

The Visible Computer

In this chapter, you will learn how to

- Describe how computing devices work
 - Identify common connectors and devices on typical computer systems
 - Discuss features common to operating system software
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Charles Babbage didn't set out to change the world. He just wanted to do math without worrying about human error, something all too common in his day. Babbage was a mathematician in the nineteenth century, a time well before anyone thought to create electronic calculators or computers (see [Figure 2-1](#)). When he worked on complex math, the best "computers" were people who computed by hand. They solved equations using pen or pencil and paper.

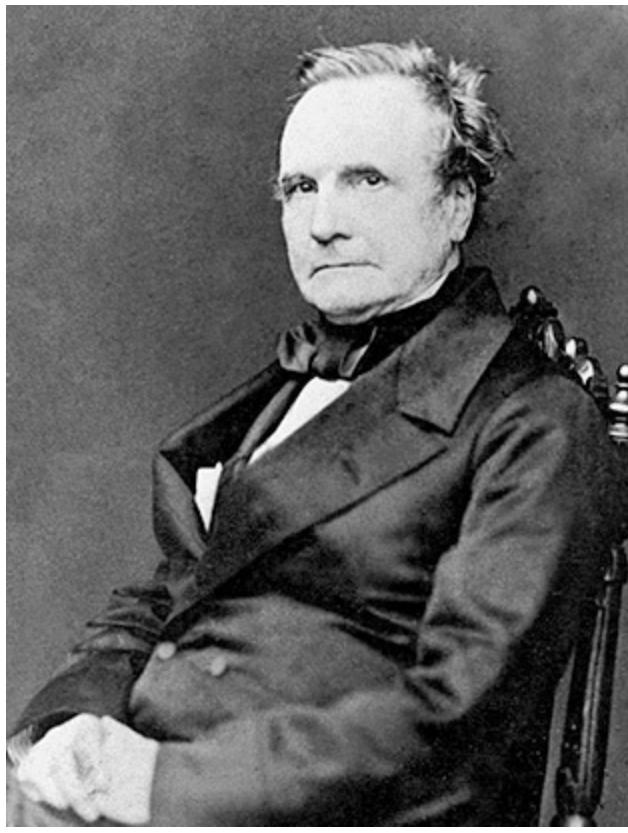


Figure 2-1 Charles Babbage, father of the computer

Babbage thought of making machines that would do calculations mechanically, so the numbers would always be right. Although his ideas were ahead of his time, inventors in the mid-twentieth century picked up the concepts and created huge calculating machines that they called *computers*.

This chapter explores how computing devices work. We'll look first at the computing process, then turn to hardware components common to all devices. The chapter finishes with a discussion about software, exploring commonality among all operating systems and specific functions of application programming. And, there are lots of pictures.

Historical/Conceptual

The Computing Process

In modern terms, a *computer* is an electronic device that can perform

calculations. The most common types use special programming languages that people, known as *computer programmers*, have written and compiled to accomplish specific tasks.

When most people hear the word “computer,” they picture *general computing devices*, machines that can do all sorts of things. The typical *personal computer (PC)* runs the operating system Microsoft Windows and is used for various tasks (see [Figure 2-2](#)). You can use it to manage your money and play games, for example, without doing anything special to it, such as adding new hardware.



Figure 2-2 A typical PC

Here are some other general-purpose computing devices:

- Apple Mac
- Apple iPad
- Smartphone
- Laptop (see [Figure 2-3](#))



Figure 2-3 A laptop

Plenty of other devices do *specific* computing jobs, focusing on a single task or set of similar tasks. You probably encounter them all the time. Here's a list of common specific-purpose computers:

- Pocket calculator
- Digital watch
- Digital clock
- Wi-Fi picture frame
- Basic mobile phone
- Xbox One X
- GPS device (Global Positioning System, the device that helps drivers figure out how to get where they need to go)
- Roku
- Point of sale (POS) system (see [Figure 2-4](#))



Figure 2-4 A point of sale computer in a gasoline pump

- Digital camera

This list isn't even close to complete! Plus, there are computers *inside* a zillion other devices. Here are some:

- Modern refrigerators
- Every automobile built since 1995
- Airplanes
- Boats
- Mall lighting systems
- Zambonis
- Home security alarms

You get the idea. Computers help the modern world function.

Modern computer techs need to know how different types of computing devices work so they can support the many devices used by their clients. This diversity is also reflected in the CompTIA A+ exams.

If the list of devices to support seems overwhelming, relax. The secret savior for modern techs is that computing devices function similarly to each other. Once you know what a device should enable a user to do, you'll be able to configure and troubleshoot successfully.



NOTE I picked 1995 as an arbitrary date for when every new car built had a computer. Computers have been used with cars for a long time. Simple computers helped make car factories work better starting in the 1970s, for example. The earliest mass-production car I found that had a central processor chip for added performance was the BMW 3 Series. The 1985–86 BMW 325, for example, can gain a few extra horsepower just from a chip upgrade costing approximately \$200.

The Computing Parts

A modern computer consists of three major components:

- Hardware
- Operating system
- Applications

The *hardware* is the physical stuff that you can touch or hold in your hand. With a smartphone, for example, you hold the phone. On a typical personal computer, you touch the keyboard or view images on the monitor.

The *operating system (OS)* controls the hardware and enables you to tell the computer what to do. The operating system often appears as a collection of windows and little icons you can click or touch (see [Figure 2-5](#)). Collectively these are called the *user interface (UI)*, which means the software parts with which you can interact. The UI that offers images or icons to select (as opposed to making you type commands) is called a *graphical user interface (GUI)*.

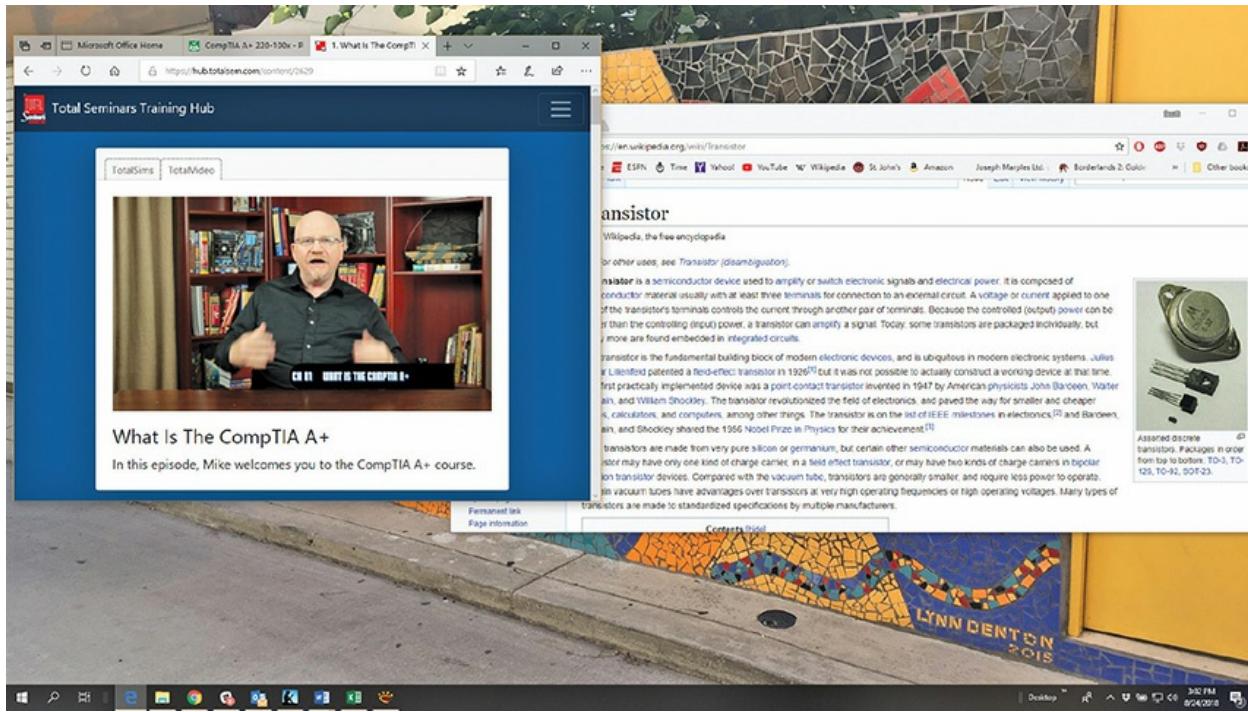


Figure 2-5 The Microsoft Windows 10 operating system

Applications (or programs) enable you to do specialized tasks on a computer, such as

- Type a letter
- Send a message from your computer in Houston to your friend's computer in Paris
- Wander through imaginary worlds with people all over Earth

Very simple computing devices might have an operating system with only a few features that give you choices. A digital camera, for example, has a menu system that enables you to control things like the quality of the picture taken (see [Figure 2-6](#)).



Figure 2-6 Changing settings on a digital camera

More complicated devices offer more choices. An Apple iPhone, for example, can do some cool things right out of the box, including make a phone call. But you can visit the Apple online store—the App Store—for programs and download applications (known as apps) to do all sorts of things that Apple didn't include (see [Figure 2-7](#)).

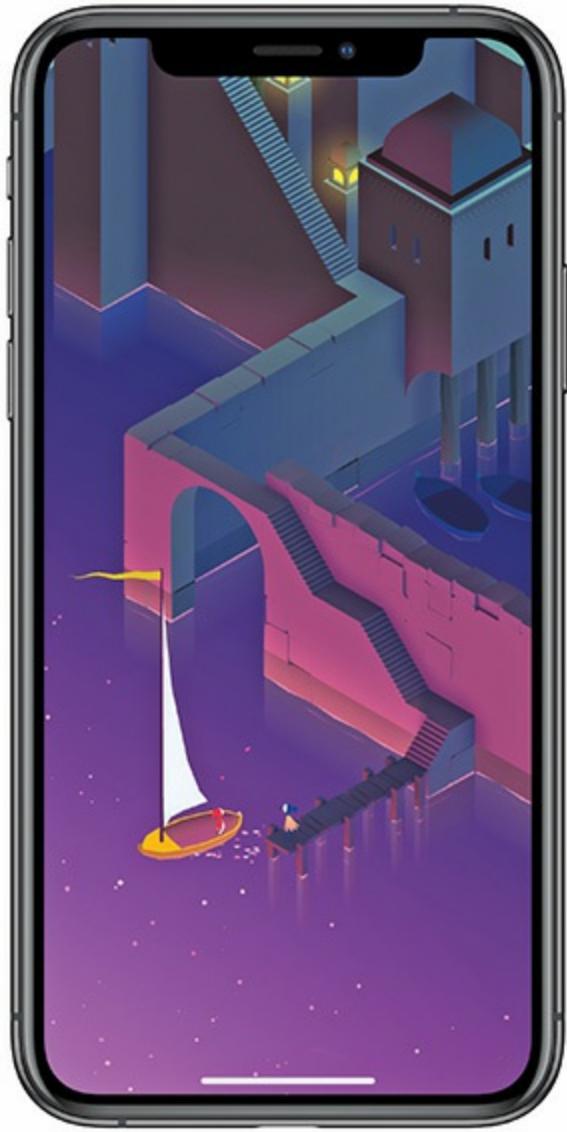


Figure 2-7 Monument Valley II game from the Apple App Store

Finally, multipurpose computers like the typical Windows PC or macOS computer offer applications to help you do everything from write a book on CompTIA A+ certification to talk with someone on the other side of the world, with full audio and video (see [Figure 2-8](#)).

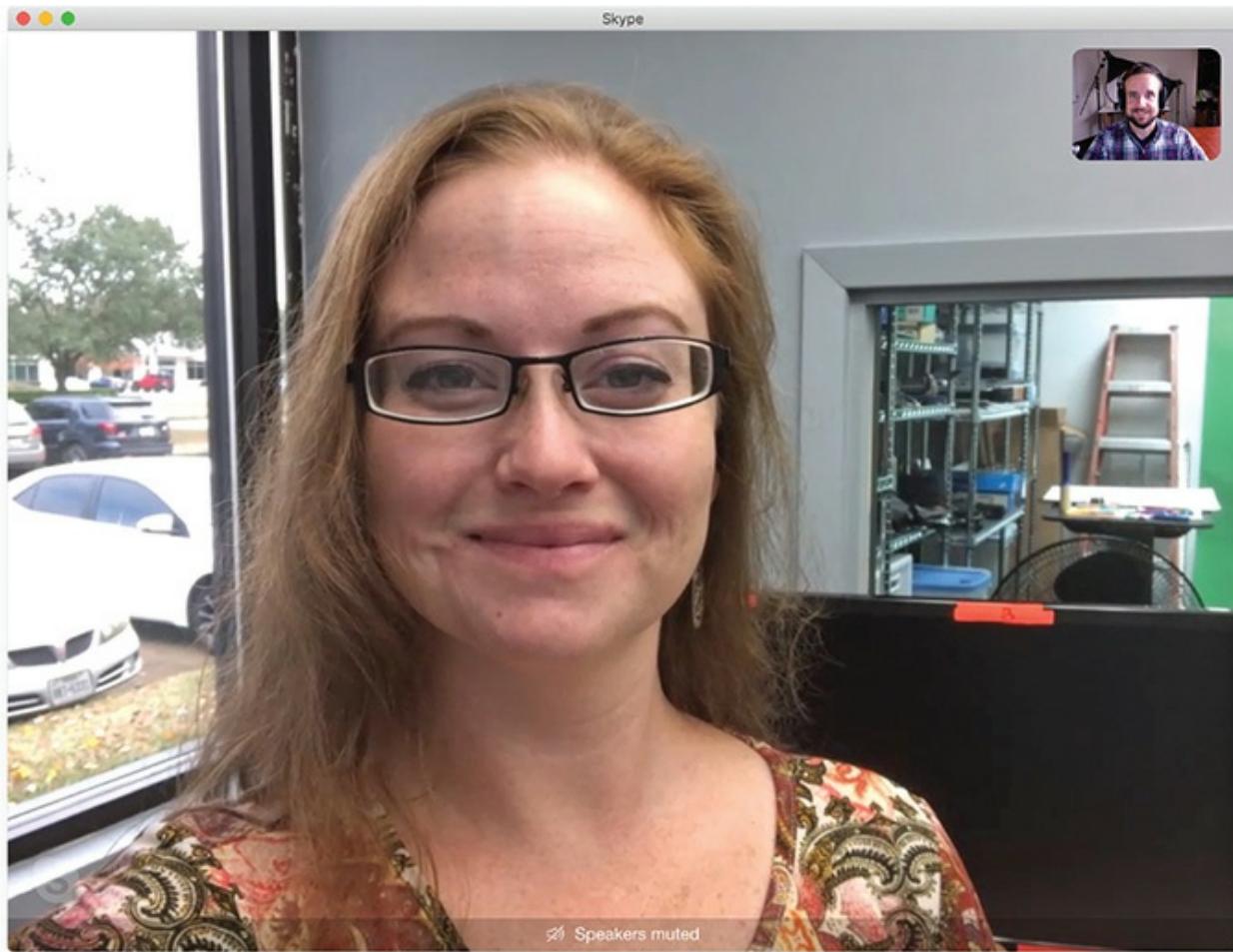


Figure 2-8 Apple FaceTime communication

Stages

At the most basic level, computers work through three stages, what's called the *computing process*:

- Input
- Processing
- Output

You start the action by doing something—clicking the mouse, typing on the keyboard, or touching the touch screen. This is *input*. The parts inside the device or case take over at that point as the operating system tells the hardware to do what you've requested. This is *processing*.

In fact, at the heart of every computing device is a *central processing unit*

(CPU), usually a single, thin wafer of silicon and tiny transistors (see [Figure 2-9](#)). The CPU handles the majority of the processing tasks and is, in a way, the “brain” of the computer.

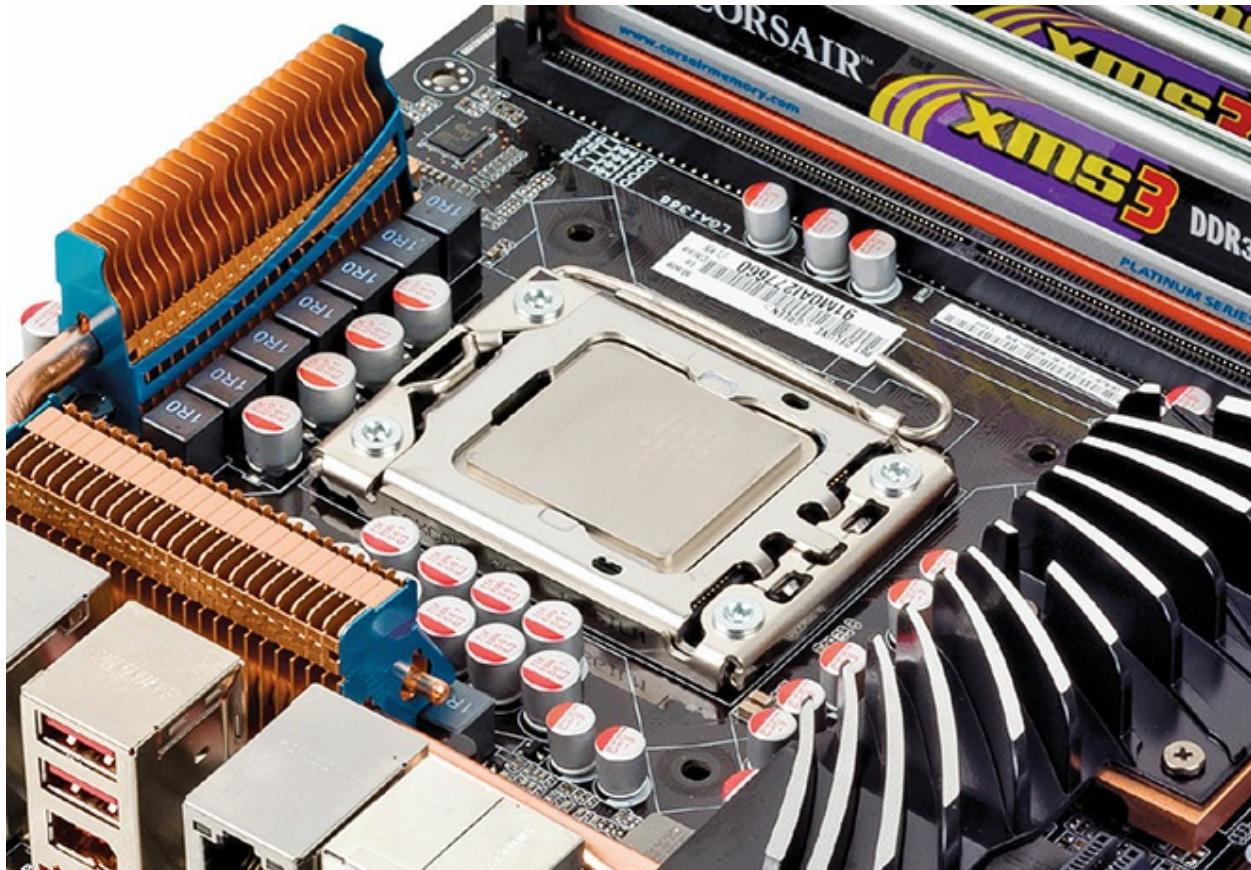


Figure 2-9 An Intel Core i7 CPU on a motherboard



NOTE [Chapter 3, “CPUs,”](#) gives a lot more information on CPUs and other processing components.

Once the computer has processed your request, it shows you the result by changing what you see on the display or playing a sound through the speakers. This is *output*. A computer wouldn’t be worth much if it couldn’t demonstrate that it fulfilled your commands! [Figure 2-10](#) shows the

computing process.

