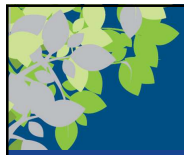


Learning Objectives (1)

- Understand the difference between system software and application software.
- Explain the different functions of an operating system and discuss some ways that operating systems enhance processing efficiency.
- List several ways in which operating systems differ from one another.

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2



Learning Objectives (2)

- Name today's most widely used operating systems for smartphones and other mobile devices.
- Discuss the operating systems used with mainframes and supercomputers.
- Discuss the role of utility programs and outline several tasks that these programs perform.
- Describe what the operating systems of the future might be like.

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3



Overview

- This chapter covers:
 - Differences between system software and application software
 - Functions of and general differences between operating systems
 - Specific operating systems most widely used today
 - Various types of utility programs
 - A look at future of operating systems

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System Software vs. Application Software

- **System software** refers to the operating system and utility programs that control a computer system and allow you to use that system
 - Enables the boot process, launches applications, transfers files, controls hardware configuration, manages files on the hard drive, and protects from unauthorized use
- **Application software** refers to programs that allow a user to perform specific tasks on a computer
 - Word processing, playing games, browsing the Web, listening to music, etc.

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5

The Operating System

- A computer's **operating system** is a collection of programs that manage and coordinate the activities taking place within a computer
 - Acts as an intermediary between the user and the computer and between the application programs and system hardware

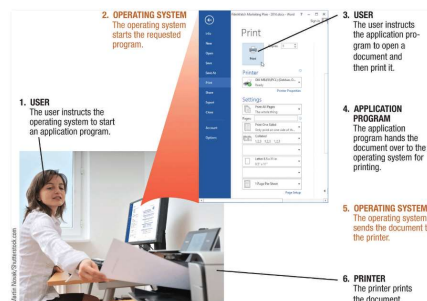


FIGURE 5-1
The intermediary role of the operating system.

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Functions of an Operating System: Interfacing with Users and Booting the PC

- Interfacing with users (typically via a GUI)
- Booting the computer
 - Loads the essential part of operating system (**kernel**) into memory
 - Reads opening batch of instructions
 - Determines the hardware connected to computer
 - Startup programs are launched automatically
 - Windows users can control via the Task Manager
 - Other instructions are stored in the Windows registry

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7

Windows Task Manager

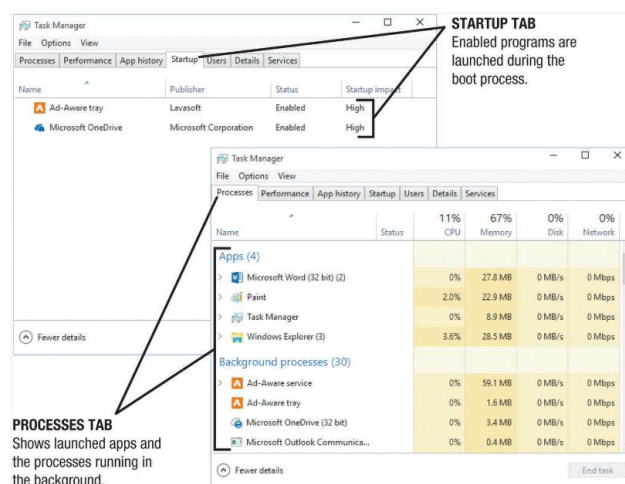


FIGURE 5-2
Windows Task Manager. Shows all running programs and processes and allows you to specify startup programs.

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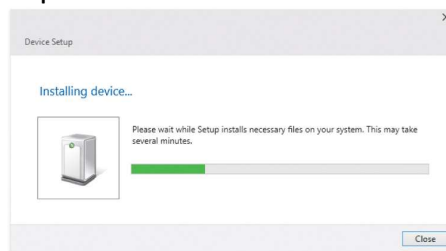
8

Configuring Devices

- Configuring devices so they operate properly
 - **Device drivers** communicate with peripheral devices
 - Most operating systems look for and recognize new devices each time the computer boots
 - Device drivers can be updated and reinstalled as needed

FIGURE 5-3

Finding new hardware. Most operating systems are designed to detect new hardware and to try to configure it automatically.



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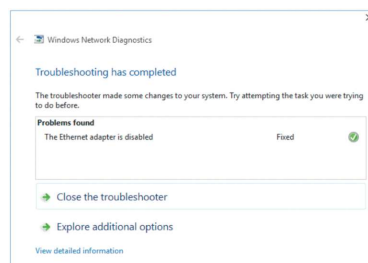
9

Managing Networking Connections

- Managing network connections
 - Manages wired connections to home or office network
 - Manages wireless connections at home, school, work, or on the go
 - Can troubleshoot and repair networking connections when needed

FIGURE 5-4

Network connections. Most operating systems can repair network connections when needed.



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Managing Resources, Files, and Security

- Managing and monitoring resources and jobs
 - Makes resources available to devices and programs
 - Monitors for problems and tries to correct any that arise
 - Schedules jobs to be carried out
- File management - Keeps track of stored files on computer so they can be retrieved when needed
 - Path shows folders from root to desired item
 - File extensions indicate type of file
- Security - Uses passwords, biometric characteristics and other security procedures to limit access to system resources

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11

Hard Drive Organization and File Extensions

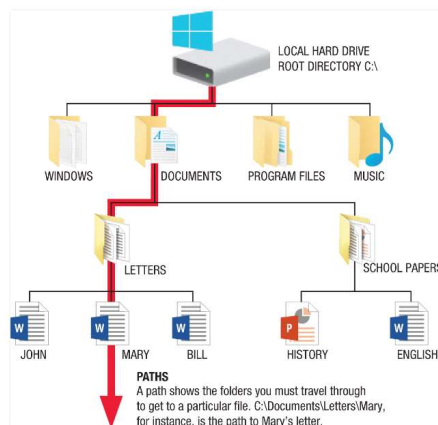


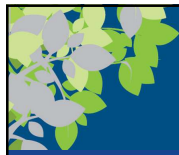
FIGURE 5-5
A sample hard drive organization.

