Network Hardware
(Objective 7.4)

- Network adapter: For the different nodes on a network to communicate with each other and access the network, each node needs a network adapter.

- Network interface card (NIC): refer to an integrated network adapter.

- Modem

- Router

- Switch

- Internet of Things (IoT): is defined as the interconnection of uniquely identifiable embedded computing devices that transfer data over a network without requiring human-to-human or human-to-computer interaction.

Network Components
Network Software
(Objective 7.5)

- Operating system for P2P networking

- Client/server network

  - Communicate through centralized server

  - Specialized network operating system (NOS) software

Connecting to the Internet
Broadband Internet Connections (1 of 2)
(Objective 7.6)

- Home network
  - Share an Internet connection

- Must purchase Internet access from ISP
  - Specialized providers
  - Companies that provide other services

- Broadband
  Refers to a type of connection that offers a means to connect to the Internet with fast throughput.

- Cellular or Dial-up

Connecting to the Internet
Broadband Internet Connections (2 of 2)
(Objective 7.6)

- Broadband
  - Cable Internet
  - DSL (digital subscriber line)
  - Fiber-optic service
  - Satellite Internet: ex: starlink
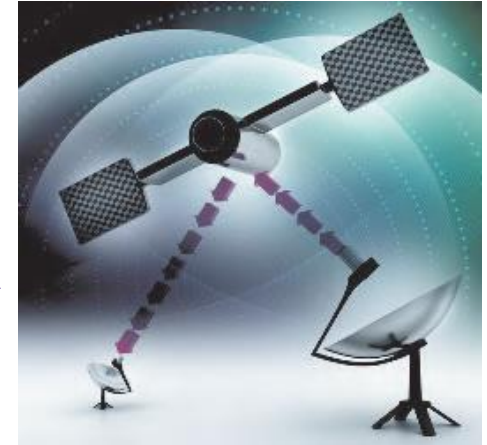
Broadband Type	Transmission Medium	Speed Considerations	Average and Maximum Download Speeds
Cable	Coaxial cable, similar to cable TV wire	Cable connections are shared, so speed can drop during high-usage periods	Average speed of 10 Mbps, with maximum of 30 Mbps
DSL (Digital Subscriber Line)	Copper wire 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
Wireless Internet Access
(Objective 7.7)

- Mobile broadband

  - Wireless Internet at home

  - Mobile hotspot

  - Wireless ISP

  - Data plan

Emails sent/received (no attachments)	Web pages viewed
60 e-mails a day	10 pages a day
Emails with photo attachments	Apps/games/songs downloaded
5 e-mails a day	4 apps a day
Emails sent/received with attachments	Social media posts with photos uploaded
20 e-mails a day	5 posts a day
Minutes of streaming video	Minutes of HD streaming video
30 minutes a day	2 minutes a day
Hours of streaming music	
3 hours a day	

Estimate of Monthly Data Usage   RESET CALCULATOR

5 GB

300 MB   10 GB

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Try This: Page 255

Testing Your Internet Connection Speed

Installing and Configuring Home Networks Planning Your Home Network

(Objective 7.8)

- List all the devices you are using

- Use the latest standards
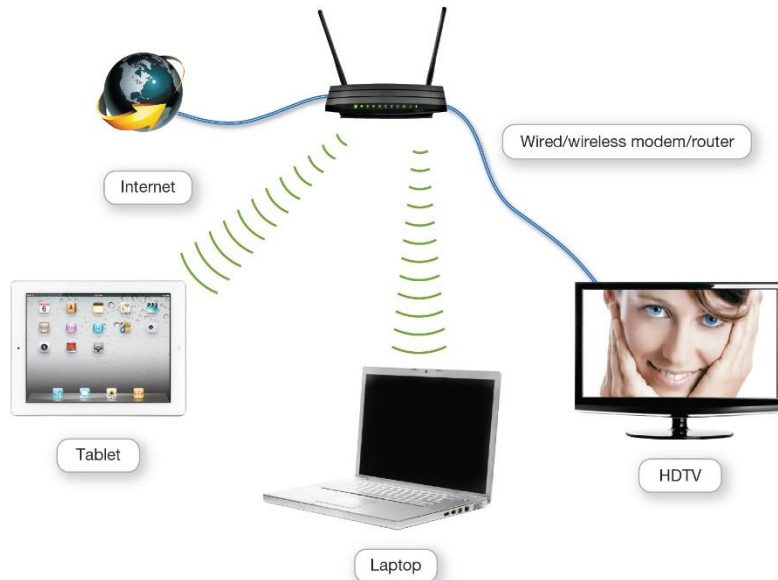
- Use the newest equipment