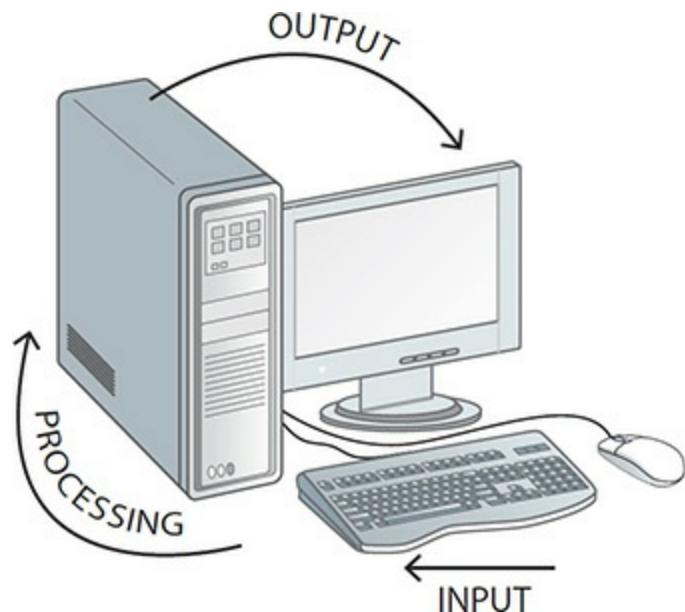


Figure 2-10 The computing process

Modern computing devices almost always have two other stages:

- Data storage
- Network connection

Data storage means saving a permanent copy of your work so that you can come back to it later. It works like this. First, you tell the computer to save something. Second, the CPU processes that command and stores the data. Third, the computer shows you something, such as a message saying that the data is stored. Any work that you *don't* save is lost when you turn the computer off or exit the application.

Most computing devices connect to other devices to access other resources. A *network connection* often describes how one computer connects to one or more other computers. And it doesn't just apply to a couple of office computers. Every smartphone, for example, can connect to the Internet and play a video from YouTube (assuming you have a signal from a cell tower and a data plan).

At this point, students often ask me a fundamental question: “Why should I care about the computing process?” The answer to this question defines

what makes a good computer technician. Here's my response.

Why the Process Matters to Techs

Because the computing process applies to every computing device, it provides the basis for how every tech builds, upgrades, and repairs such devices. By understanding both the components involved and how they talk to each other, you can work with *any* computing device. It might take a couple minutes to figure out how to communicate with the device via input, for example, but you'll quickly master it because you know how all computing devices work.

Breaking It Down

The whole computer process from start to finish has a lot of steps and pieces that interact. The more you understand about this interaction and these pieces, the better you can troubleshoot when something goes wrong. *This is the core rule to being a great tech.*

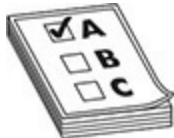
Here are nine steps that apply to most computers and computing devices when you want to get something done:

1. Power up. Computers run on electricity.
2. Processing parts prepare for action.
3. You provide input.
4. Processing parts process your command.
5. Processing parts send output information to your output devices.
6. Output devices show or play the results to you.
7. Repeat Steps 3–6 until you're satisfied with the outcome.
8. Save your work.
9. Power down the computer.

We'll come back to these processing steps as we tackle troubleshooting scenarios throughout the book. Keep these steps in mind to answer the essential question a tech should ask when facing a problem: What can it be? Or, in slightly longer fashion: What could cause the problem that stopped this device from functioning properly?

Computing Hardware

Later chapters examine specific computing hardware, such as CPUs and mass storage devices. CompTIA expects competent techs to know what to call every connector, socket, and slot in a variety of computing devices. Rather than describe all of those briefly here, I decided to create a photo walkthrough naming points of interest and the chapters that discuss them.



EXAM TIP Memorize the names of the components, connectors, and terms discussed and displayed in this section. You'll see them in future chapters, in the real world, and on the CompTIA A+ 1001 exam.

This section serves as a visual introduction to the components and connections. Plus, it should work great as a set of study sheets for memorizing names just before taking the 1001 exam. The images that follow indicate the chapters where you'll find information about a component or connection standard.

[Figure 2-11](#) shows a typical PC. The input and output devices should be familiar to most.

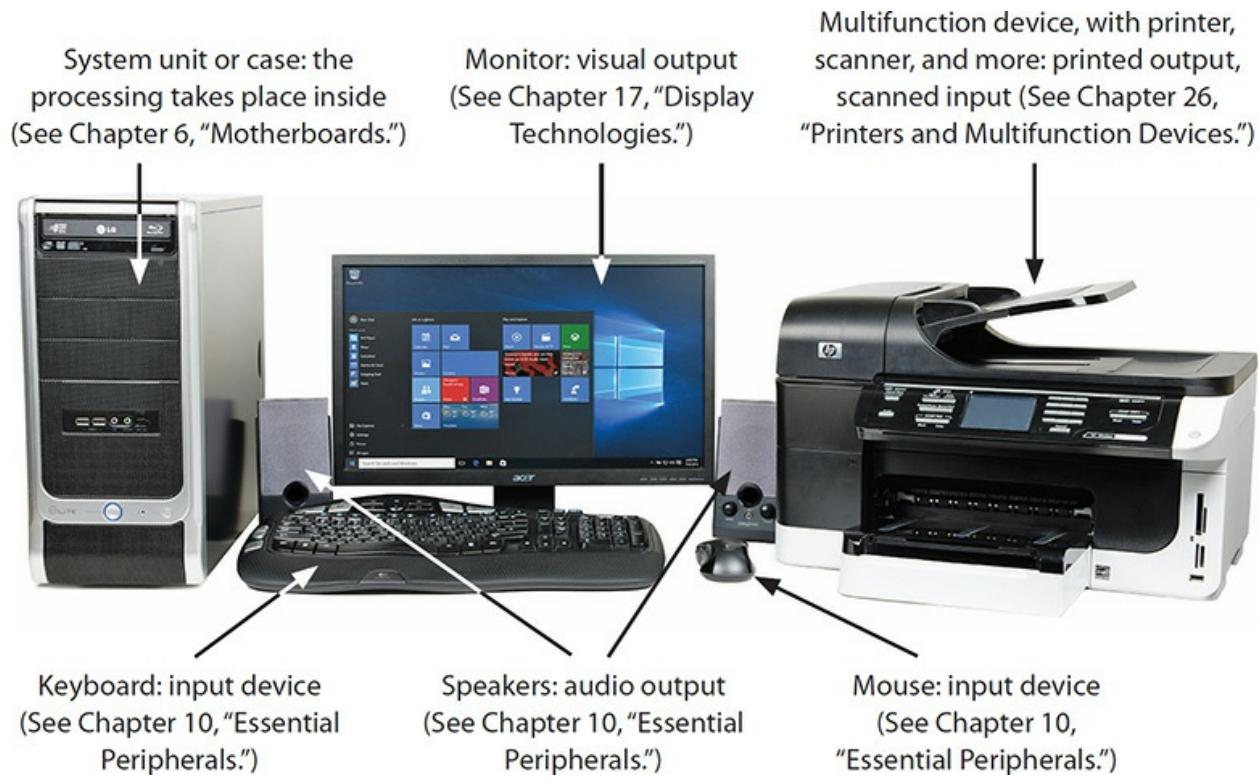


Figure 2-11 PC with common peripherals



NOTE The computer in [Figure 2-11](#) is technically a *workstation*, meaning a computer you'd use at a desk. This is opposed to a *server*, a computer designed to provide network-available programs or storage. We'll talk about servers when we reach networking, though they're covered more in CompTIA Network+ than in CompTIA A+.

[Figure 2-12](#) shows the back of a PC's system unit, where you'll find the many connection points called ports. Some ports connect to output devices; a couple are exclusively used for input devices. Most (such as the universal serial bus, or USB) handle either type of device.

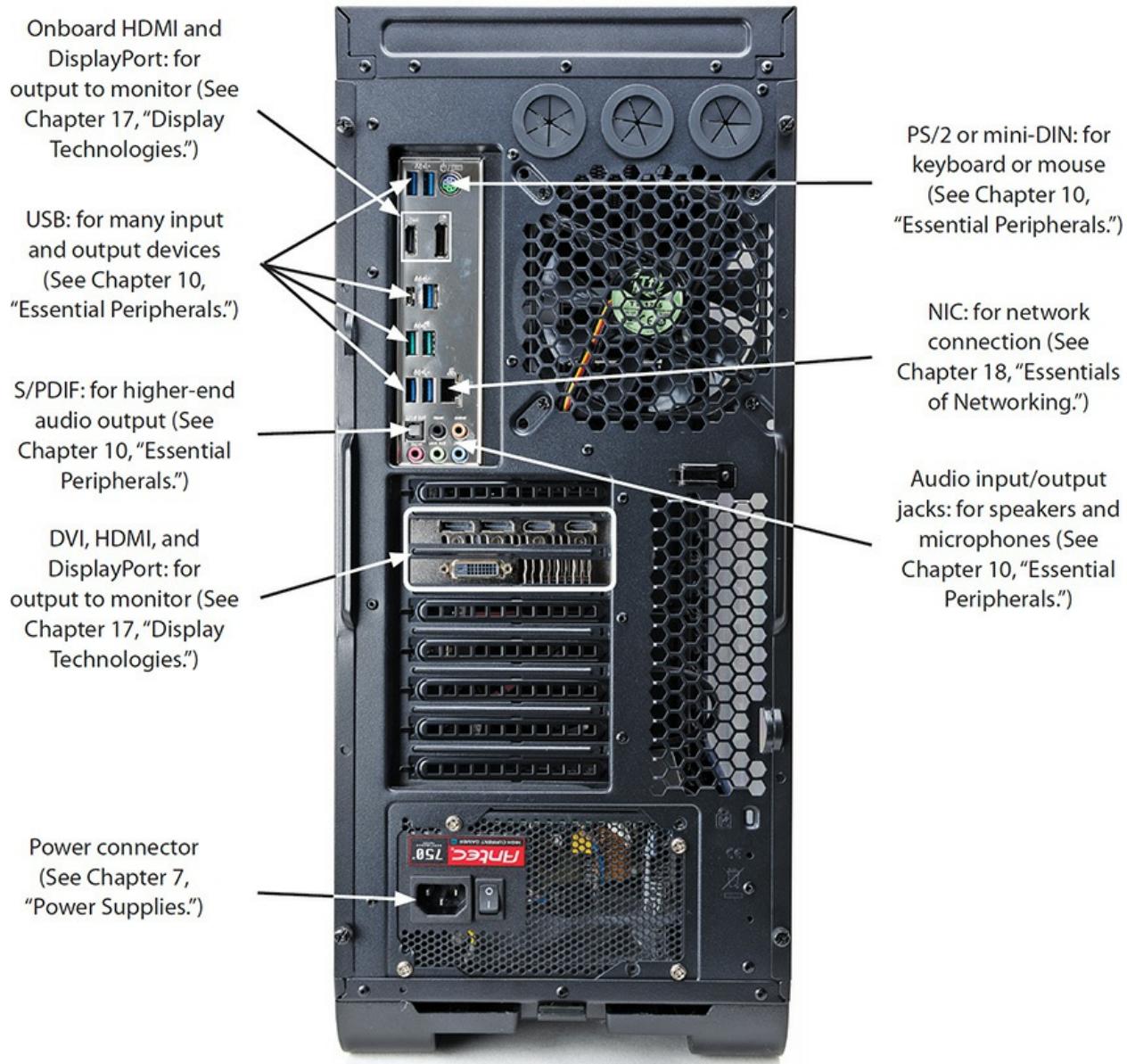


Figure 2-12 The business end of a PC

Figure 2-13 reveals the inside of a PC case, where you'll find the processing and storage devices. Hiding under everything is the motherboard, the component into which everything directly or indirectly connects.

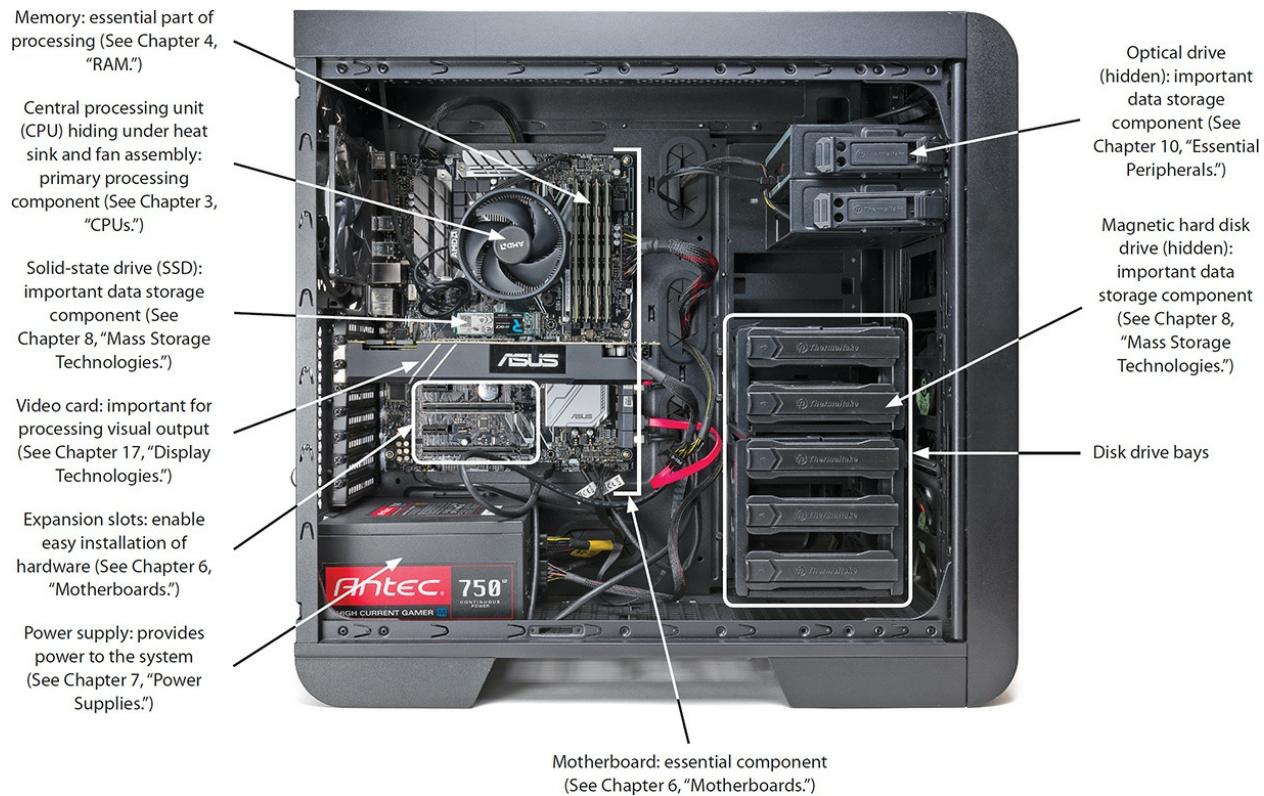


Figure 2-13 Inside the system unit

Figure 2-14 shows a clamshell-style laptop, in this case an Apple MacBook Air. The portable nature of the device calls for input and output devices built into the case—some variation from the typical PC displayed earlier, therefore, but all the standard computing component functions apply. Chapter 23, “Portable Computing,” goes into a lot of detail about each component displayed here.

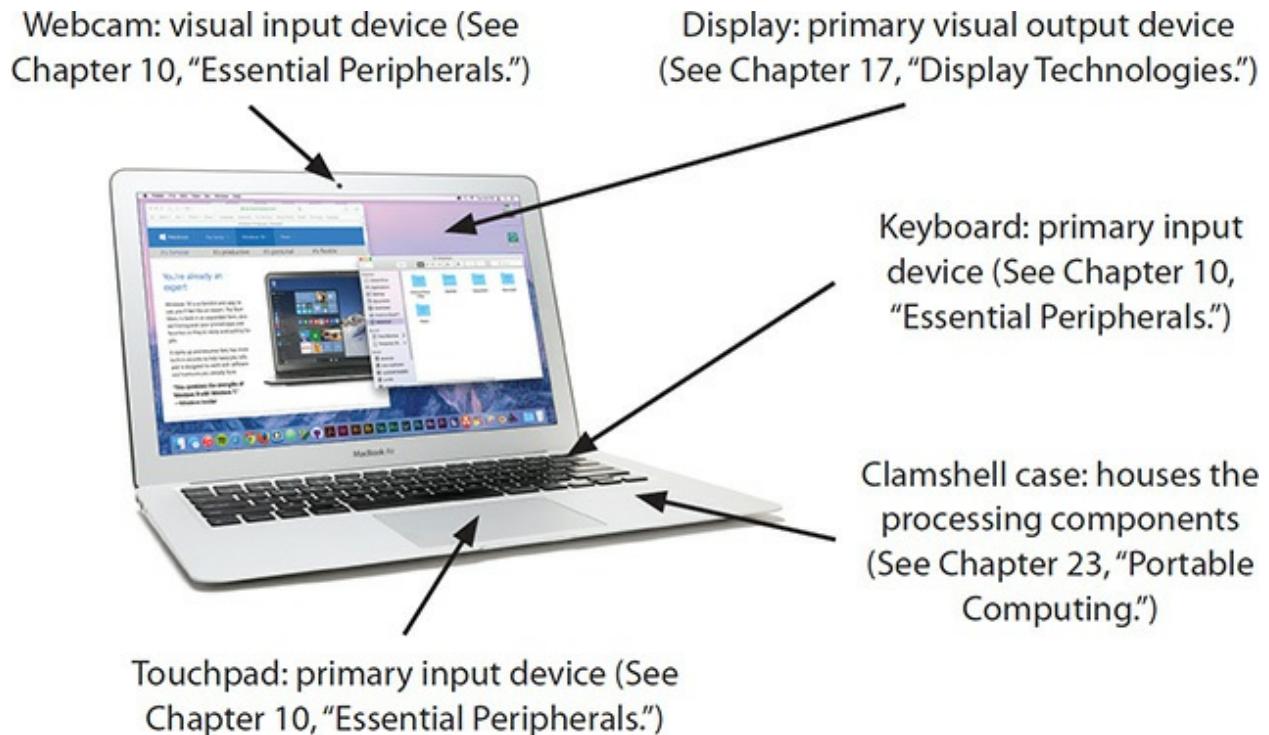


Figure 2-14 Laptop (a MacBook Air)

Figure 2-15 shows the side of a laptop with three different connection types.

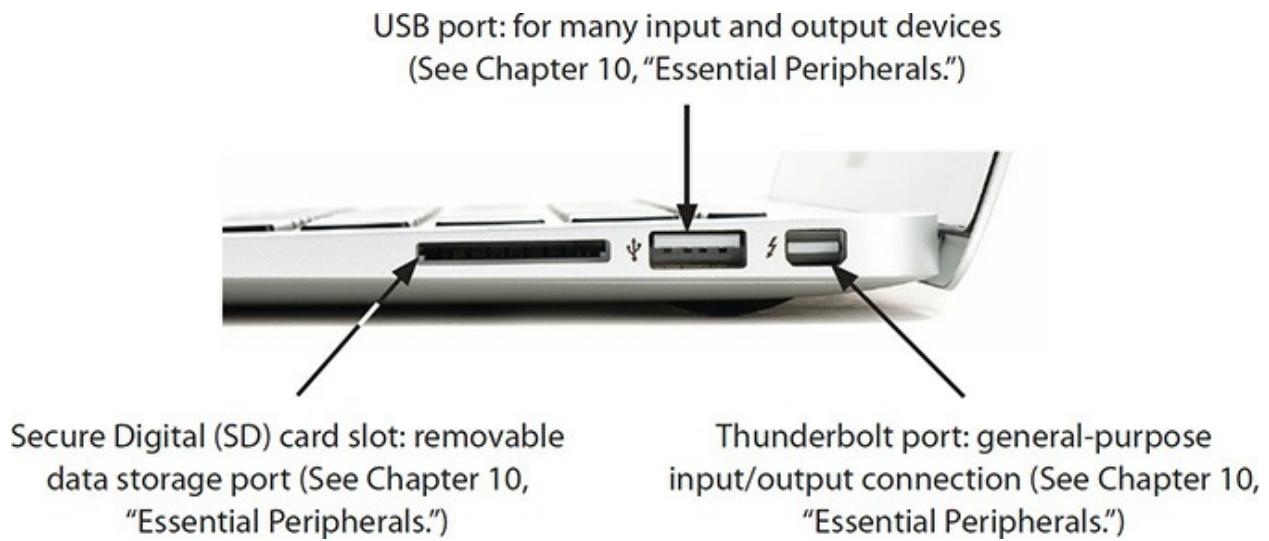


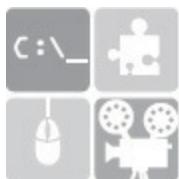
Figure 2-15 Ports on a laptop

Figure 2-16 shows a tablet computer, an Apple iPad. Note that the screen has a touch interface, which makes it both an input and output device.