DOCUMENTS
.doc .docx .txt .rtf .htm .html .mhtml .xml .xls .xlsx .mdb .accdt .ppt .pptx .pdf .sxc .xsi .odf
PROGRAMS
.com .exe
GRAPHICS
.bmp .tif .tiff .jpg .jpe .jpeg .eps .gif .png .pcx .svg .dib
AUDIO
.wav .au .mp3 .snd .aiff .midi .aac .wma .ra .m4a
VIDEO
.mpg .mp2 .mp4 .mpe .mov .avi .rm .wmv .wm .asf
COMPRESSED FILES
.zip .sit .sitx .tar

FIGURE 5-6
Common file extensions.

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12

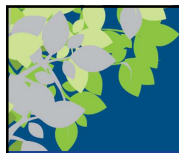


Processing Techniques for Increased Efficiency: Multitasking and Multithreading

- **Multitasking** refers to the ability of an operating system to have more than one program (task) open at one time
 - CPU rotates between tasks
 - Switching is done quickly
 - Appears as though all programs are executing at the same time
- Multithreading enables the computer to rotate between multiple threads so that processing is completed faster and more efficiently
 - A thread is a sequence of instructions within a program that is independent of other thread
- In either case, tasks are performed sequentially

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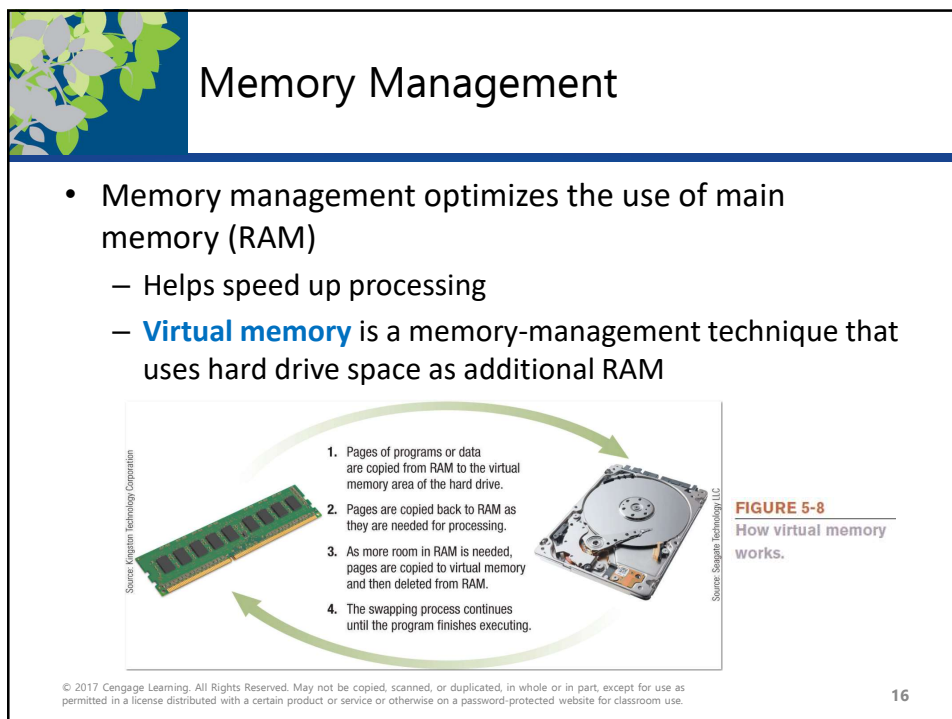
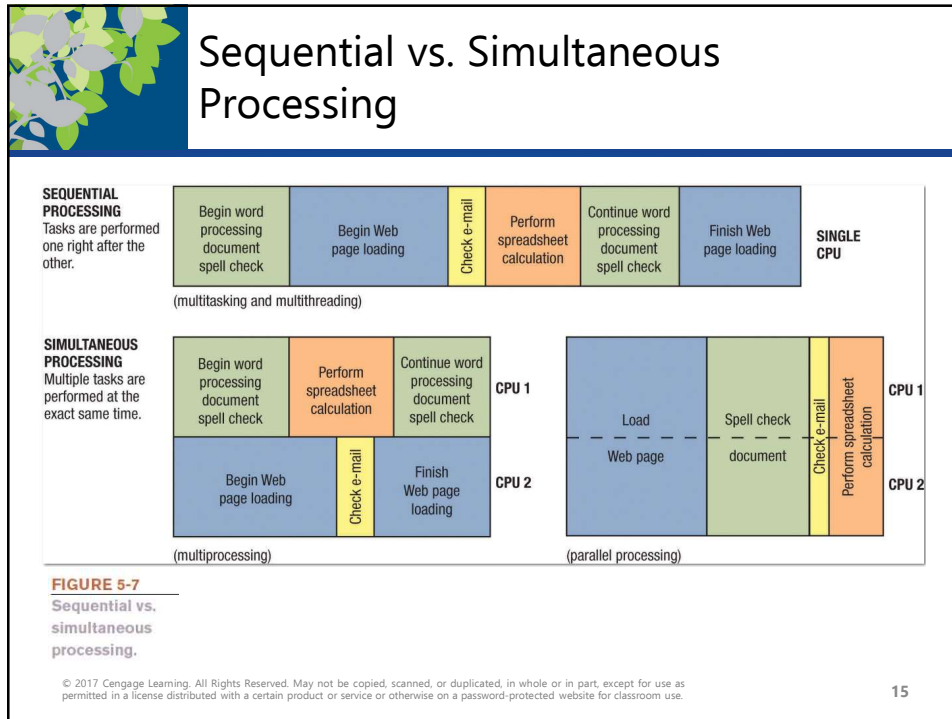