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Installing and Configuring Home Networks Connecting Devices to a Network (1 of 2)
(Objective 7.9)

- Routers

- Switches

Router

Switch

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Internet
Wired/wireless modem/router
Tablet
Laptop
HDTV

Laurentiu Iordache/Fotolia, Beboy/Shutterstock, Oleksiy Maksymenko/Alamy, Sergey Peterman/Shutterstock, Iko/Shutterstock

- ## Specialized Home Networking Devices

  - Network-attached storage (NAS) devices

  - Home network servers

  - Network-ready device
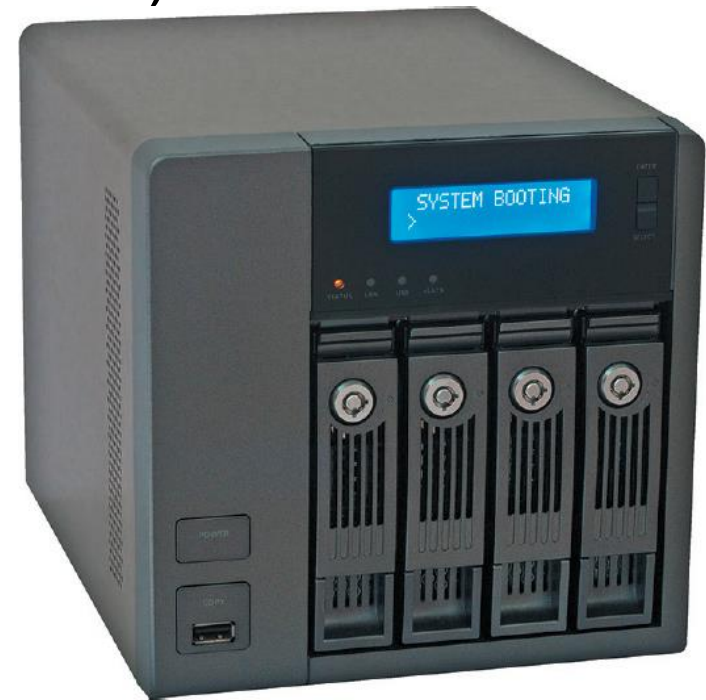
Leslie Wilk/Alamy Stock Photo

Installing and Configuring Home Networks
Configuring Software for Your Home Network
(Objective 7.10)