Figure 2-16 Tablet computer

We could continue with any number of computing devices in the same picture show, but at this point the uniformity of computing component functions should be clear. They all work similarly, and, as a competent tech, you should be able to support just about any customer device. Let's turn now to a visual feast of software.



SIM Check out the excellent [Chapter 2 Challenge!](#) sim on motherboard matching at <http://totalsem.com/100x>. It's a cool sim that helps names stick in your head.

Computing Software

The CompTIA A+ 1002 exam covers a lot of software, though mostly operating system tools rather than specific applications. The exam explores three workstation operating systems, Microsoft Windows, Apple Macintosh OS, and Linux. The exam covers Windows 7, Windows 8, Windows 8.1, and Windows 10. The current Apple workstation OS is macOS, which is how the book refers to it throughout. The exam covers common Linux features, but not distribution-specific features. The book follows this pattern as well.



EXAM TIP The exam objectives use “Apple Macintosh OS” and “Mac OS” to refer to Apple’s workstation OS. Apple changed the branding from “Mac OS X” to “macOS” in 2016. All these terms refer to the same OS.

In addition to the workstation operating systems, the CompTIA A+ 1002 exam covers four smartphone/tablet operating systems: Microsoft Windows, Google Android, Apple iOS, and Google Chrome OS. Android and iOS utterly dominate the market, with 98%+ market share, which makes including Windows and Chrome OS odd at best.

Common Operating System Functions

All OSs are not created equal, but every OS provides certain functions. Here’s a list:

- The OS communicates, or provides a method for other programs to communicate, with the hardware of the PC or device. Operating systems run on specific hardware. For example, if you have a 32-bit CPU, you need to install a 32-bit version of an operating system. With a 64-bit CPU, you need a 64-bit OS ([Chapter 3](#), “Microprocessors,” explains 32- vs. 64-bit processors).
- The OS creates a *user interface (UI)*—a visual representation of the computer on the monitor that makes sense to the people using the computer.

- The OS enables users to determine the available installed programs and run, use, and shut down the programs of their choice.
- The OS enables users to add, move, and delete the installed programs and data.
- The OS provides a method to secure a system from all sorts of threats, such as data loss or improper access.

All operating systems enable you to use programs, but the formats vary so widely that you can't just install any program on any OS. Programmers have to do extra work to build separate versions of a program that can run on more than one OS. This is one example of what the CompTIA A+ 1002 exam calls *compatibility concerns between operating systems*. The software your users need can restrict the list of acceptable OS choices, and the OS choice limits available software. This can also affect how well users on multiple operating systems can collaborate!

Another common compatibility concern is whether a specific OS can communicate with a given piece of hardware. A device that works well with one OS may work poorly or not at all with another! One OS may need no extra software to work with a device, while another might need a special program installed in order to control it. Likewise, brand-new hardware may not work well on any OS until the OSs receive updates to support the new hardware.

Almost every chapter in this book explores the interaction of OS and hardware. [Chapter 11](#), “Building a PC,” examines adding and removing programs. Many security features show up in multiple chapters, such as [Chapter 13](#), “Users, Groups, and Permissions,” and [Chapter 27](#), “Securing Computers.” The rest of this chapter, therefore, focuses on the user interface and the file structures.

User Interfaces

This section tours the various operating system *desktop styles/user interfaces*. Like the hardware tours earlier, this section serves a double purpose. First, you need to know the proper names for the various UI features and understand their functions. Second, it serves as a handy quick review section before you take the 1002 exam.



NOTE Chapter 24, “Understanding Mobile Devices,” details the operating systems for mobile devices—iOS, Android, Windows, and Chrome OS.

Windows 7

Figure 2-17 shows the standard interface for Windows 7, a traditional multifunction computer. Windows uses a graphical user interface primarily, so you engage with the mouse or other pointing device and click on elements. The background is called the *Desktop*. The open applications are Internet Explorer—the default browser in Window 7—and a Windows Explorer window showing the Windows 7 default Libraries.

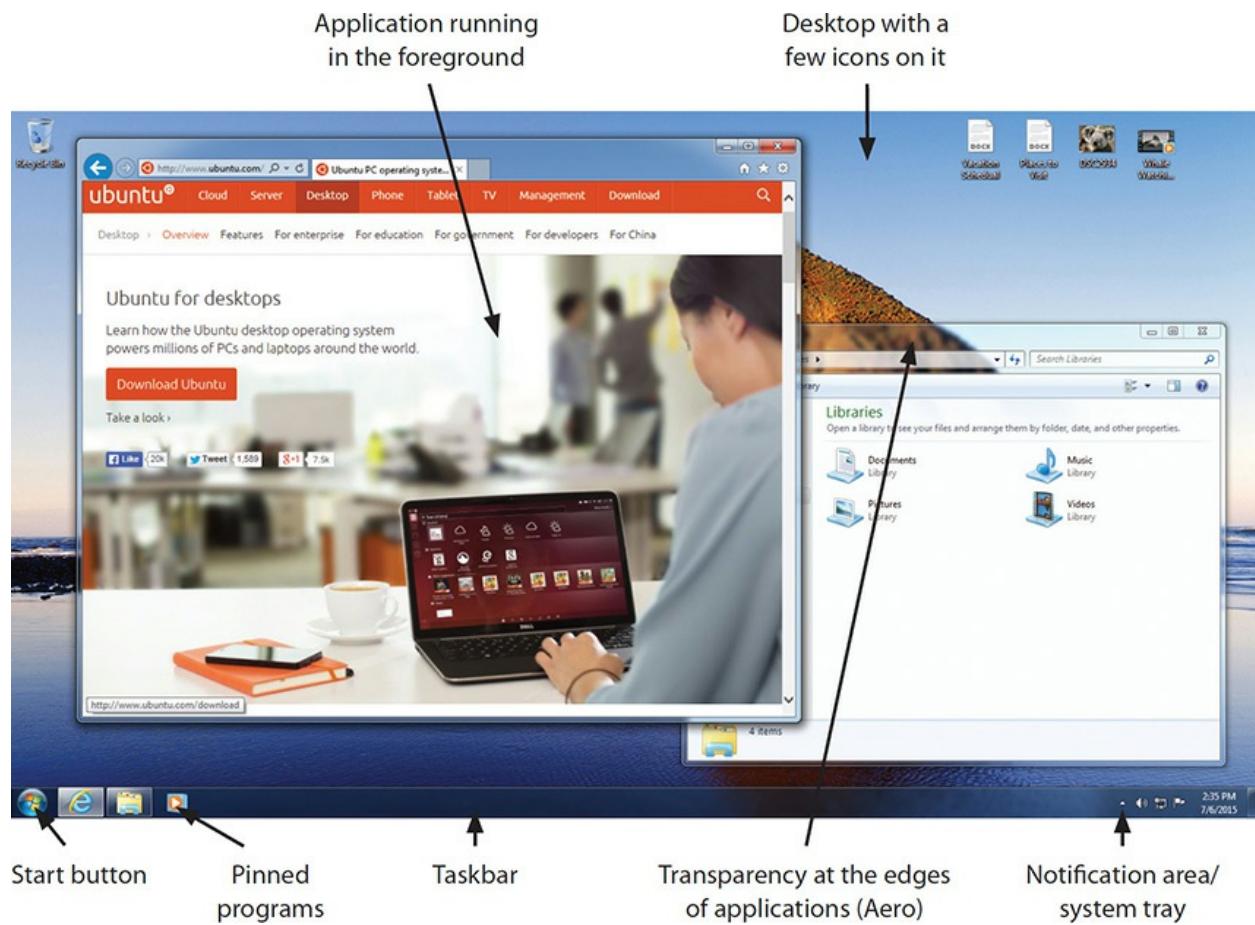


Figure 2-17 Windows 7 with applications open

Other visible items are as follows:

- The open applications demonstrate *transparency*, where the edges of the applications show blurred background images. This feature is called *Aero*, or *Aero Glass*.
- Click the *Start button* to get access to applications, tools, files, and folders.
- The *pinned programs* enable you to launch a program with a single left-click.
- The *taskbar* shows running programs.
- The *notification area* shows programs running in the background. Many techs also call it the *system tray*.

Interacting with the classic Windows interface for the most part involves using a mouse or touchpad to move the cursor and either left-clicking or right-clicking the icons. Left-clicking selects an item; double left-clicking opens an item. Right-clicking opens a *context menu* from which you can select various options (see [Figure 2-18](#)). (Most people refer to a left-click simply as a *click*. This book makes the left/right distinction clear, so you learn how to access tools properly.)

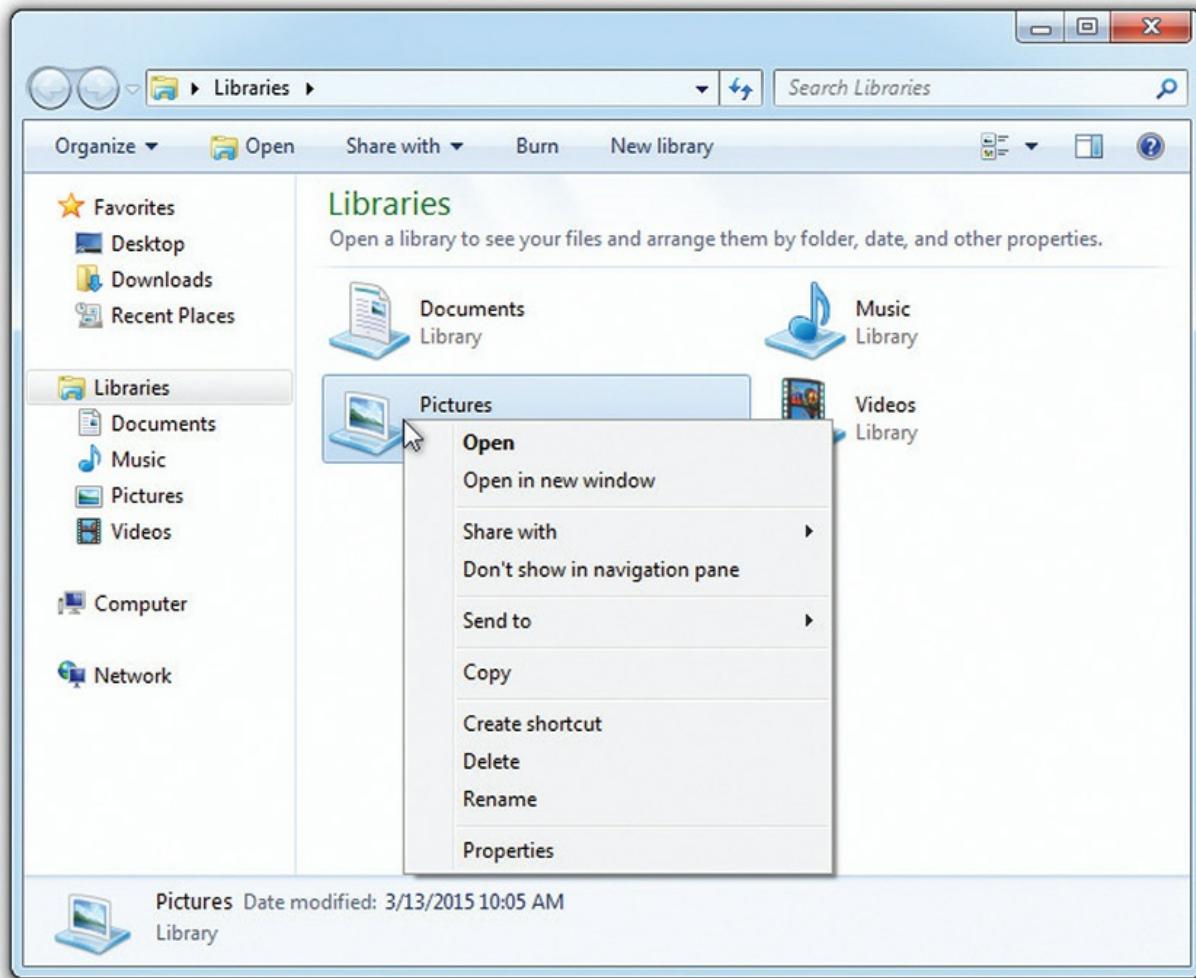


Figure 2-18 Context menu



NOTE The context menu offers options specific to the icon you right-click. Right-clicking a file, for example, gives you a context menu that differs greatly from when you right-click an application.

Windows 8/8.1

Microsoft made significant changes to the Windows interface with the introduction of Windows 8. They borrowed from tablet operating systems,

such as Windows Phone, to create a graphical set of *tiles* for full-screen programs, called *apps*. Note that the screen shows *pinned apps*—the default programs and programs selected by the user—and not all the applications installed on the computer.

The Windows 8 interface, code-named *Metro UI*, works great for touch-enabled devices. The PC becomes in essence a giant tablet. Touch an app to load, drag your finger across the screen to see other apps, and have fun.

Figure 2-19 shows the default Windows 8 interface, called the *Start screen*, with various elements called out.

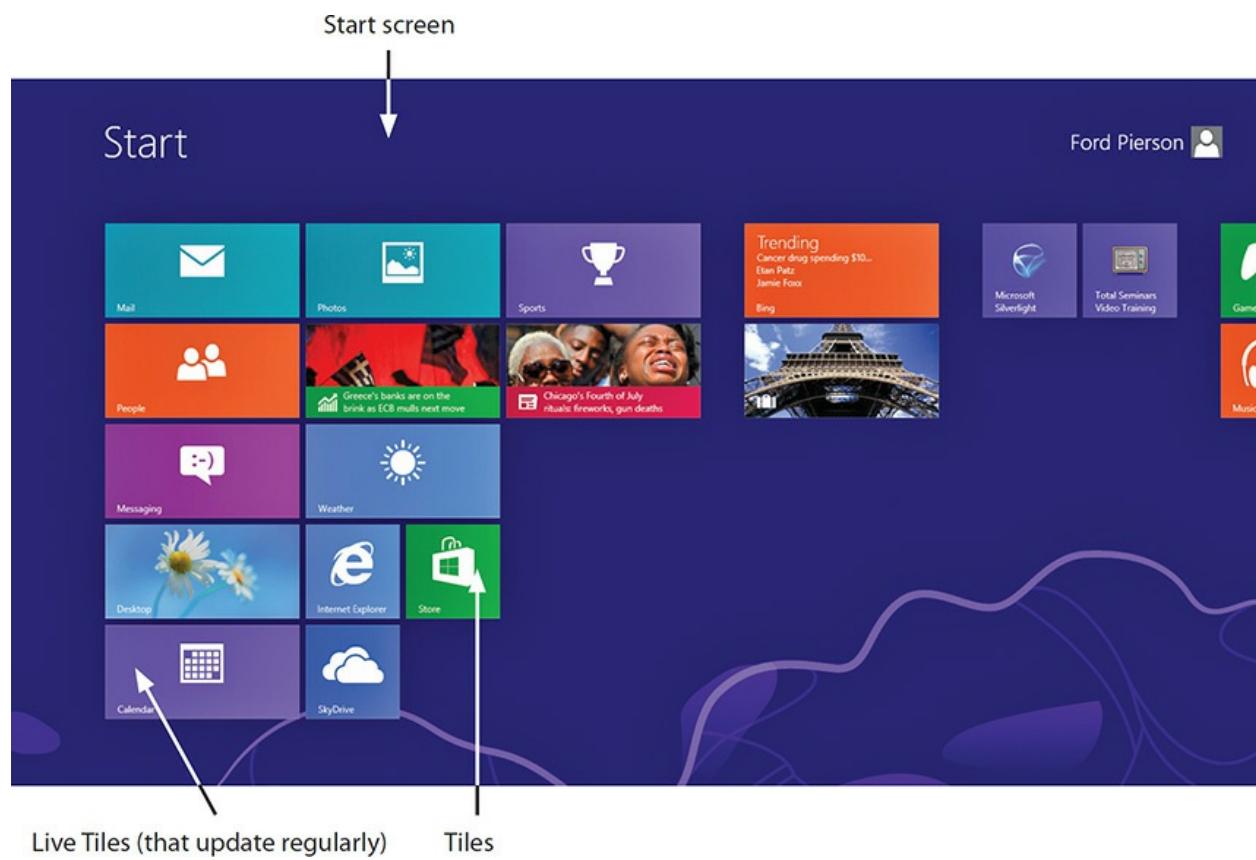


Figure 2-19 Windows 8 Start screen



NOTE Microsoft dropped the “Metro UI” moniker just before releasing Windows 8 due to legal concerns, replacing it with “Modern UI.” A lot of

techs and IT industry pros continue to refer to the unique Windows interface as “Metro.”

Windows 8 also features a more classic Desktop, but one with the noticeable absence of a visible Start button (see [Figure 2-20](#)). You access this screen by pressing the *Windows logo key* on a standard keyboard.



Figure 2-20 Windows 8 Desktop

Using a keyboard and mouse with Windows 8 bothered a lot of users making the jump from Windows 7. Scrolling with the mouse wheel, for example, scrolls right to left rather than up and down (see [Figure 2-21](#)).

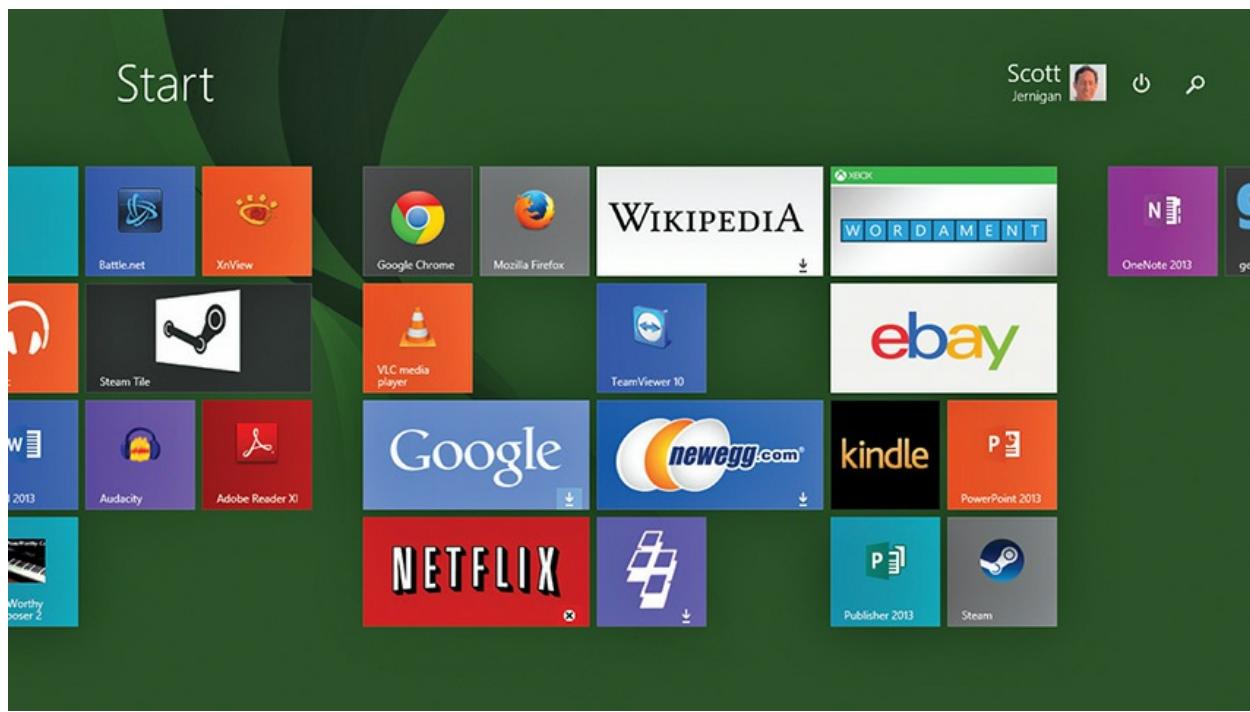


Figure 2-21 Windows 8 Start screen scrolled to the right

Windows 8 took advantage of modern widescreen monitors with the *side-by-side apps* feature. Select an open application and press WINDOWS LOGO KEY + LEFT ARROW and the application will pin to the left half of the monitor. Do the reverse with another application, and it'll pin to the right half of the monitor. With apps like Microsoft Word, where each document opens in a unique window, side-by-side apps make it easy to compare two documents.