Multiprocessing and Parallel Processing

- Both involve using two or more CPUs or CPU cores in one computer to perform work more efficiently
 - Multiprocessing: Each CPU or core typically works on a different job
 - Used with computers and devices that have multi-core CPUs and/or multiple CPUs
 - Parallel processing: The CPUs or cores typically work together to complete one job more quickly
 - Used most often with supercomputers
- In either case, tasks are performed simultaneously

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Buffering and Spooling

- A **buffer** is an area in RAM or on the hard drive designated to hold data that is waiting to be used by the computer
- **Buffering** or **spooling** places items in a buffer so they can be retrieved by the appropriate device when needed

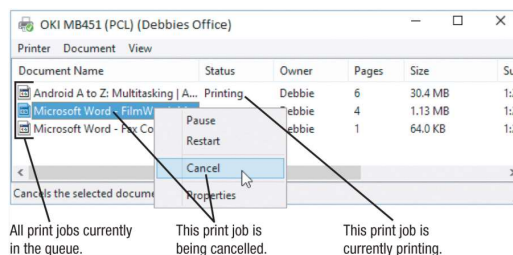


FIGURE 5-9
A print queue.

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Graphical vs. Command Line Interface

- A **graphical user interface (GUI)** has icons, buttons, and other objects that the user selects to issue commands
 - Used by most operating systems
- A **command line interface** requires the user to input text-based commands using the keyboard

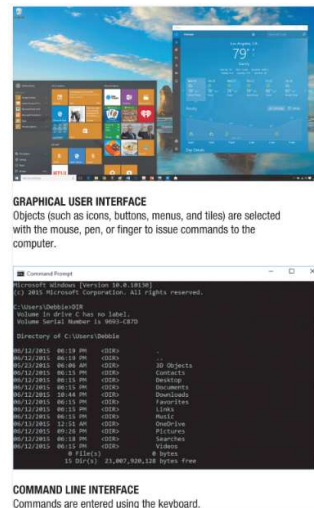


FIGURE 5-10
Graphical user
vs. command line
interfaces.

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Categories of Operating Systems

- **Personal (desktop) operating systems** are designed to be installed on a single computer
- **Server (network) operating systems** are designed to be installed on a network server
 - Client computers still use a personal operating system
 - Server operating system controls access to network resources
- **Mobile operating systems** are used with smartphones and other mobile devices
- **Embedded operating systems** are built into devices (cars, kiosks, consumer electronics, etc.)

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Example of How Network Operating Systems Work

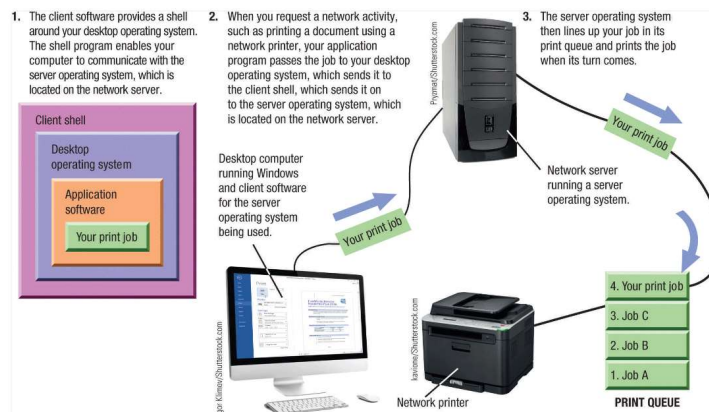
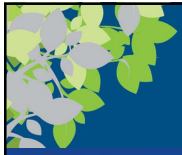


FIGURE 5-11
How network
operating systems
work.

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Types of Processors Supported and Support for New Technologies

- Most operating systems are designed for a specific type of processor
 - Desktop, mobile, or server processors
 - 32-bit or 64-bit CPUs
- Operating systems must respond to new technologies or trends
 - New CPU characteristic or new type of bus
 - Virtualization
 - Mobility and wearables
 - Security concerns
 - Power-consumption concerns
 - Touch and gesture input
 - The move to cloud software

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Trend

Amazon Echo

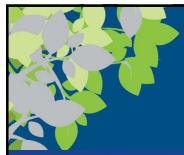
- A voice-controlled assistant (Alexa)
- Connects to the Internet and devices via Wi-Fi and Bluetooth
- Designed to understand spoken commands and provide the requested information: Music, news, traffic, weather, Internet information, and more
- If This Then That (IFTTT) capabilities



Amazon Echo

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Quick Quiz (1)

1. Which processing technique allows a computer to work with more than one program at a time?
 - a. interfacing
 - b. buffering
 - c. multitasking
2. True or False: Most operating systems today use a command line interface.
3. _____ is the task included with operating systems that allows to you keep track of the files stored on a computer.