- Setting up a Windows based network

- Sharing files
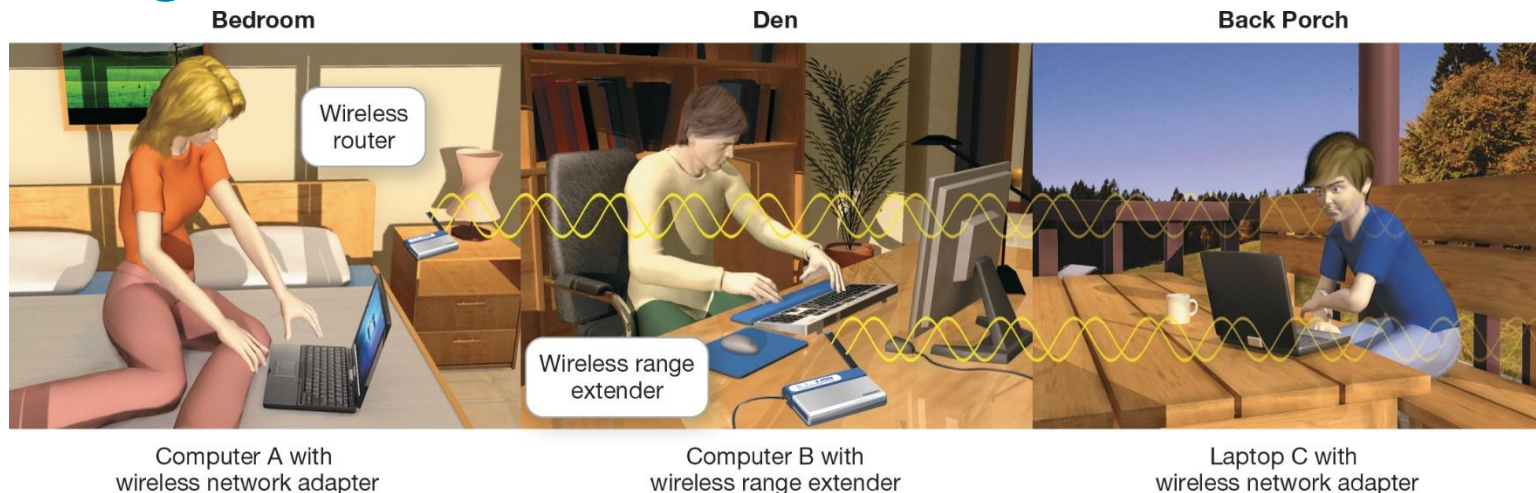
- Connecting mobile devices
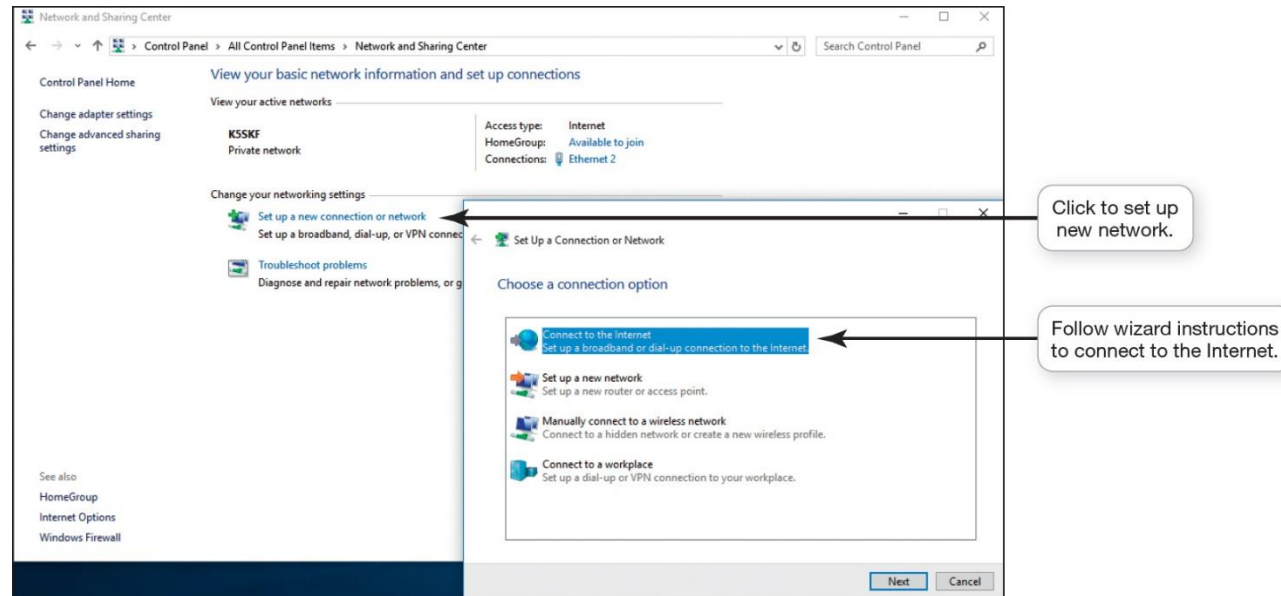
Windows 10, Microsoft Corporation

Managing and Securing Wireless Networks
Troubleshooting Wireless Network Problems
(Objective 7.11)

- Range

- Speed (throughput)

- Range extender

Bedroom — Wireless router

Den — Wireless range extender

Back Porch

Computer A with wireless network adapter

Computer B with wireless range extender

Laptop C with wireless network adapter

Managing and Securing Wireless Networks
Securing Wireless Networks (1 of 3)
(Objective 7.12)

- Use encryption and security protocols
- Change network name (SSID)
- Disable SSID broadcast
- Change the default password
- Create a passphrase
- Implement media access controls

Managing and Securing Wireless Networks Securing Wireless Networks (2 of 3)

(Objective 7.12)

- Limit signal range

- Apply firmware upgrades

- Disable remote access

- Keep router firmware up to date

Managing and Securing Wireless Networks
Securing Wireless Networks (3 of 3)
(Objective 7.12)

Windows 10, Microsoft Corporation

Questions

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