NOTE The Windows Store (Windows 7/8.x) or Microsoft Store (Windows 10) enables you to purchase Windows apps directly from Microsoft. The app is called Store when you look at the Windows interface, as you can see in [Figure 2-19](#), among others. Microsoft has updated the Windows Store several times, tying it together with their Xbox gaming system, for example. Finally, the Windows Store is the place to get touch-first apps, meaning programs designed specifically with touchscreen interfaces in mind.

With a series of updates culminating in Windows 8.1, Microsoft brought back features such as the Start button, easy access to a Close button for apps, and the ability to boot directly to the Desktop. [Figure 2-22](#) shows the standard interface for Windows 8.1 with the various elements called out. Note that it's very similar to Windows 7.

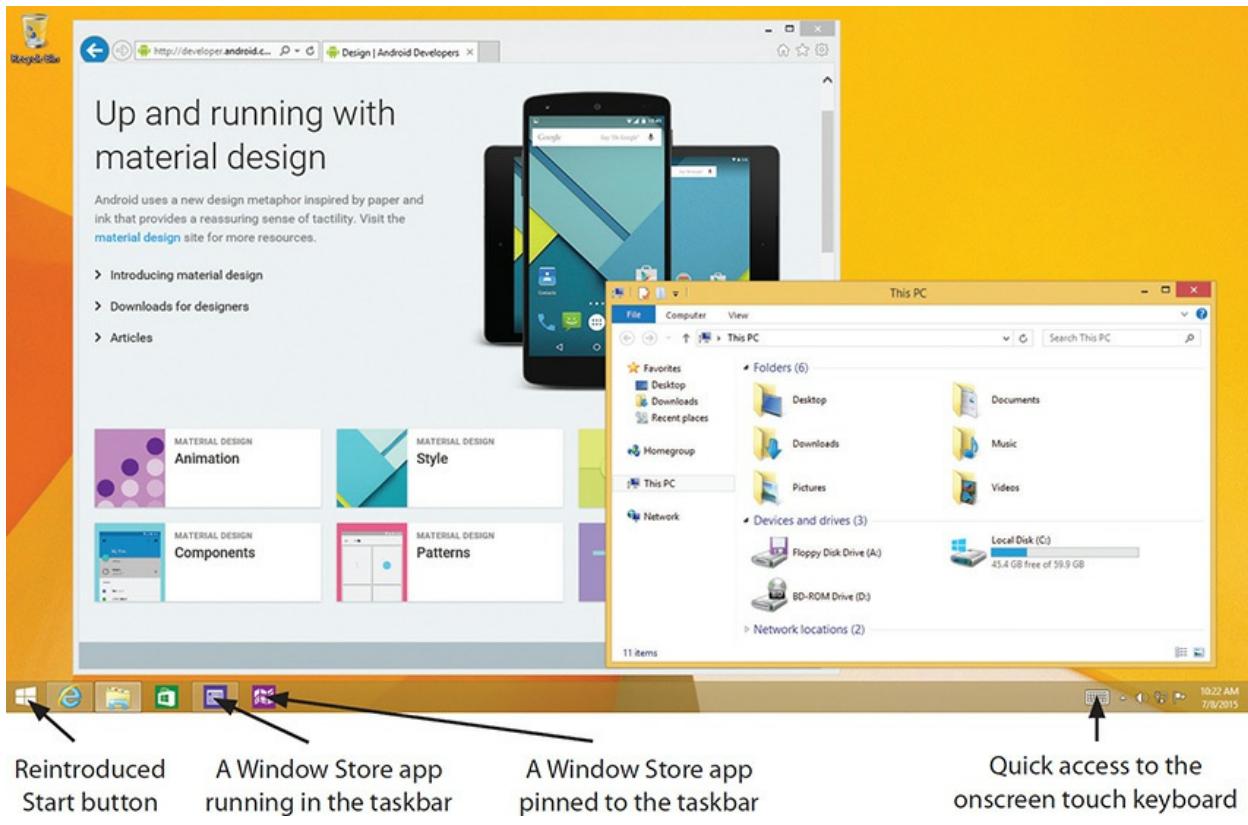


Figure 2-22 Windows 8.1

Windows 8.1 makes it very easy to pin apps to the Start screen. Selecting the arrow at the bottom left brings up the Apps pane where you can sort and select apps and utilities (see [Figure 2-23](#)). Right-click an icon to pin it to the Start screen.

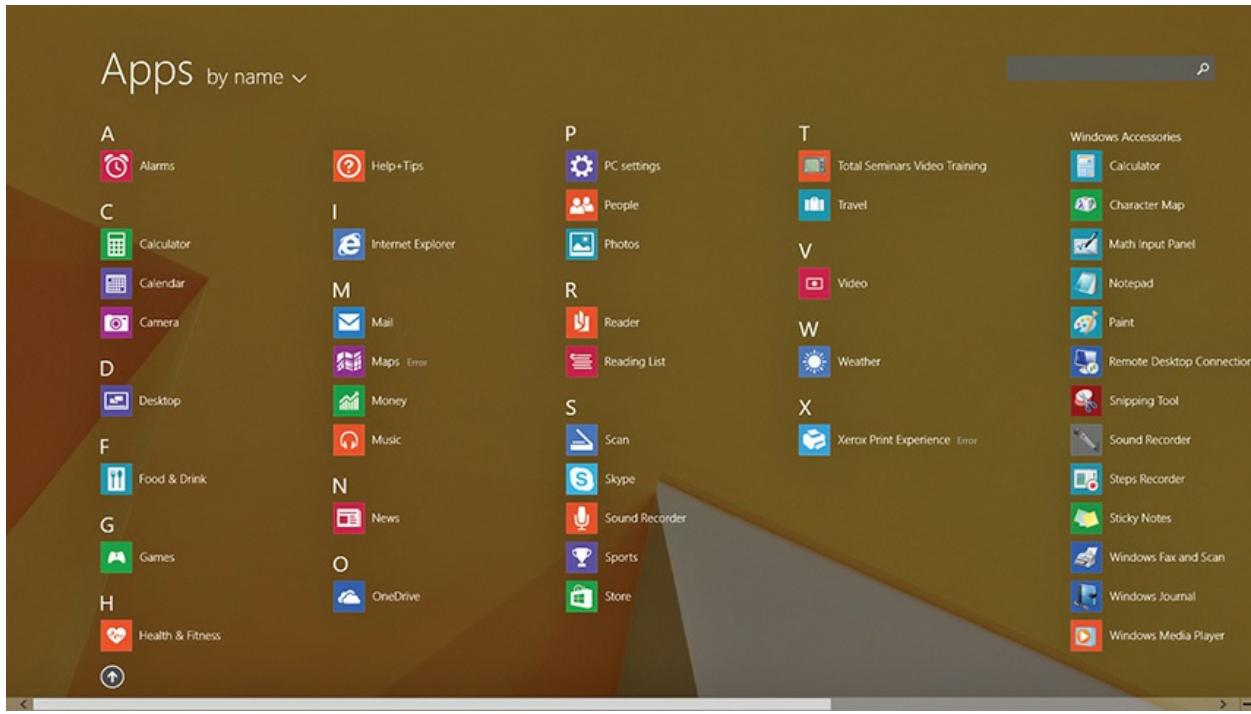


Figure 2-23 Apps sorted by name

Windows 8/8.1 offer lots of hidden interface components that activate when you place the cursor in certain places on the screen. Dropping the cursor to the bottom left corner, for example, activates the Start button (see [Figure 2-24](#)) when in the Start screen.

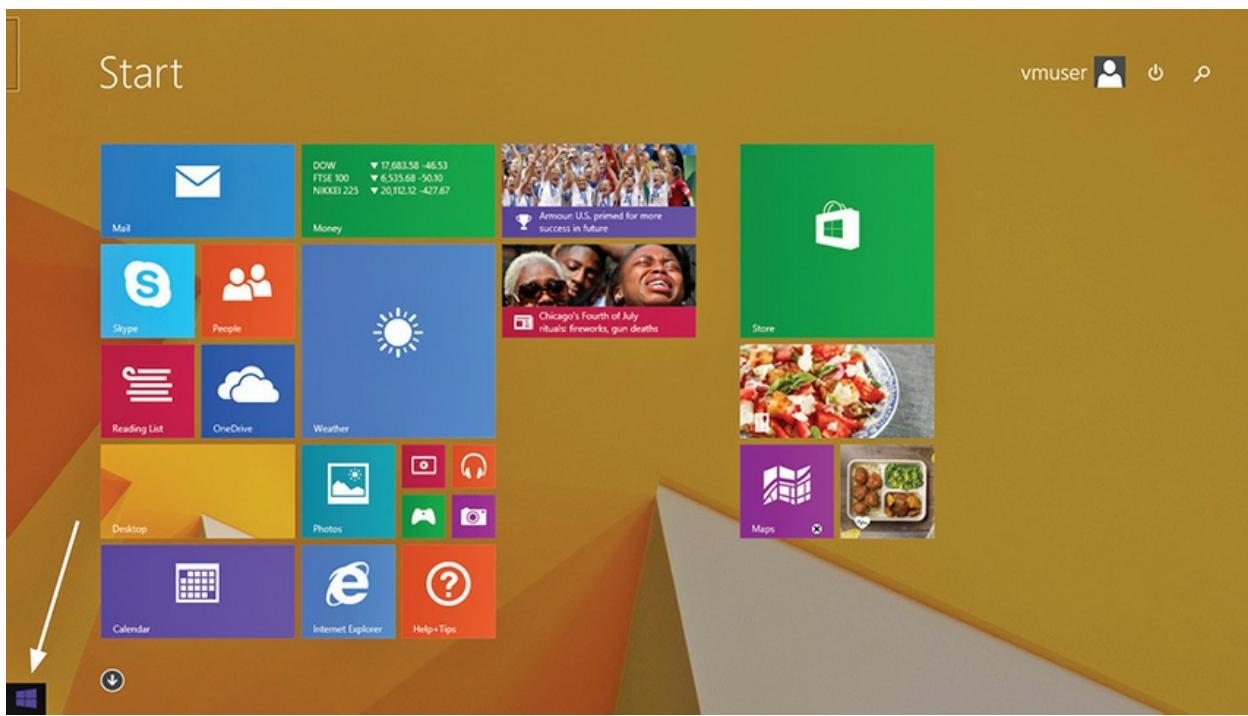
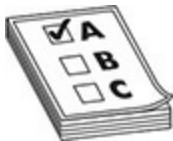


Figure 2-24 Start button magically appears



EXAM TIP The first release of Windows 8 had no visible Start button on the Desktop (except in the Charms bar). Microsoft added it to the Desktop in later patches.

Placing the cursor in the top- or bottom-right corner of the screen reveals the *Charms bar*, a location for tools called *charms*. See the right side of [Figure 2-25](#). Charms include a robust Search tool that enables a search of the computer or even the Internet in one location. There's a Share charm for sharing photos, e-mail messages, and more. We'll revisit the charms later in this chapter when exploring how to access tech tools.



Figure 2-25 Charms accessed by cursor in upper- or lower-right corner

The final version of Windows 8.1 uses the Desktop rather than the Start screen as the default interface. The Start button is visible in the bottom left (see [Figure 2-26](#)). You can still access the charms using the cursor and the upper- and lower-right corners of the screen.

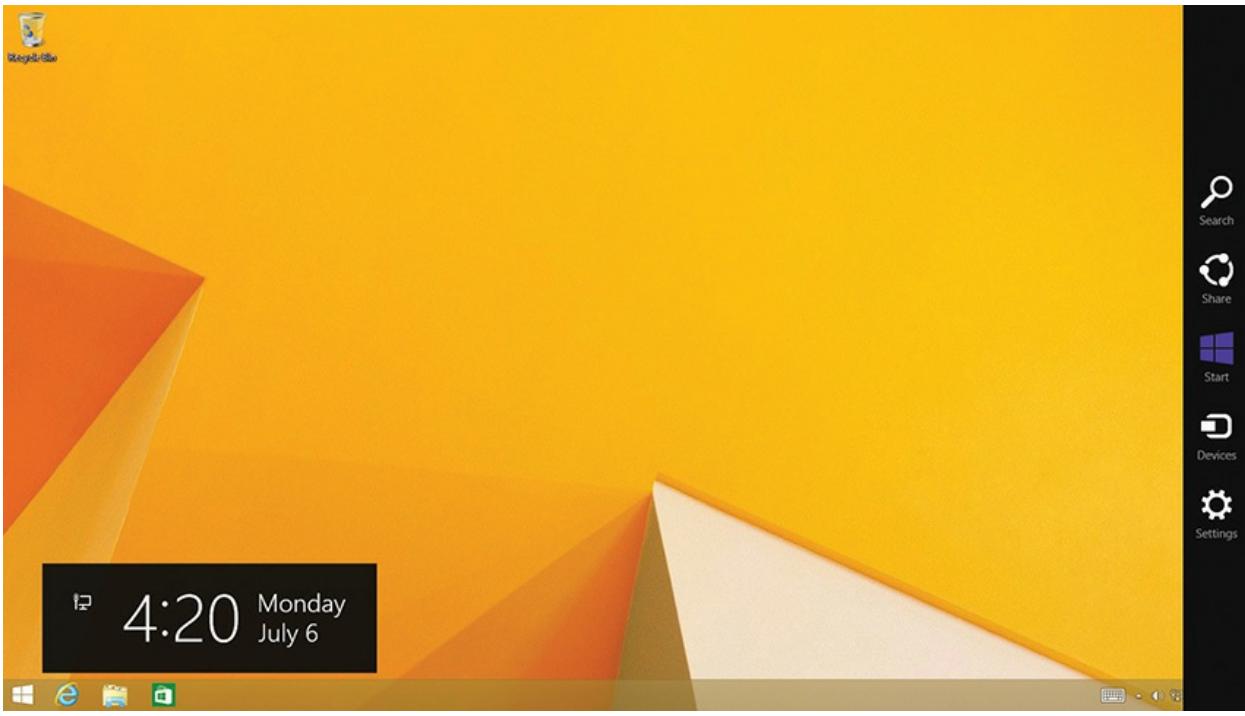


Figure 2-26 Windows 8.1 Desktop



EXAM TIP Windows 8 offers interesting options for the taskbar when used with multiple monitors. The default option duplicates the running and pinned apps on both the main monitor and additional monitor(s). The multimonitor taskbars can also show icons for apps running on a specific monitor. Right-click the taskbar and select Properties to change the taskbar behavior.

Windows 10

With Windows 10, Microsoft created an OS that blends the traditional Windows 7-style Desktop experience with some of the more progressive features of the Windows 8.x Metro/Modern UI. Microsoft retained and refined the Start menu and removed many unloved features as well. Microsoft incorporated the essential tools—Search being my go-to feature—into the lower-left corner of the taskbar. [Figure 2-27](#) shows the Windows 10

interface with an active application in the foreground.

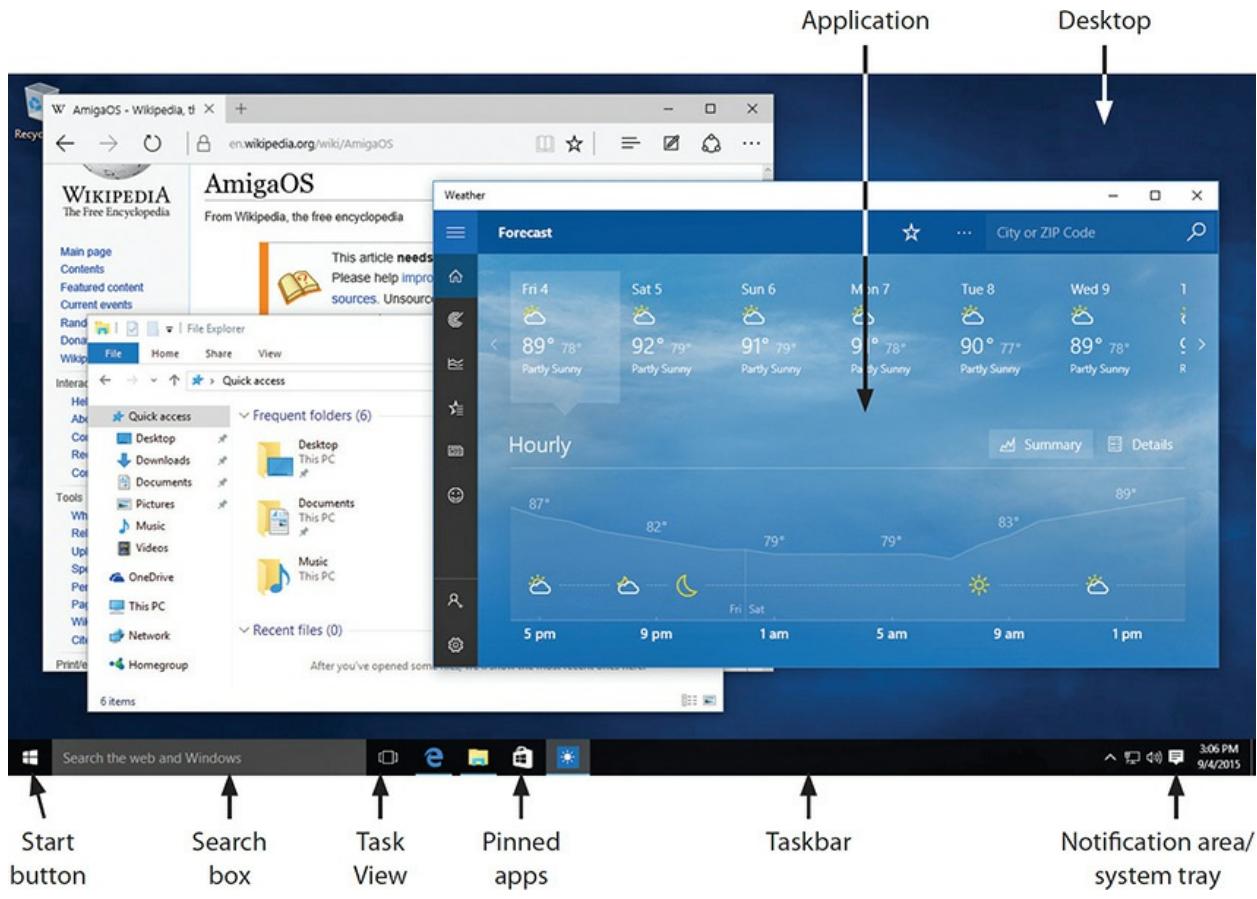


Figure 2-27 Windows 10 with a few applications open

When you press the WINDOWS LOGO KEY on the keyboard, Windows 10 brings up the Start menu with useful tools and your most used apps on the left and pinned apps on the right (see [Figure 2-28](#)). Just like with Windows 8.1, you can click the link helpfully named All apps (bottom left) to open a list of installed applications. Right-click to pin any app to the Start screen.