Answers:

1) c; 2) False; 3) File management

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Operating Systems for Personal Computers and Servers: DOS

- **DOS (Disk Operating System)**
 - DOS traditionally used a command-line interface
 - Dominant operating system in the 1980s and early 1990s
 - PC-DOS
 - Created originally for IBM microcomputers
 - MS-DOS
 - Created for use with IBM-compatible computers
 - Can enter DOS commands in Windows using the Command Prompt

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Example of Entering DOS Commands via the Command Prompt

```

Microsoft Windows [Version 10.0.10130]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Users\Debbie>CD PICTURES
C:\Users\Debbie\Pictures>G:
G:\>COPY CHRISTMAS.PNG C:
1 file(s) copied.
G:\>C:
C:\Users\Debbie\Pictures>DIR
Volume in drive C has no label.
Volume Serial Number is 9693-C87D
Directory of C:\Users\Debbie\Pictures

06/12/2015  09:26 PM    <DIR>        ..
06/12/2015  09:26 PM    <DIR>        .
06/12/2015  06:20 PM    <DIR>        Camera Roll
06/12/2015  09:26 PM             788,847 Christmas.png
  
```

CHANGE DIRECTORY (CD) COMMAND
Changes to a different folder on the current drive.

DRIVE COMMAND
Changes to a new drive.

COPY COMMAND
Copies files from one location to another.

DIRECTORY (DIR) COMMAND
Displays the files and folders in the current location.

FIGURE 5-12
DOS. Even though DOS has become technologically obsolete, Windows users can still issue DOS commands via the Command Prompt.

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Windows

- **Windows** is the predominant personal operating system developed by Microsoft Corporation
- History
 - Windows 1.0 released in 1985
 - Windows 1.0 through Windows 3.x were operating environments for DOS
 - Windows after 3.11 were full-fledged operating systems
 - Windows 95, Windows 98, and Windows ME
 - Designed for personal computers
 - Windows NT (New Technology) and Windows 2000
 - Designed for high-end workstations and servers

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26

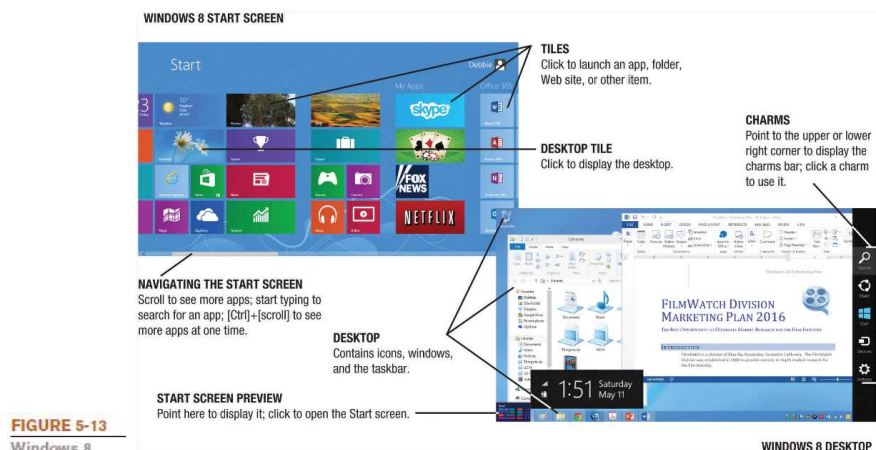
More Recent Versions of Windows

- Windows XP
 - Support for new hardware, networking, and the Internet
- Windows Vista
 - Introduced the Aero interface and Sidebar feature
- Windows 7
 - Required less memory and processing power; designed to run well on netbooks and tablets
- Windows 8
 - Designed to be used with a wide range of devices Supports multi-touch input
 - Includes Start screen, tiles, and charms bar
- There are also server versions of these operating systems (Windows Server and Windows Home Server)

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Windows 8



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Windows 10

- **Windows 10** is the latest version of Windows
 - Is a universal operating system that will run on any device
 - Replaces all previous versions of Windows
 - Looks and feel are consistent
 - Experience is optimized to match the device being used
 - Looks similar to Windows 8 but has new features
 - The **Start menu** contains a menu and tiles
 - Apps run in resizable windows
 - Task View allows personalized, virtual desktops
 - Edge Web browser
 - Cortana virtual assistant

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Windows 10 Desktop

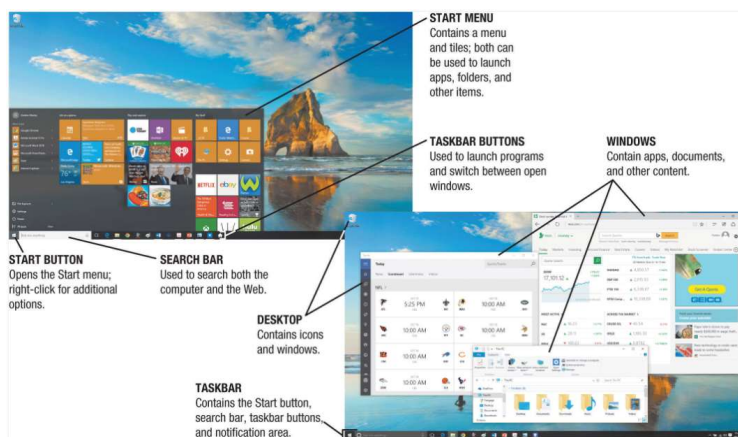
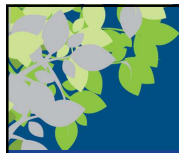


FIGURE 5-14
Windows 10.