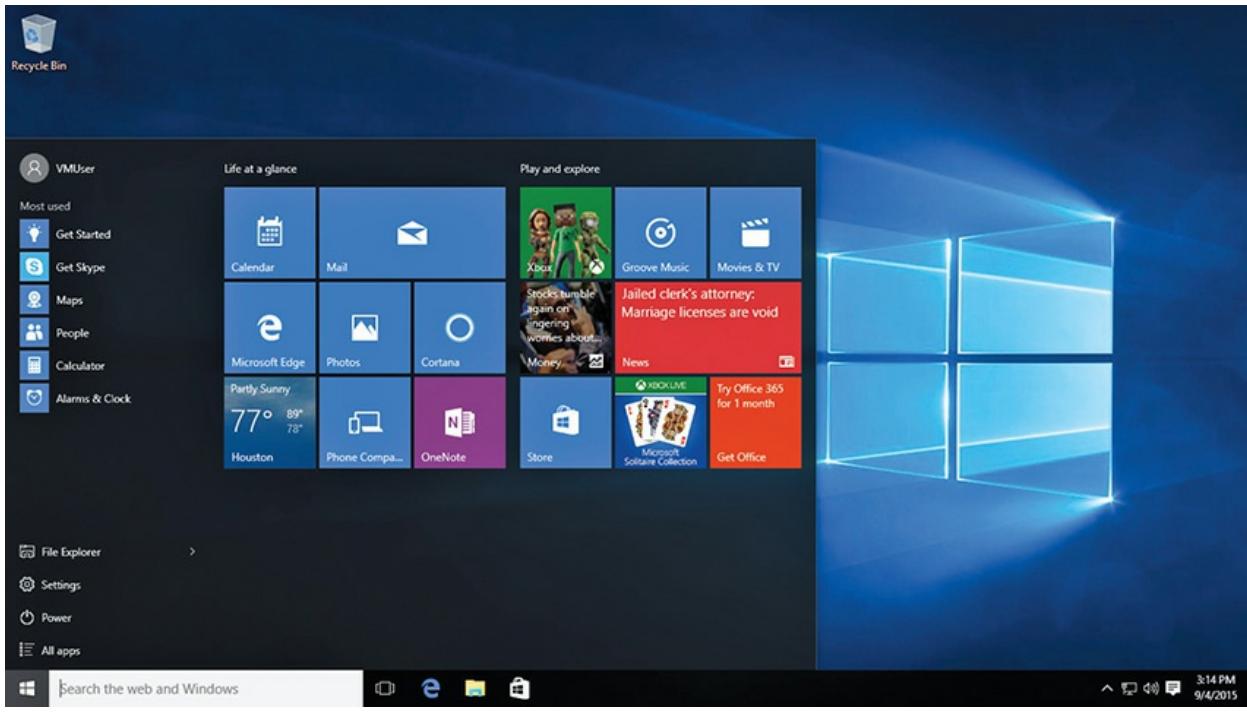


Figure 2-28 Start menu in Windows 10



NOTE Windows 10 also has a tablet mode that mirrors the full-screen tiled interface of Windows 8/8.1. This mode is very useful in touch-enabled devices.

Click the Windows 10 Task View button to create and manage *multiple Desktops* for grouping your open applications. macOS and Linux each have their own take on this feature, as you'll see in the following sections.



NOTE Microsoft altered the side-by-side apps feature in Windows 10 in one very cool way. Select the first application you want to pin and press the

WINDOWS LOGO KEY + LEFT ARROW or RIGHT ARROW and two things happen. The application pins to the left or right half of the monitor and thumbnails of every other open application pop up on the other side of the screen. Click the thumbnail of whichever application you want to work with and it'll open in that half of the screen.

macOS

The macOS operating system interface offers similar functions to those found on Windows. The background of the main screen is called the *Desktop*. You can access frequently used applications by clicking their icons on the *Dock*, the bar that runs along the bottom of the Desktop by default. Just like with the taskbar pinned apps, you can add and remove apps from the Dock with a right-click. The Dock is more than a set of apps, though. It also shows running applications (like the taskbar in Windows). [Figure 2-29](#) shows a typical macOS interface.

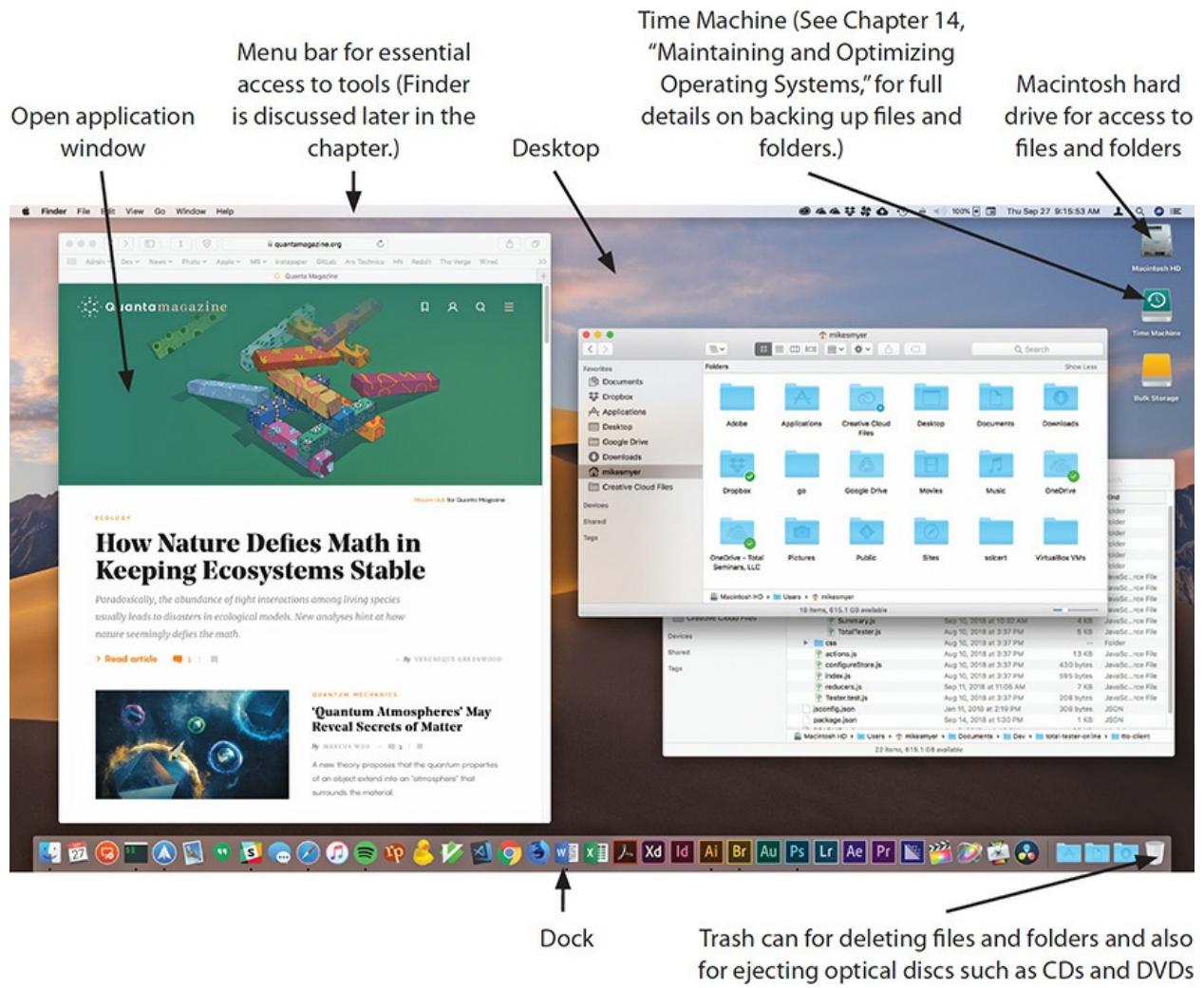


Figure 2-29 macOS

Pressing the Mission Control button on an Apple keyboard (see [Figure 2-30](#)) brings up a utility, called *Mission Control*, that enables you to switch between open applications, windows, and more, as shown in [Figure 2-31](#). You can also access Mission Control by pressing and holding the CONTROL/CTRL key and then pressing the UP ARROW key.



Figure 2-30 Mission Control button on keyboard

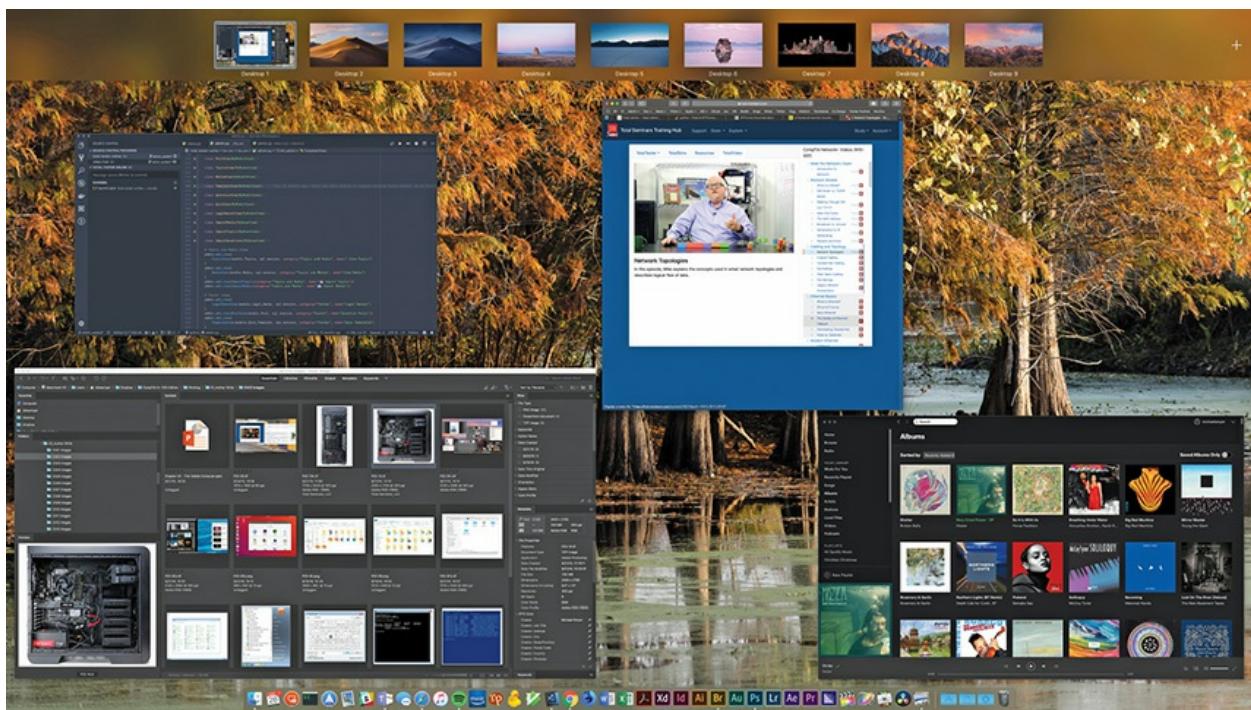


Figure 2-31 Mission Control showing four open apps and nine Desktops

The macOS interface supports *Spaces*—essentially multiple Desktops—that can have different backgrounds and programs, but keep the same Dock. You can optimize your workflow, for example, by putting your primary program full screen on Desktop 1 and putting your e-mail client on Desktop 2 (see [Figure 2-32](#)). New messages won't disturb you when working, but you can access the second Desktop easily when you want with Mission Control. On the latest versions of macOS, press and hold the CONTROL key and press

the RIGHT ARROW and LEFT ARROW keys to scroll through Spaces.

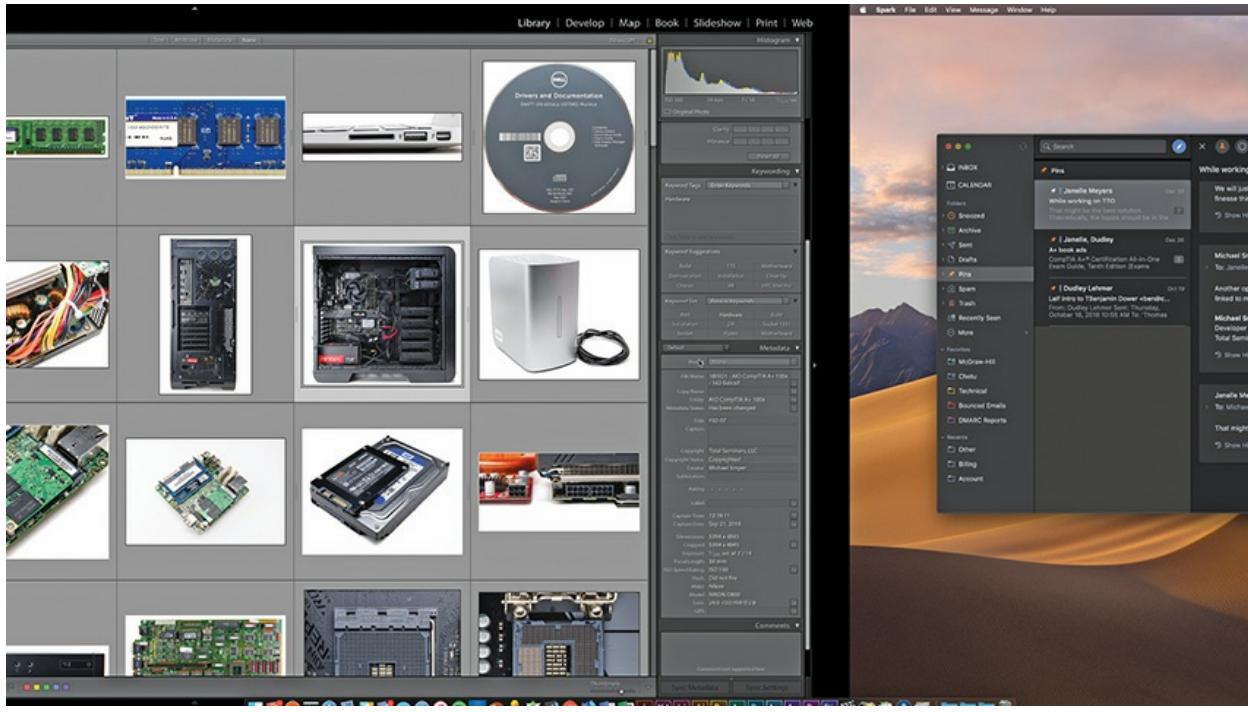


Figure 2-32 Switching between multiple Desktops



EXAM TIP Windows 10 supports multiple Desktops with Task View, but you won't find support for that feature in earlier versions of Windows.

Linux

The many different versions or *distributions* (*distros*) of Linux offer a variety of user interfaces, called *desktop environments* (*DEs*). They offer similar functions to those in Windows or macOS. [Figure 2-33](#) shows a popular Linux version—Ubuntu Linux with the GNOME desktop, and notes the various features. Frequently used utilities and applications are locked on the Launcher on the left side of the screen. Most distros give you options for Web browsing, e-mail, accessing files and folders, and so on.

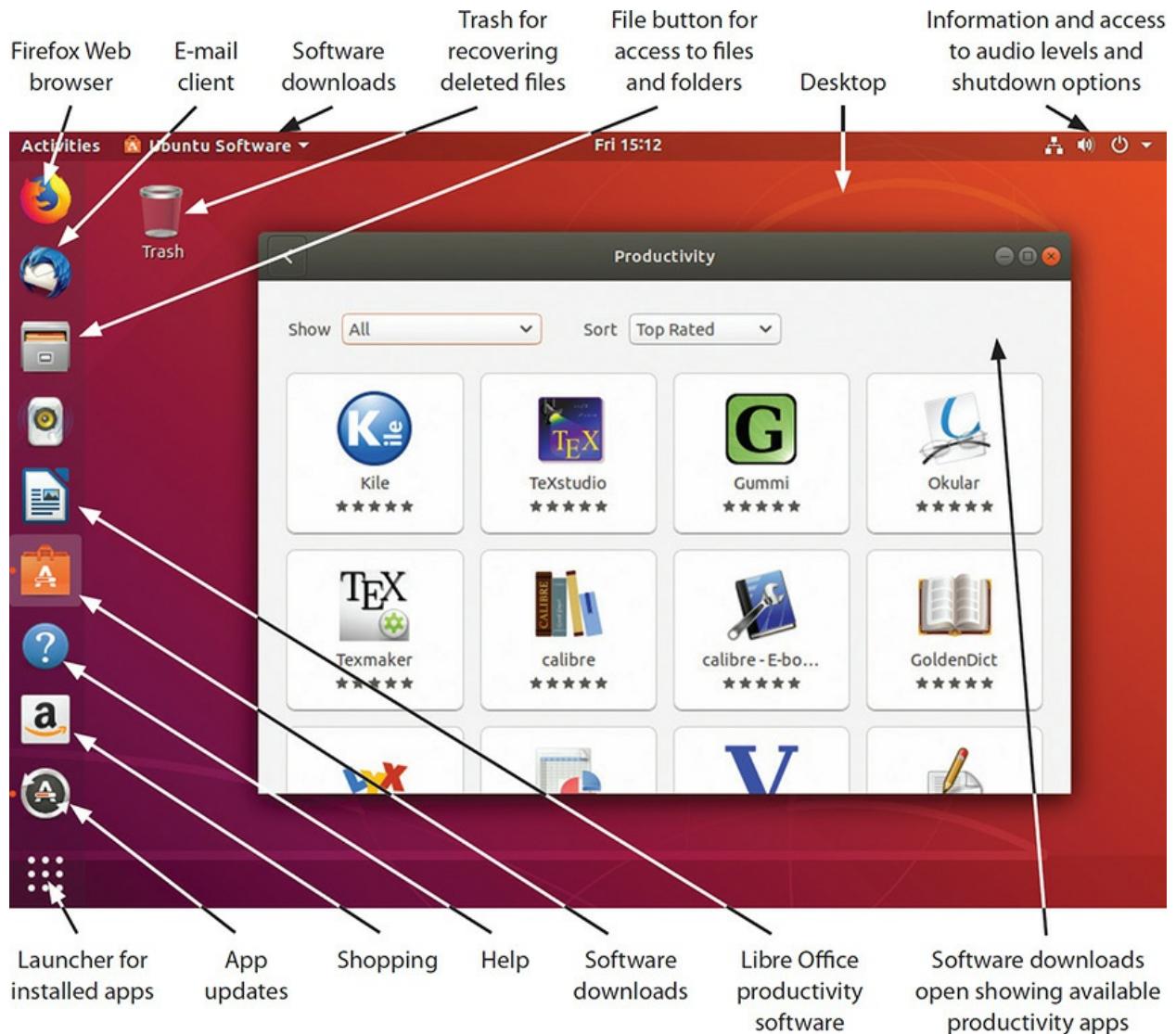


Figure 2-33 Ubuntu Linux desktop environment

Try This! Try This! Ubuntu Emulator Online

Ubuntu.com has a basic emulator for an older version of Ubuntu Linux that enables you to poke around the desktop to get a sense of its look and feel. Try this! Open the URL <http://tour.ubuntu.com/en/> in a Web browser to take the tour. Have fun!

File Structures and Paths

Knowing where to find specific content—files and the folders in which they

reside—helps techs help users do their day-to-day tasks more efficiently. Almost every operating system stores files in folders in a tree pattern. The root of the tree is the drive or disc, followed by a folder, subfolder, sub-subfolder, and so on, until you get to the desired file. The drive or disc gets some designation, most usually a *drive letter* like C:. [Chapter 9](#), “Implementing Mass Storage,” goes into gory detail on how modern operating systems implement systems for storing data. This section is more dictated by CompTIA’s obsession with requiring examinees to memorize paths.

Windows

Windows has important folders that help organize programs and documents. They sit in the *root directory*—where the operating system is installed—and of course they have variations depending on the version of Windows. The following sections walk through the locations of important folders.

Most users and techs access folders and files in Windows with a tool called *Windows Explorer* in Windows 7 and *File Explorer* in Windows 8/8.1/10—although you can only see that difference in name by right-clicking the Start button or by moving your mouse over the folder icon in the taskbar (see [Figure 2-34](#)).

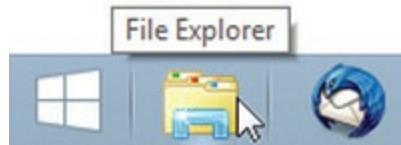


Figure 2-34 Mousing over the File Explorer icon

The name of the window that opens when you run Windows Explorer or File Explorer generally reflects the current focus of the exploration. [Figure 2-35](#) shows File Explorer displaying the contents of the Documents folder in Windows 10. Note the title of the window is *Documents*. The tool, regardless of the title, is File Explorer.

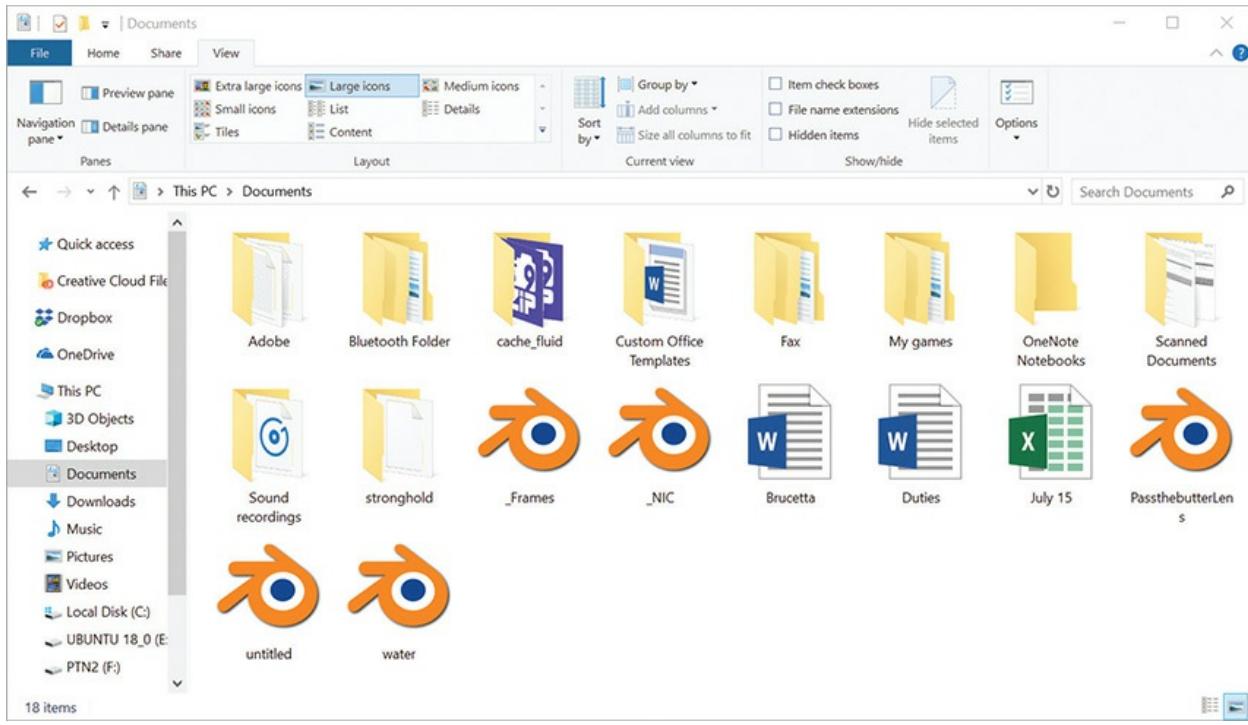


Figure 2-35 File Explorer

The default file and folder view in Windows has a couple of notable features that you can see in [Figure 2-35](#). Note the “July 15” file? That X icon says Windows recognizes the file as a Microsoft Excel spreadsheet, which means almost certainly the actual filename is July 15.xlsx. The .xlsx is the *file extension*, hidden by default, that tells the OS which application to use with the file. This pairing of application with file extension is called *file association*.

Note also that [Figure 2-35](#) has the View options displayed—that’s the ribbon at the top of the window. To change the default view, make changes here.



EXAM TIP The CompTIA A+ 1002 exam uses slightly older terms to describe the View options, such as *view hidden files* and *hide extensions*. Microsoft changes the wording and placement of things in the View options from version to version. The functions stay the same: show or hide specific

elements in a folder.

You can also right-click a file or folder and select Properties to open the Folder Properties—or *Folder Options*, as you’ll see on the exam. On the General tab, you can change several aspects of the file or folder. You can make it hidden, for example, or read-only. Context menus unlock many options in Windows features.

The folder structures that follow here use the standard formatting for describing folder structures. This is what you’ll see on the 1002 exam and in almost any OS. Windows hides the “\” characters at the beginning to make it prettier. File Explorer might show something like “Local Disk (C:) > Users > Mike.” This translates in proper fashion as C:\Users\Mike.

C:\Program Files (All Versions) By default, most programs install some or all of their essential files into a subfolder of the Program Files folder. If you installed a program, it should have its own folder in here. Individual companies decide how to label their subfolders. Installing Photoshop made by Adobe, for example, creates the Adobe subfolder and then an Adobe Photoshop subfolder within it.

C:\Program Files (x86) The 64-bit editions of Windows create two directory structures for program files. The 64-bit applications go into the C:\Program Files folder, whereas the 32-bit applications go into the C:\Program Files (x86) folder. The separation makes it easy to find the proper version of whatever application you seek.

Personal Documents Modern versions of Windows use subfolders of the C:\Users folder to organize files for each user on a PC. [Figure 2-36](#) shows the default folders for a user named Mike. Let’s quickly survey the ones you need to know for the CompTIA A+ exams:

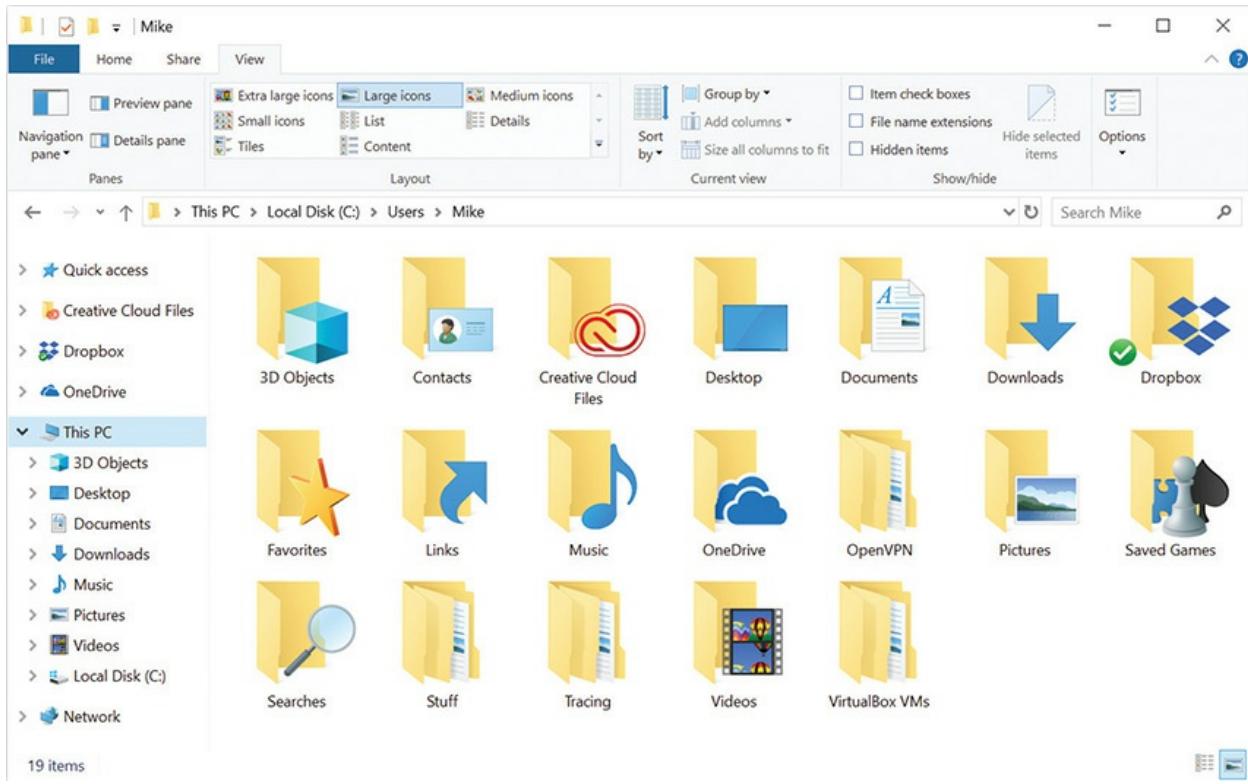


Figure 2-36 File Explorer viewing Mike’s folders

- **C:\Users\Mike\Desktop** This folder stores the files on the user’s Desktop. If you delete this folder, you delete all the files placed on the Desktop.
- **C:\Users\Mike\Documents** This is the Documents or My Documents folder for that user. (Only Windows 7 uses My Documents. The others use Documents.)
- **C:\Users\Mike\Downloads** Microsoft’s preferred download folder for applications to use. Most applications use this folder, but some do not.
- **C:\Users\Mike\Music** This is the default location for music you download. My guess is that more people have music in iTunes, but that’s just me.
- **C:\Users\Mike\Pictures** Pictures is the default location for images imported into the PC, although the Pictures library can (and does) draw from many folder locations.
- **C:\Users\Mike\Videos** Videos is the default location for movies and homebrewed videos imported into a PC.

macOS

Finder holds the keys to files and folders in macOS. [Figure 2-37](#) shows Finder open to display Mike’s Users folder. Note that, although its style differs from the Windows screen shown in [Figure 2-36](#), it has functionally similar folders. These are the default locations for files on the Desktop, in Documents, Downloads, Music, Pictures, and so on. Each user account on the Mac will have a unique Users folder that is inaccessible by other users on that computer.

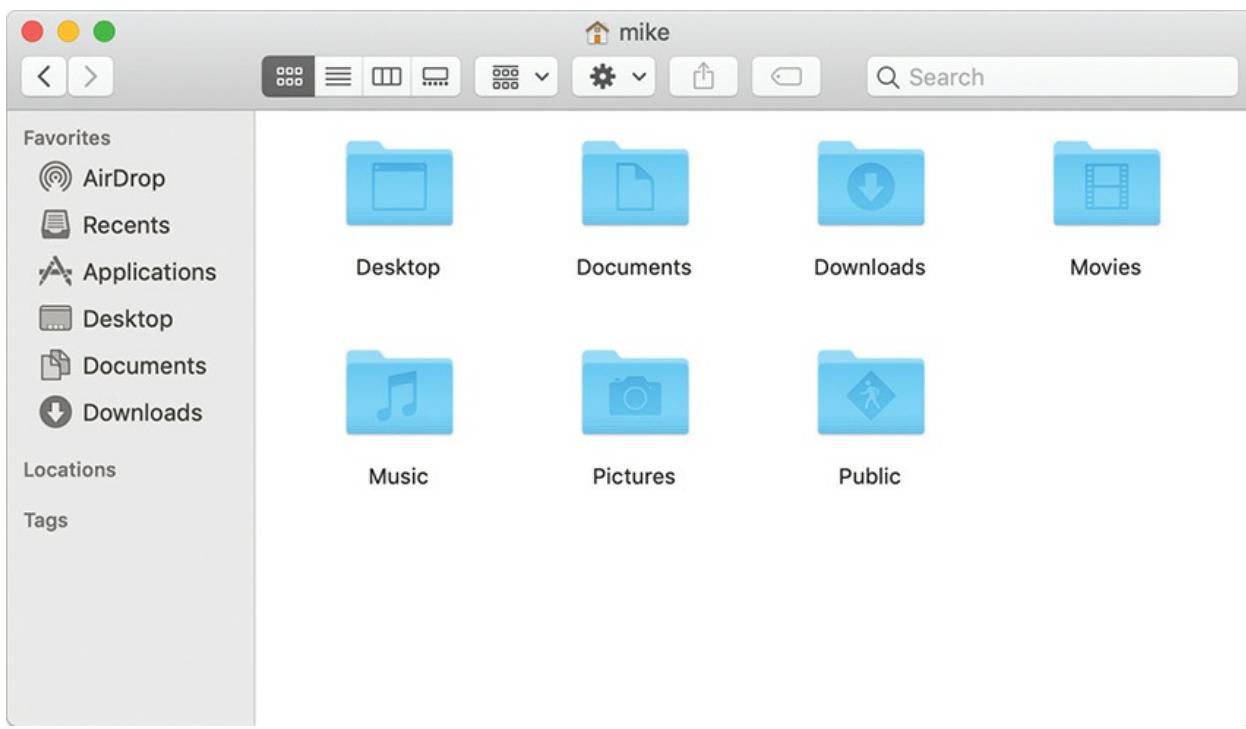


Figure 2-37 Mike’s Users directory in Finder

Linux

Ready to be shocked? Not surprisingly, Linux uses pretty much the same structure for user organization (see [Figure 2-38](#)). I guess once something seems logical to enough people, there’s no reason to add confusion by changing the structure. The only major difference is the name: Linux uses the Home folder, rather than the Users folder.

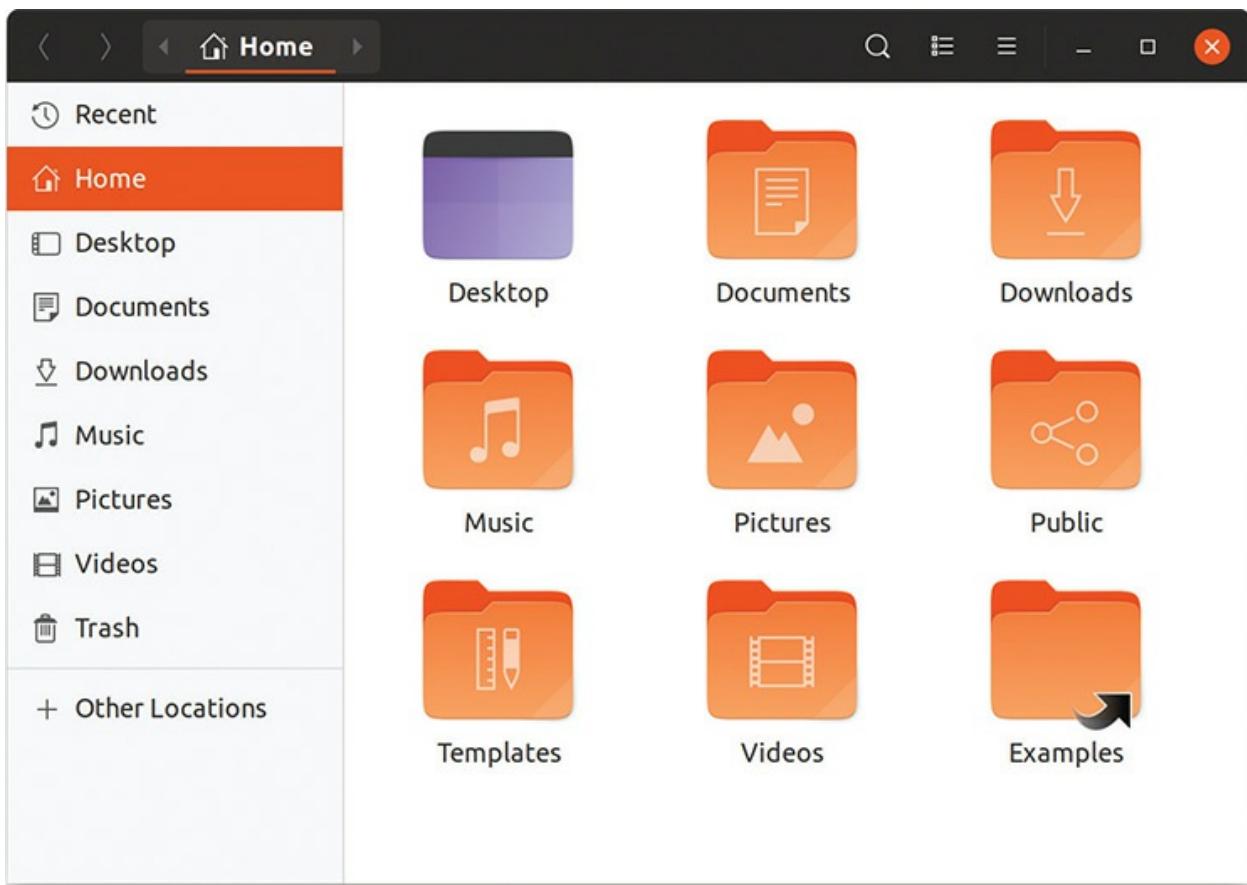


Figure 2-38 Mike’s Home directory in File Manager

The Tech Launch Points

Every OS has two or three areas for tech-specific utilities. This section shows you how to access those areas, primarily so that we don’t have to repeat the steps to get to them when accessing them many times throughout the book. Just refer back to this section if you have difficulty remembering how to arrive at a place later on. Also, CompTIA will test your knowledge on how to access these tool locations, with specific steps. Use this section for the last-minute cram before taking the exams.



EXAM TIP The 1002 exam will test you on specific paths to specific tools. Be prepared for several multiple-choice and scenario-based questions on the

topic.

Windows 7

Windows 7 has three tech launch points: the Control Panel, System Tools, and the command-line interface. You can get to each launch point in multiple ways.

Control Panel The *Control Panel* handles most of the maintenance, upgrade, and configuration aspects of Windows. As such, the Control Panel is the first set of tools for every tech to explore. You can find the Control Panel by clicking the Start button and choosing Control Panel from the Start menu.

The Control Panel opens in the Control Panel's Category view by default, which displays the icons in groups like Hardware and Sound. See [Figure 2-39](#). This view requires an additional click (and sometimes a guess about which category includes what you need), so many techs use Classic view.



Figure 2-39 Windows 7 Control Panel Category view



NOTE The Control Panel enables you to access *Device Manager*, a critically important tool for techs and troubleshooting every device on a PC. With Device Manager, you can examine all of the hardware and drivers in a Windows computer. As you might suspect from that description, every tech spends a lot of time with this tool. You'll work with Device Manager many more times during the course of this book and your career as a PC tech.

The CompTIA A+ 1002 exam specifically assumes Classic view with large icons, so you should do what every tech does: switch from Category view to Classic view. In Windows 7, select either Large icons or Small icons from the View by drop-down list for a similar effect. [Figure 2-40](#) shows the Windows 7 Control Panel in Large icons view.