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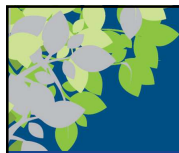


OS X

- **OS X** is the proprietary operating system for computers made by Apple Corporation
 - Designates a unique name for each version
 - OS X El Capitan, OS X Yosemite, etc.
 - Based on the UNIX operating system
 - Originally set the standard for graphical user interfaces
 - High level of multimedia functions and connectivity
 - Includes the Safari Web browser and a Dock
 - Recent features are the Notification Center and Continuity feature
 - Continue work from one device to another and sync all your Apple devices via iCloud
 - OS X Server is the server version of OS X

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OS X Yosemite

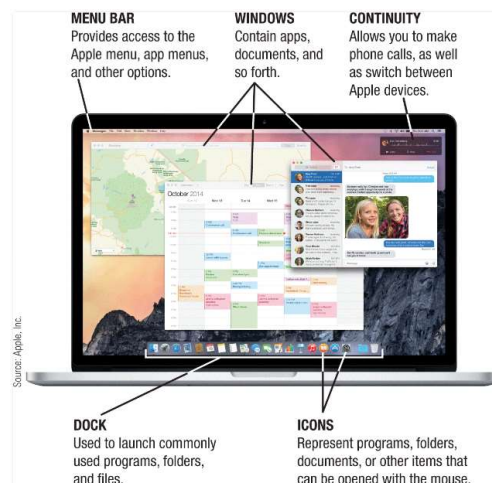



FIGURE 5-15
OS X Yosemite.

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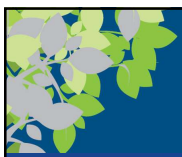


UNIX

- **UNIX** is an operating system developed in the late 1960s for midrange servers
 - Multiuser, multitasking operating system
 - More expensive, requires high level of technical knowledge; harder to install, maintain, and upgrade
 - “UNIX” initially referred to the original UNIX operating system, now refers to a group of similar operating systems based on UNIX
 - Many UNIX flavors are not compatible with each other
 - Single UNIX Specification is a standardized UNIX programming environment

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Linux

- **Linux** resembles UNIX but was developed independently by Linus Torvalds in 1991
 - Open-source software; has been collaboratively modified by volunteer programmers all over the world
 - Originally used a command line interface, most recent versions use a GUI
 - Strong support from mainstream companies, such as IBM, NVIDIA, HP, Dell, and Novell
 - Reasons to switch to Linux
 - Cost
 - More control over the computer
 - Faster

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Linux Desktop

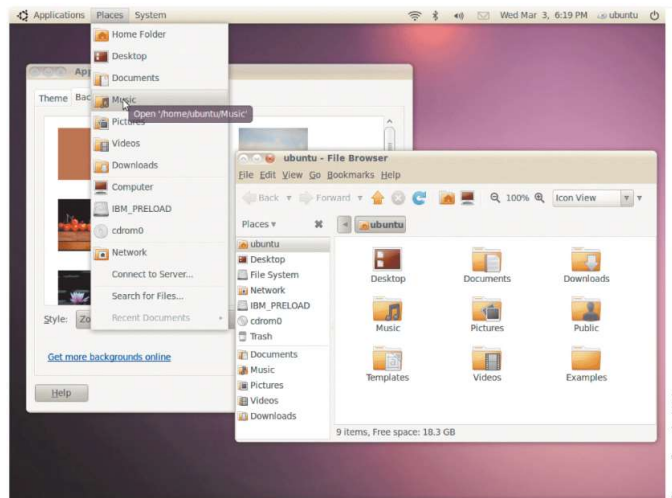


FIGURE 5-16

Linux. This version is Ubuntu, one of the most widely-used Linux operating systems.

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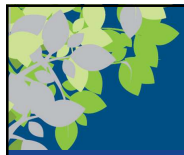
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Chrome OS

- Chrome OS is the first cloud operating system
 - Is essentially the Chrome Web browser redesigned to run a computer
 - Replaces traditional desktop operating systems
 - Designed for devices that are used entirely online
 - Currently only available preinstalled on Chrome devices
 - Chromebooks

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Quick Quiz (2)

1. What is the most recent personal version of Windows?
 - a. Windows 10
 - b. Windows 8
 - c. Windows XP
2. True or False: Linux is an open source operating system available for free via the Internet.
3. The operating system most commonly used on Apple personal computers today is _____.

Answers:

1) a; 2) True; 3) OS X

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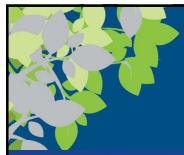


Operating Systems for Mobile Devices

- Notebook and other portable personal computers typically use the same operating systems as desktop computers
- Mobile devices typically use a mobile operating system
 - Mobile version of a personal operating system (Windows or Linux)
 - Special operating system designed for mobile devices (Android or Apple iOS)
- Embedded operating systems used with everyday objects
- Users should consider the operating system when selecting a smartphone, tablet, or other mobile device

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Technology and You

Smart Cars

- Self-driving systems and self-parking systems
- Lane departure, drowsiness, and blind spot detection systems
- Adaptive cruise control and distance alert systems
- Windshield displays
- Collision warnings and auto brakes
- Keyless entry/ignition systems
- Distraction-prevention systems
- Safe use of gadgets is a concern



This mobile app controls a smart car's self-parking system.

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Windows 10 Mobile

- Windows 10 Mobile
 - Uses the same kernel, user interface, and other features as desktop installations
 - Continuum feature allows Windows to provide the most appropriate interface for the device being used
 - Keyboard and mouse input vs. touch input
 - Enables some smartphones to function as a PC
 - Replaces older mobile and embedded versions of Windows (Windows Phone 8, Windows RT, etc.)

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Windows 10 Mobile on a Smartphone vs. Windows 10 on a PC

SMARTPHONE
PERSONAL COMPUTER

FIGURE 5-17
 Windows 10 has a universal appearance.