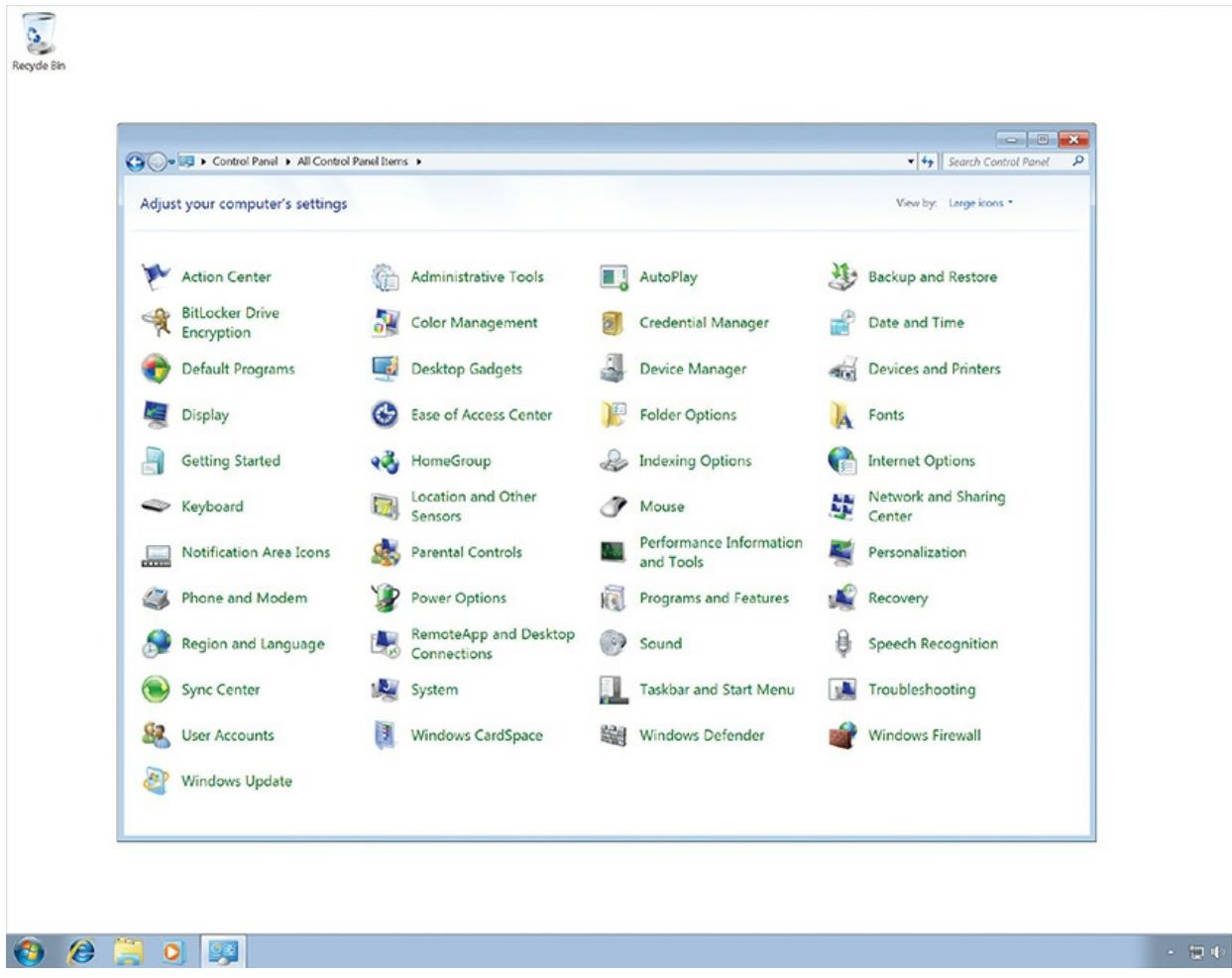


Figure 2-40 Windows 7 Control Panel Large icons view

Many programs, called *applets*, populate the Control Panel. The names and selection of applets vary depending on the version of Windows and whether any installed programs have added applets. But all versions of Windows have applets that enable you to control specific aspects of Windows, such as the appearance, installed applications, and system settings. You will get details on each applet as we put them into use over the course of this book.

System Tools The Start menu in Windows 7 offers a variety of tech utilities collected in one place: System Tools. In the *System Tools* menu, you'll find commonly accessed tools such as System Information and Disk Defragmenter (see [Figure 2-41](#)).

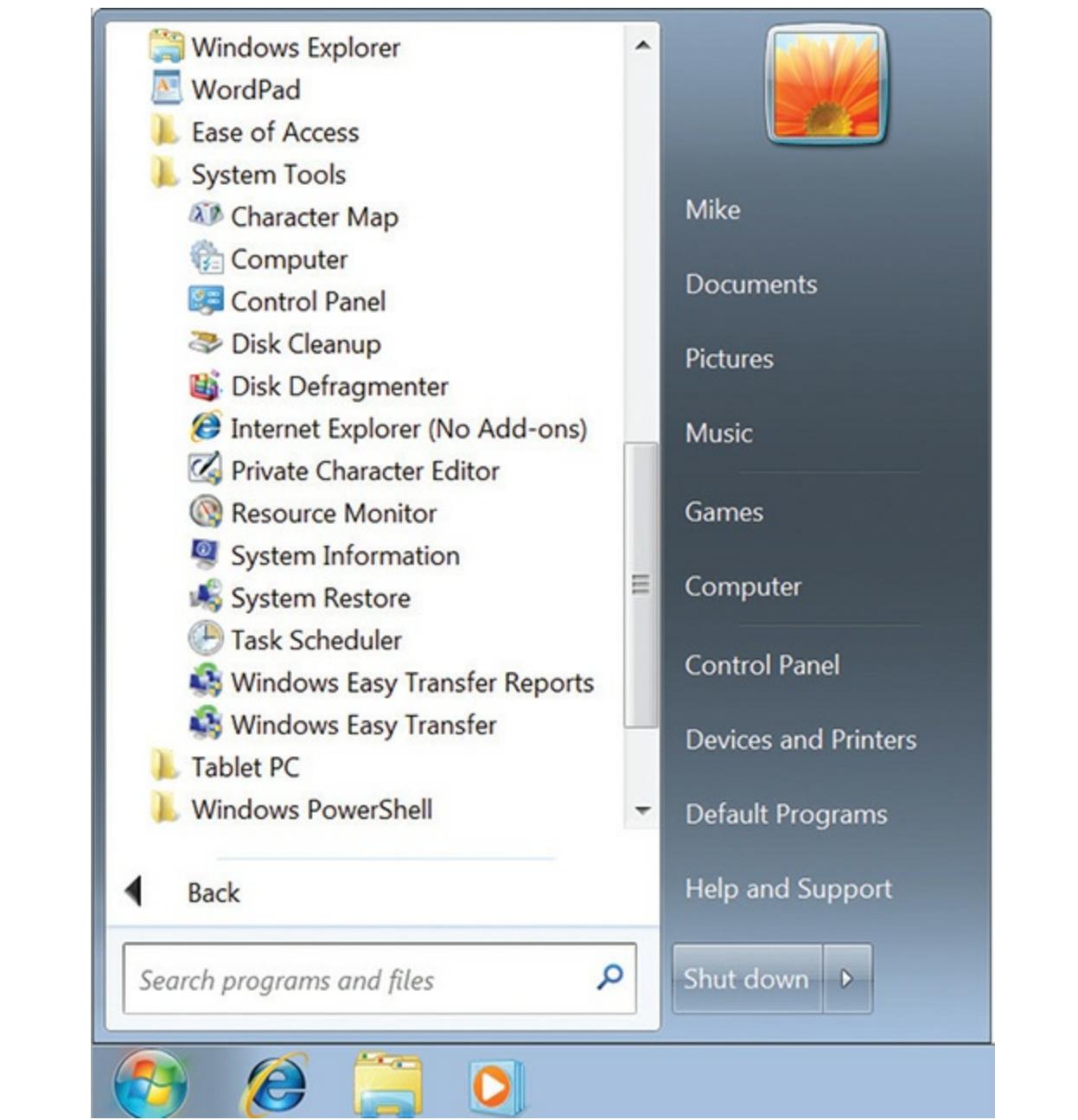


Figure 2-41 Windows 7 System Tools menu options

Many techs overlook memorizing how to find the appropriate Windows tool to diagnose problems, but nothing hurts your credibility with a client like fumbling around, clicking on a variety of menus and applets, while mumbling, “I know it’s around here somewhere.” The CompTIA A+ certification 1002 exam therefore tests you on a variety of paths to appropriate tools.

To access System Tools in Windows 7, go to Start | All Programs | Accessories | System Tools. Each version of Windows shares many of the same tools, but each includes its own utilities as well. Rather than go through every tool here, I'll discuss each in detail during the appropriate scenarios in the book. Here's one example that won't appear again, Character Map.

Ever been using a program only to discover you need to enter a strange character such as the euro character (€) but your word processor doesn't support it? That's when you need the Character Map. It enables you to copy any Unicode character into the Clipboard (see [Figure 2-42](#)) and paste it into your document. Unicode has all the special symbols and alphabet characters used in languages throughout the world.

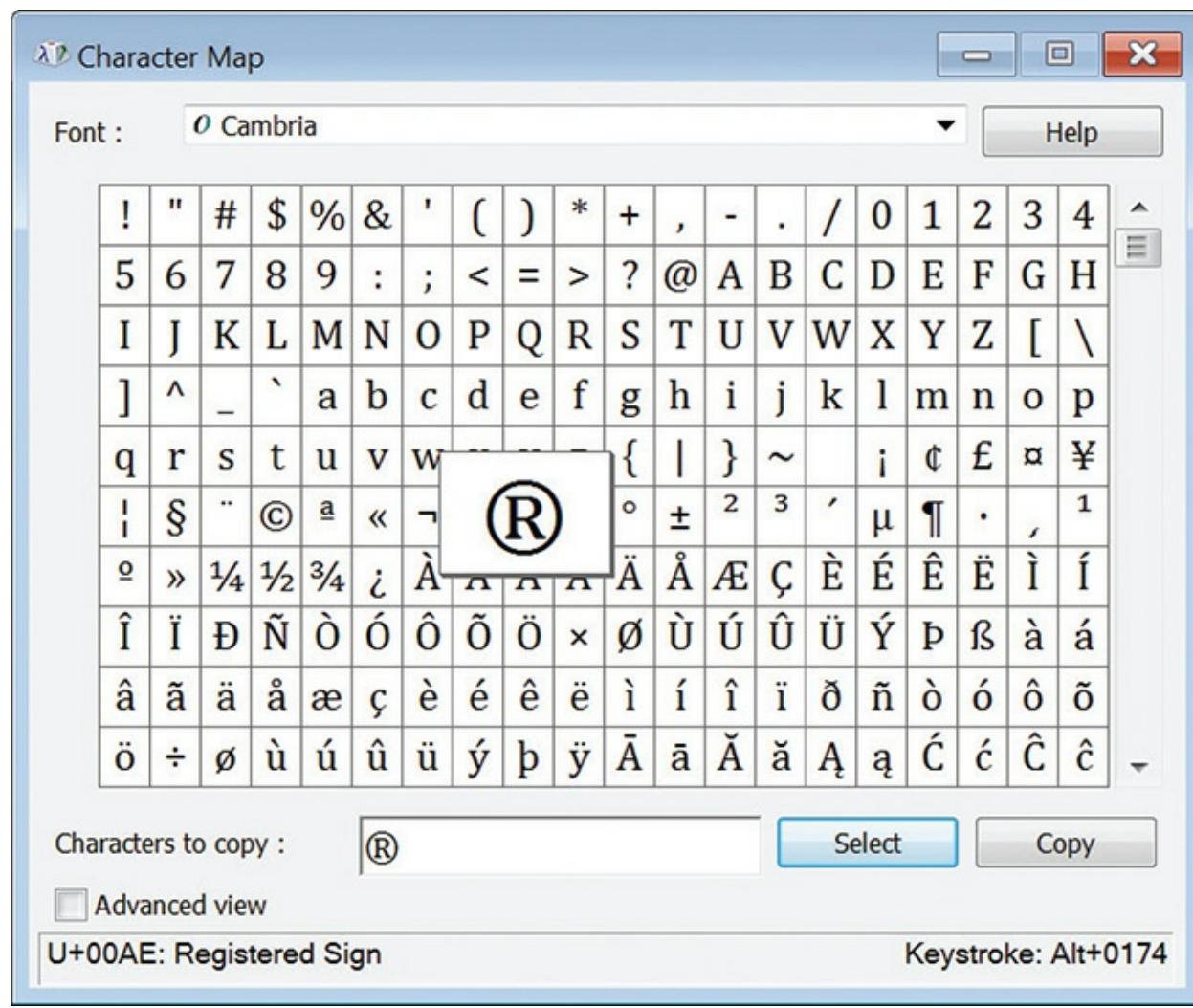


Figure 2-42 Character Map

Command Line The Windows *command-line interface (CLI)* is a throwback to how Microsoft operating systems worked a long, long time ago when text commands were entered at a command prompt. [Figure 2-43](#) shows the command prompt from DOS, the first operating system commonly used in PCs.

```
Volume in drive C is SYSTEM
Volume Serial Number is 3A95-79D2
Directory of C:\

COMMAND   COM      54,645 05-31-94  6:22a
DOS        <DIR>          04-21-09  3:13p
WINDOWS    <DIR>          04-21-09  3:28p
WINA20     386       9,349 05-31-94  6:22a
CONFIG     OLD           71 04-21-09  3:15p
AUTOEXEC   OLD           78 04-21-09  3:15p
WIN311     <DIR>          04-21-09  4:20p
CONFIG     SYS           85 04-21-09  3:32p
AUTOEXEC   BAT           93 12-22-10  2:31p
GORILLA    BAS          30,702 10-21-09  4:24p
FILE0001   CHK          32,768 02-23-12  5:04p
SHMANSI    <DIR>          04-14-10  2:38p
               12 file(s)      127,791 bytes
                           2,081,423,368 bytes free

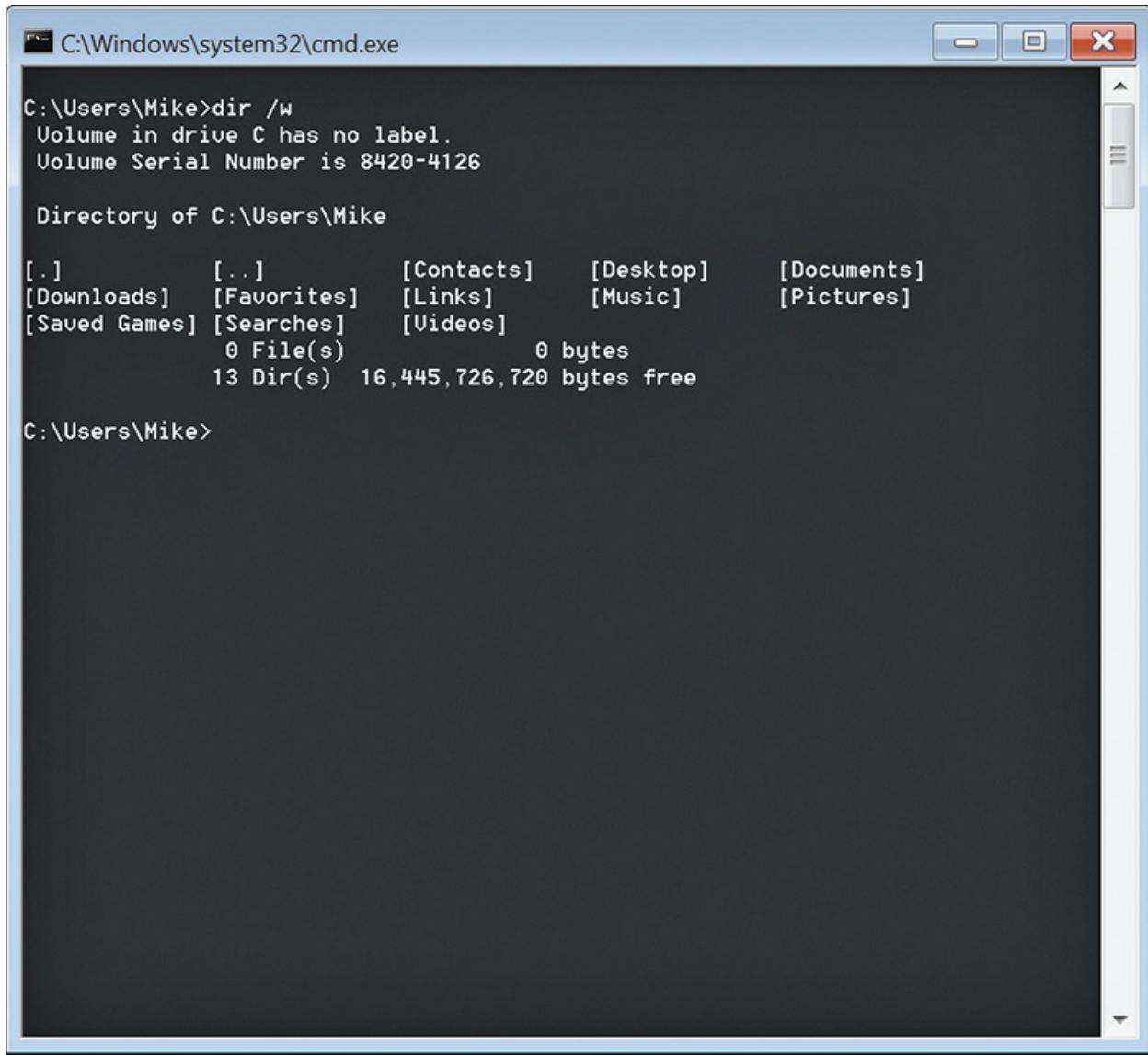
C:\>ver

MS-DOS Version 6.22

C:\>_
```

Figure 2-43 DOS command prompt

DOS is dead, but the command-line interface is alive and well in every version of Windows. Every good tech knows how to access and use the command-line interface. It is a lifesaver when the graphical part of Windows doesn't work, and it is often faster than using a mouse if you're skilled at using it. An entire chapter ([Chapter 15](#), "Working with the Command-Line Interface") is devoted to the command line, but let's look at one example of what the command line can do. First, you need to get there. Click the Start button, type **cmd** in the Search text box, and press the ENTER key. [Figure 2-44](#) shows a command prompt in Windows 7.



C:\Windows\system32\cmd.exe

```
C:\Users\Mike>dir /w
Volume in drive C has no label.
Volume Serial Number is 8420-4126

Directory of C:\Users\Mike

[.]      [...]      [Contacts]      [Desktop]      [Documents]
[Downloads]  [Favorites]  [Links]  [Music]  [Pictures]
[Saved Games]  [Searches]  [Videos]

          0 File(s)           0 bytes
       13 Dir(s)  16,445,726,720 bytes free

C:\Users\Mike>
```

Figure 2-44 Command prompt in Windows 7

Once at a command prompt, type **dir** and press ENTER. The **dir** *command-line utility* displays all the files and folders in a specific directory—probably your user folder for this exercise—and displays folder and file names as well as other information. (A *directory* is the same thing as a folder.) The **dir** command is just one of many command-line tools. You’ll learn much more about **dir** in [Chapter 15](#).

Windows 8/8.1

Windows 8/8.1 have three tech tool starting points, but they differ a little

from the big three in Windows 7. The newer versions feature the Control Panel, Administrative Tools, and the command-line interface.

Control Panel The Control Panel in Windows 8/8.1 serves the same function as in previous versions of Windows—the go-to source for tech tools. You can access the Control Panel in several ways:

- Click the down arrow on the lower right of the Start screen and scroll all the way to the right in the list of Apps. In the Windows System category, click Control Panel (see [Figure 2-45](#)). That's the slow way, but you should know it for the exams. You can also start typing **control panel** in the Search field in the Apps list. Control Panel will quickly appear as the best option to select.