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Android

- **Android** is a Linux-based operating system created with current mobile device capabilities in mind
 - Developed by Google and the Open Handset Alliance
 - Open platform but must adhere to specifications to call a device “Android compatible”
 - Current version is Android 6.0, known as Marshmallow
 - Supports multi-touch input and has a variety of built-in Google apps
 - Google Now and Google on Tap
 - Android Device Manager
 - Android Pay
- Android Wear, Android TV, and Android Auto

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Examples of Android Devices

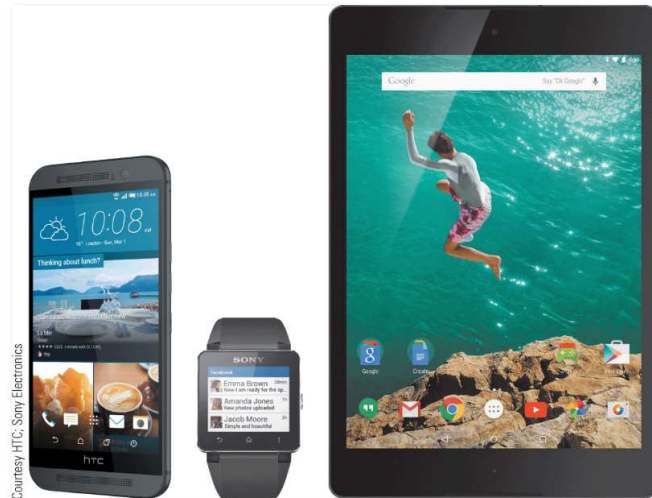


FIGURE 5-18
Android is used with
a variety of devices.

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iOS

- **iOS** is designed for Apple mobile devices
 - Supports multi-touch input
 - Current version is iOS 9
 - Safari Web browser
 - Siri virtual assistant
 - Facetime video calling
 - Touch ID and Apple Pay
 - Find My iPhone
 - Support for Apple Watch
- watchOS (Apple Watch) and tvOS (Apple TV)

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Examples of iOS Devices



FIGURE 5-19
iOS.

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BlackBerry OS and Mobile Linux

- BlackBerry OS and BlackBerry PlayBook OS
 - Designed for BlackBerry devices
- Additional Linux-based mobile operating systems besides Android and iOS
 - Ubuntu
 - webOS
 - Firefox OS
 - Tizen


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Inside the Industry

Drones

- An unmanned aircraft
- Usually remote-controlled
- Look like small airplanes or multi-rotor helicopter
- Commonly used for aerial filming
- Use is skyrocketing; FAA regulates drone use
- Amazon is currently testing a drone-based delivery system



Drone assisting in a search and rescue operation.

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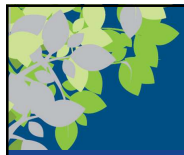
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Operating Systems for Larger Computers

- Larger computers sometimes use operating systems designed solely for that type of system
 - IBM's z/OS is designed for IBM mainframes
- Windows, UNIX, and Linux are also used with servers and mainframes
- Linux is also used with supercomputers
- Mainframes and supercomputers may also use a customized version of UNIX or another conventional operating system

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Utility Programs

- A **utility program** performs a specific task, usually related to managing or maintaining the computer system
 - Many utilities are built into operating systems (for finding files, viewing images, backing up files, etc.)
 - Utilities are also available as stand-alone products and as suites

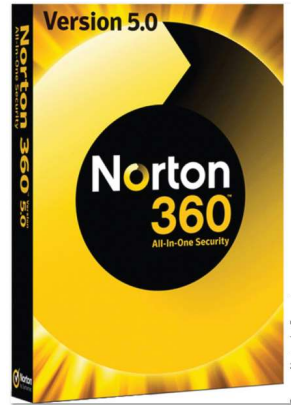


FIGURE 5-20
Utility suites contain a number of related programs.

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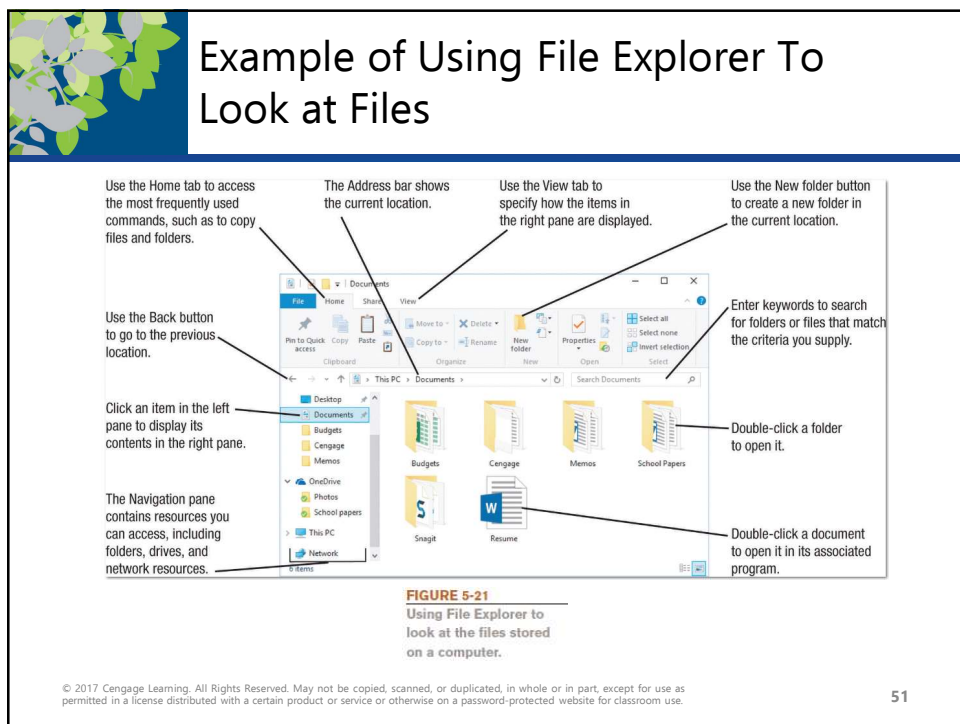
File Management Programs

- **File management programs** enable the user to perform file management tasks
 - Looking at the folders and files stored on a computer or device
 - Copying and moving files and folders
 - Copy or cut to the Clipboard, and then paste
 - Renaming files and folders
 - Deleting files and folders
 - Deleted files go to the Recycle Bin and can be restored until the Recycle Bin is emptied
- Current versions of Windows include **File Explorer**

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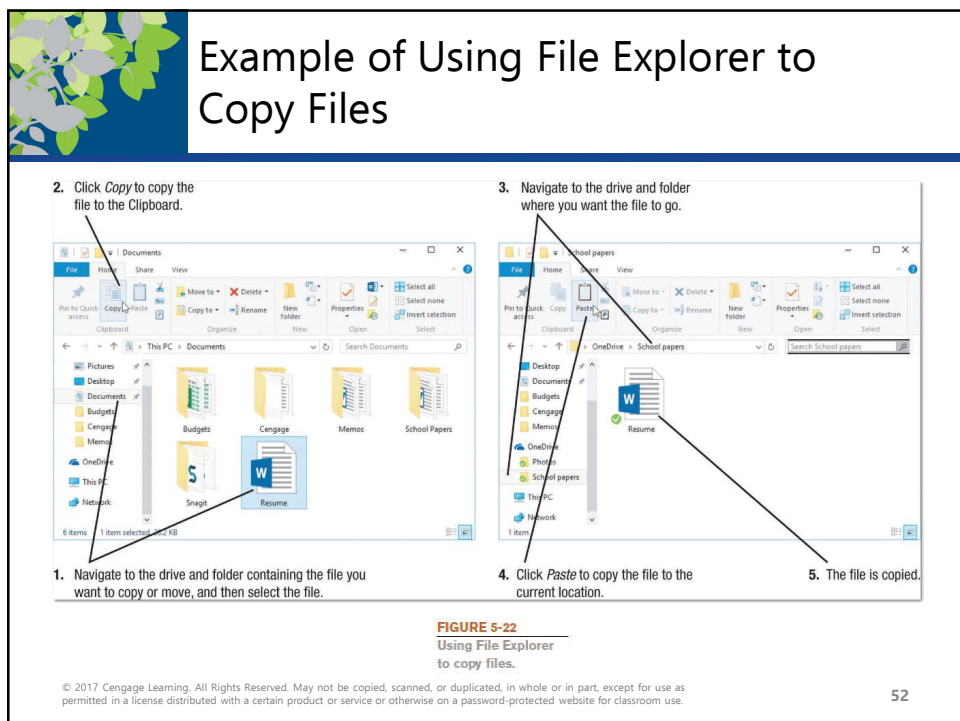
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Example of Using File Explorer To Look at Files



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Example of Using File Explorer to Copy Files



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Search Tools

- **Search tools** are designed to search for documents and other files on the user's hard drive
 - Can specify search criteria
 - Can search in File Explorer
 - Can search via the Windows 10 taskbar search box

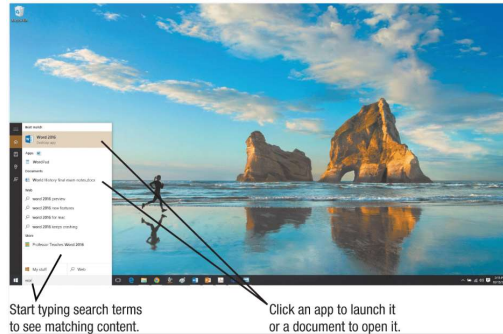


FIGURE 5-23
Using the taskbar search box in Windows 10.

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Diagnostic and Disk Management Programs

- Diagnostic programs evaluate your system and make recommendations for fixing any errors found
- Disk management programs diagnose and repair problems related to your hard drive
 - Check hard drive for errors
 - Disk defragmentation

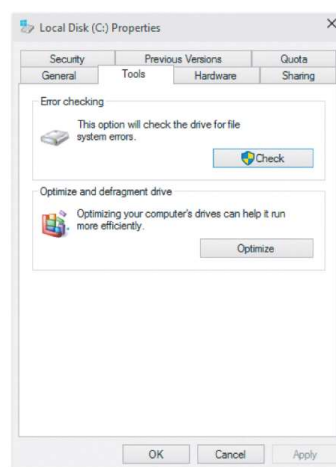


FIGURE 5-24
Windows disk tools.

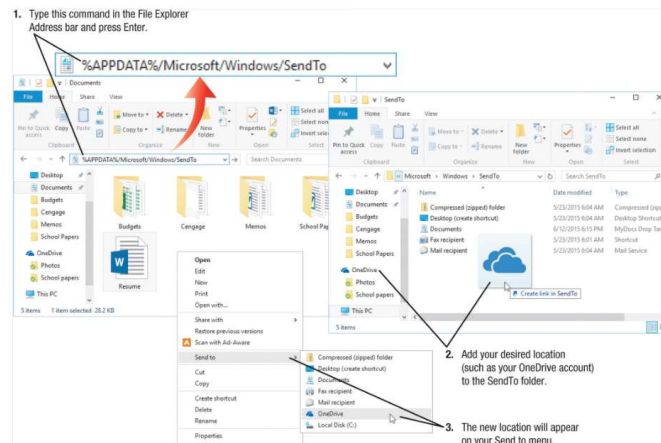
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How It Works

Sending to the Cloud

- How to add locations to the Send To menu



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Uninstall and Cleanup Utilities

- Uninstall utilities remove programs from your hard drive without leaving bits and pieces behind
 - Important to properly uninstall programs, not just delete them
 - Built into operating systems and included with some programs
- Cleanup utilities delete temporary files
 - Recycle Bin, temporary Internet and installation files, etc.
 - Windows Disk Cleanup
 - Registry cleaners delete unnecessary items in the Windows registry

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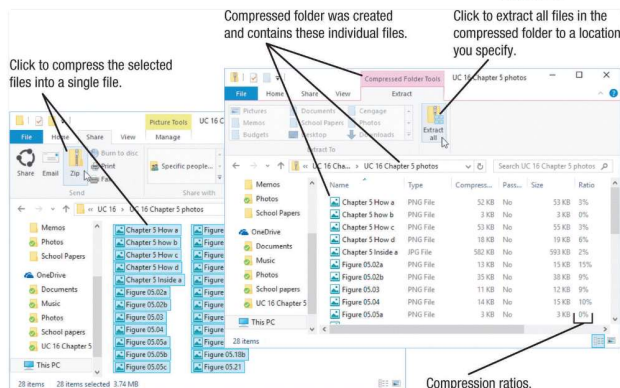
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File Compression Programs

- **File compression programs** reduce the size of files to optimize storage space and transmission time
 - Both zip and unzip files
 - Built into recent versions of Windows
 - WinZip
 - Stuffit

FIGURE 5-25

File compression. Reduces the size of files so they can be more efficiently stored or transmitted.



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Backup and Recovery Utilities

- Creating a **backup** means making a duplicate copy of important files so they can be restored if needed
 - Can backup an entire computer or just certain files
 - Can be stored on a recordable or rewritable DVD disc, a USB flash drive, an external hard drive, or in the cloud
 - Backup media should be secured
- Backup and recovery utilities make the backup and restoration process easier
- Regular backup procedures are critical for businesses
- Individuals should back up any important data and important files before they are modified

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Example of Using a Backup Program

The figure consists of three screenshots of the Carbonite software interface, illustrating the steps to use the backup program.

- 1. Use the Settings screen to select your desired backup settings.** The first screenshot shows the 'Settings' window. It includes sections for 'Online Backup Schedule' (with options for continuous or manual backup), 'Options' (for selecting what to back up, such as documents, music, and photos), and 'Carbonite Online Backup automatically backs up' (listing folders like Desktop, Documents, Music, and Pictures). A note states: 'Currently all user folders are backed up on a continuous basis.'
- 2. Use the Back Up screen to see the current backup settings; here, files are being backed up.** The second screenshot shows the 'Back Up' window. It displays the 'Online Backup' status as 'ON' and shows a progress bar for 'Next backup up' at 100%. It also indicates 'Files backing up: 10 GB' and 'Files pending: 10 GB'.
- 3. Use the Restore screen when needed to recover lost files or to copy backed up files to a new device.** The third screenshot shows the 'Restore' window. It provides options to 'Search and restore' files, 'Browse your backup' to see what's in the backup, and 'Restore all files' to restore everything at once.

Source: Carbonite, Inc.

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FIGURE 5-26
Using a backup program.

Antivirus, Antispyware, Firewalls, and Other Security Programs

- Security concerns
 - Viruses, spyware, identity theft, phishing schemes
- Security programs protect computers and users and it is essential that all computer users protect themselves and their computers
 - Antivirus, antispyware, and firewall programs
 - Operating systems are including security software integrated into the operating system
 - Windows Defender, Windows SmartScreen, and Windows Firewall

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The Windows Firewall Program

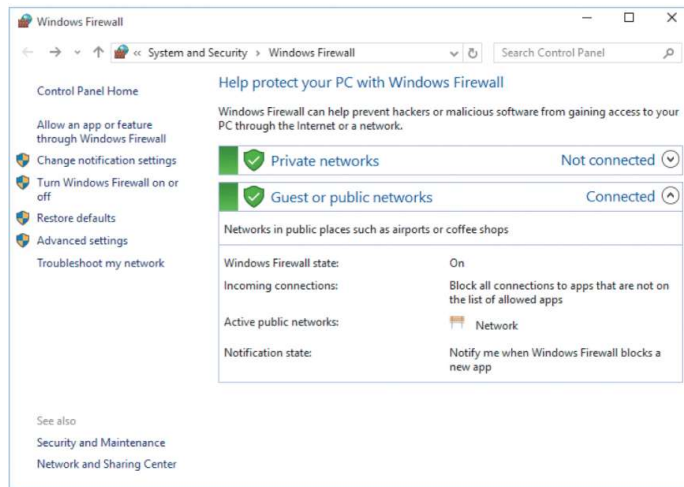


FIGURE 5-27
The Windows
Firewall program.

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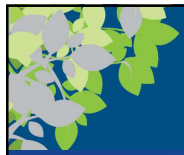
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The Future of Operating Systems

- Will likely be:
 - More user-friendly
 - Driven primarily by a voice interface, touch, and/or gesture interface
 - More stable and self-healing
 - Responsive to new security and technological improvements
 - Continuing to improve synchronizing and coordinating data and activities among a person's various computing and communicating devices
 - Used primarily to access software available through the Internet or other networks

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Quick Quiz (3)

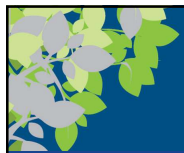
1. Which type of utility program is used to make a file smaller for transfer over the Internet?
 - a. uninstall program
 - b. antivirus program
 - c. file compression program
2. True or False: A file management program can be used to see the files located on a storage medium.
3. A(n) _____ is a duplicate copy of one or more files that can be used if there is a problem with the original file(s).

Answers:

1) c; 2) True; 3) backup

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Summary

- System Software vs. Application Software
- The Operating System
- Operating Systems for Personal Computers and Servers
- Operating Systems for Mobile Phones and Other Devices
- Operating Systems for Larger Computers
- Utility Programs
- The Future of Operating Systems

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