Figure 2-45 Selecting Control Panel from the list of Apps

- Right-click the Start button and select Control Panel from the menu (see [Figure 2-46](#)). You can bring up the same menu by pressing

WINDOWS LOGO KEY + X. I call this menu *Tech Essentials* because it gives you very quick access not only to the Control Panel and its collection of tools but also to specific tools that every tech relies on heavily, like the Task Manager (for forcing frozen programs to close, among other things).

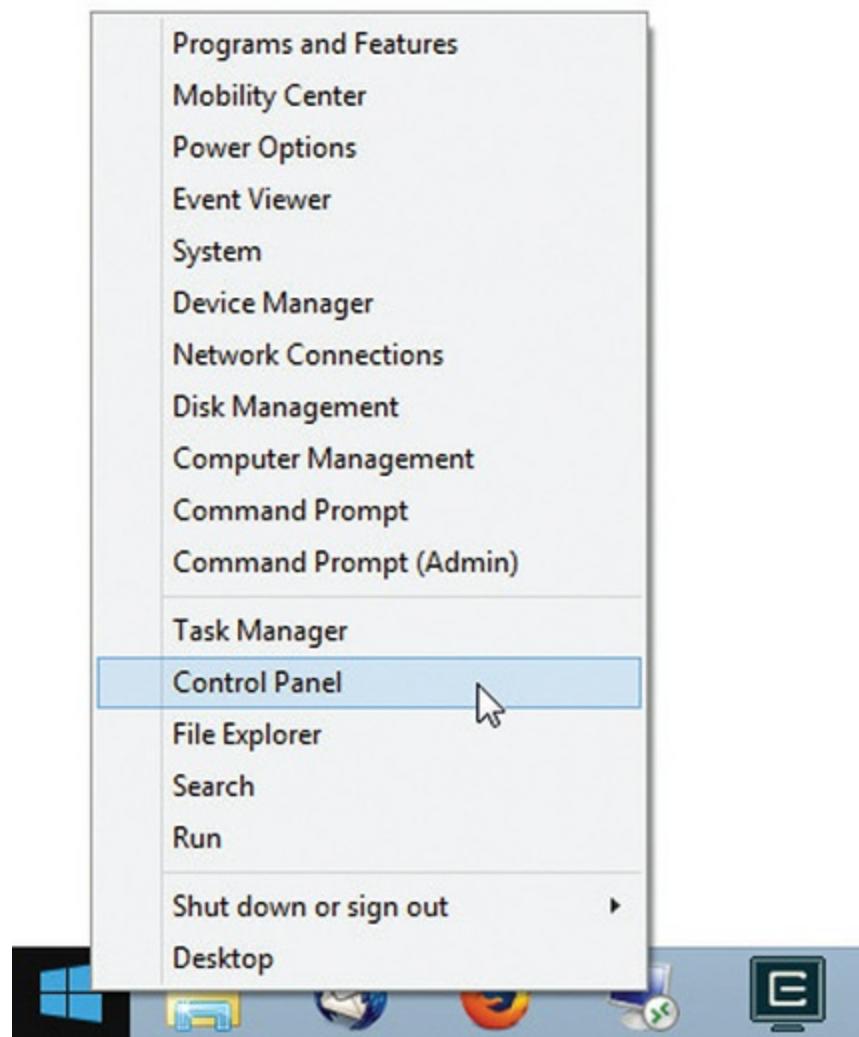


Figure 2-46 Right-clicking the Start button to access Control Panel

- In the Start screen, start typing **control panel**; the Control Panel will show up as the top option in the Search charm (see [Figure 2-47](#)). Select it to open.

Search

Everywhere ▾

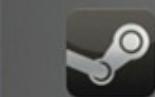
Control Panel



Misc



VMware
Workstation



Steam



Command
Prompt



FileZilla



Control Panel



PC settings



AMD Catalyst Control Center



Java Mission Control



Version Control with Subversion



Default Programs



Control the computer without the
mouse or keyboard



Change User Account Control
settings



Set up USB game controllers



application_controller



control

Control

Figure 2-47 Search charm with Control Panel as top option

Administrative Tools Microsoft beefed up Administrative Tools starting in Windows 8, adding some of the tools found in the System Tools menu in previous versions of Windows. *Administrative Tools* enables you to set up hard drives, manage devices, test system performance, and much more. This is a go-to set of tools for every tech, and one that we will access many times for scenarios in this book.

As with Control Panel, you have several options for accessing Administrative Tools:

- In the Start screen, click the down arrow to open the Apps list. Scroll a little to the right and you'll see the list of Administrative Tools (see [Figure 2-48](#)). Select the specific tool you want to open.

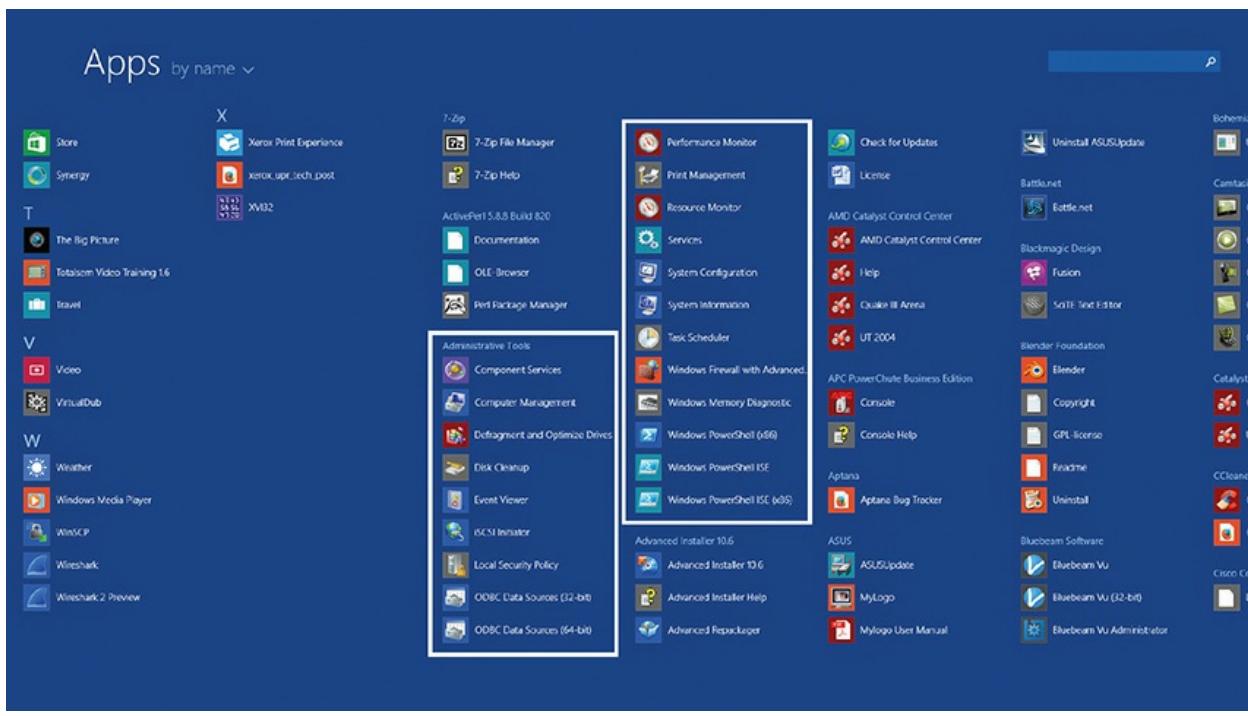


Figure 2-48 Mike's Windows 10 system only has 8 GB of RAM.

- Begin typing **administrative tools** in the Start screen and Administrative Tools will quickly appear as an option in the Search charm (see [Figure 2-49](#)). Select it to open.

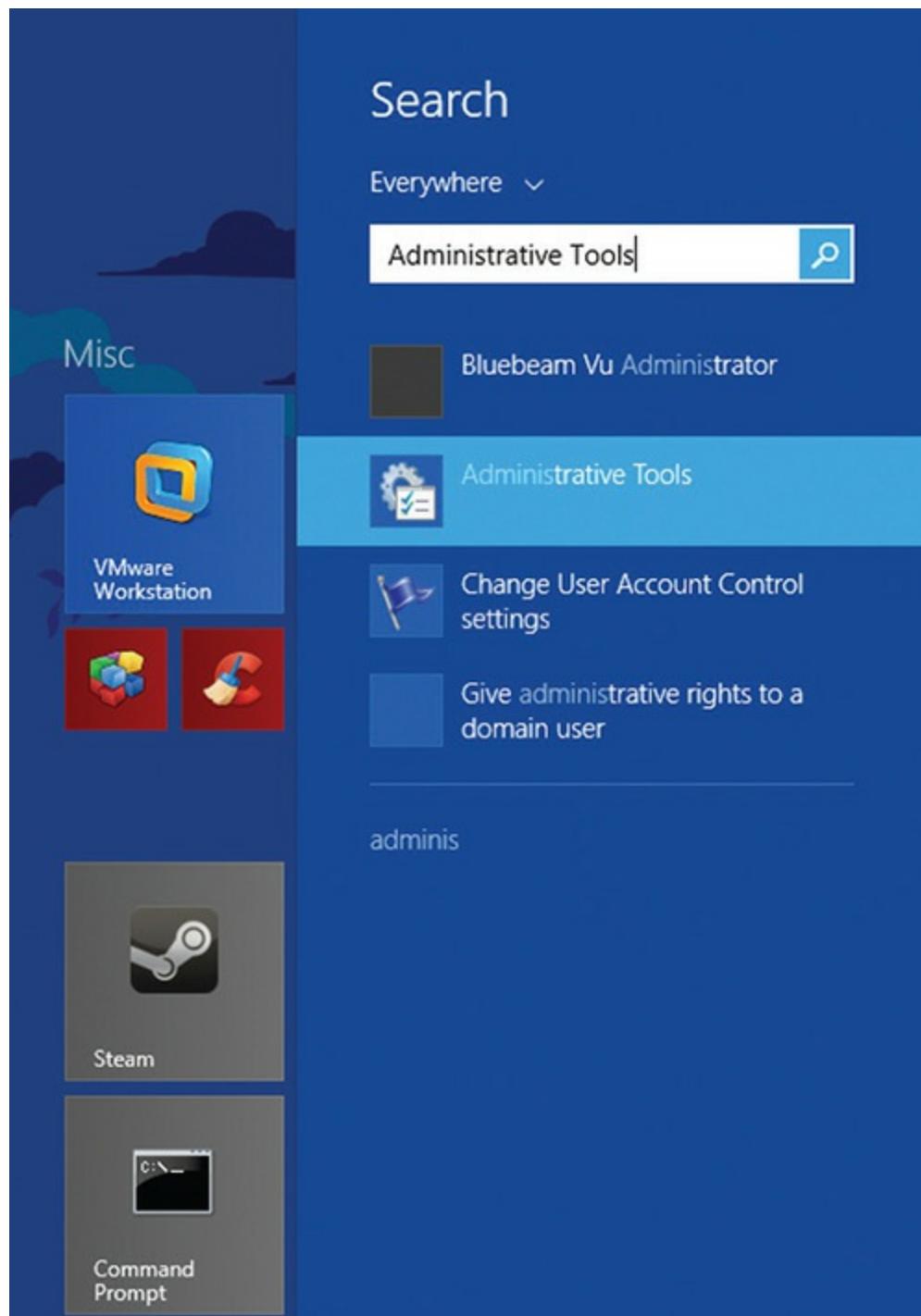


Figure 2-49 Administrative Tools option in the Search charm

- Right-click the Start button (or press WINDOWS LOGO KEY + X) and select Control Panel from the context menu. In the Control Panel, select Administrative Tools to open.

Command Line The command-line interface retains its place as a go-to tool for techs. Windows 8/8.1 offer several ways to access it:

- Click the down arrow on the lower right of the Start screen and scroll all the way to the right in the list of Apps. In the Windows System category, click Command Prompt to open the utility. You can also start typing **command prompt** in the Search field in the Apps list. Command Prompt will quickly appear as the best option to select.
- Right-click the Start button (or press WINDOWS LOGO KEY + X) and select Command Prompt from the context menu to open the command-line interface.
- In the Start screen, start typing **cmd** or **command prompt** and Command Prompt will appear in the Search charm. Click on it to open it.

Windows 10

Windows 10 keeps the Control Panel and command-line interfaces seen in earlier versions of Windows, but focuses on an expanded Settings app for day-to-day administration. A vastly more powerful command-line interface, called Windows PowerShell, is also available, offering a much deeper set of command-line utilities as well as support for power scripting. Check out [Chapter 15](#) to see more on PowerShell (see [Figure 2-50](#)).

```
Administrator: Windows PowerShell
PS C:\WINDOWS\system32> Get-EventLog -Log System -Newest 20

Index Time                EntryType   Source                                InstanceID Message
----- --                -----   ...
754 Aug 19 16:42    Warning     Microsoft-Windows...
753 Aug 19 16:07    Warning     Microsoft-Windows...
752 Aug 19 16:07    Warning     Microsoft-Windows...
751 Aug 19 16:07    Warning     Microsoft-Windows...
750 Aug 19 16:07    Error       VBoxNetLwf
749 Aug 19 16:07    Error       VBoxNetLwf
748 Aug 19 16:07    Error       VBoxNetLwf
747 Aug 19 16:07    Error       VBoxNetLwf
746 Aug 19 16:07    Information  Service Control M...
745 Aug 19 16:06    Warning     Microsoft-Windows...
744 Aug 19 16:06    Warning     Microsoft-Windows...
743 Aug 19 16:06    Information  Microsoft-Windows...
742 Aug 19 16:06    Information  Service Control M...
741 Aug 19 16:06    Information  Service Control M...
740 Aug 19 16:06    Information  Service Control M...
739 Aug 19 16:04    Warning     Microsoft-Windows...
738 Aug 19 16:04    Warning     Microsoft-Windows...
737 Aug 19 16:04    Information  BROWSER
736 Aug 19 16:03    Information  Microsoft-Windows...
735 Aug 19 16:02    Information  Service Control M...
1014 Name resolution for the name wpad timed out aft...
1014 Name resolution for the name wpad timed out aft...
1014 Name resolution for the name wpad timed out aft...
1014 Name resolution for the name wpad timed out aft...
3221487628 The driver detected an internal driver error on...
3221487628 The driver detected an internal driver error on...
3221487628 The driver detected an internal driver error on...
3221487628 The driver detected an internal driver error on...
3221487628 The driver detected an internal driver error on...
1073748869 A service was installed in the system....
1014 Name resolution for the name wpad timed out aft...
1014 Name resolution for the name wpad timed out aft...
20003 Driver Management has concluded the process to ...
1073748864 The start type of the VirtualBox NDIS 6.0 Minip...
1073748869 A service was installed in the system....
1073748869 A service was installed in the system....
1014 Name resolution for the name wpad timed out aft...
1014 Name resolution for the name wpad timed out aft...
1073749857 The browser has forced an election on network '\...
98 The description for Event ID '98' in Source 'Mi...
1073748864 The start type of the Background Intelligent Tr...
PS C:\WINDOWS\system32>
```

Figure 2-50 PowerShell in Windows 10



NOTE Windows PowerShell has been around for a while, predating Windows 7, but PowerShell has gone through six major updates, making the Windows 10 PowerShell much more powerful than the original versions. Windows 10 puts PowerShell as the default command-line interface when you right-click the Start button, though you can get to the older command

line (cmd.exe) by typing **cmd** or **command** in the *Type here to search* field on the taskbar.

Control Panel To get to the Control Panel, click the Start button, start typing **control panel**, and select Control Panel from the Search results.

Settings *Settings* in Windows 10 combines many otherwise disparate utilities, apps, and tools traditionally spread out all over your computer into one fairly unified, handy Windows app (see [Figure 2-51](#)). Since the Settings app was introduced in Windows 8, it has taken over more and more tasks from the Control Panel. Expect Settings to grow as Windows 10 matures.

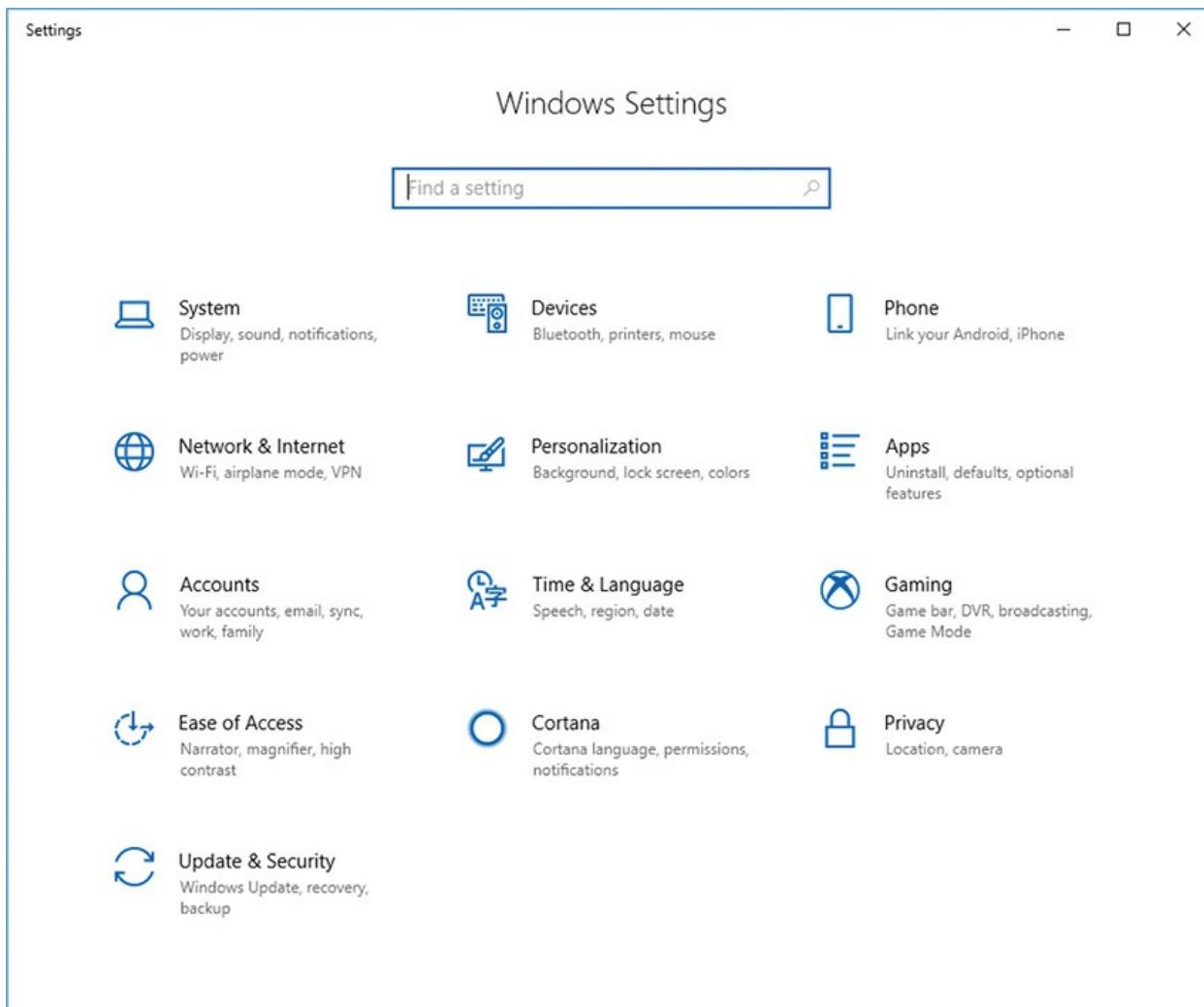


Figure 2-51 Windows Settings app

To access the Setting app, press the WINDOWS LOGO KEY to access the Start menu. Select Settings from the lower left to open the tool (see [Figure 2-52](#)).

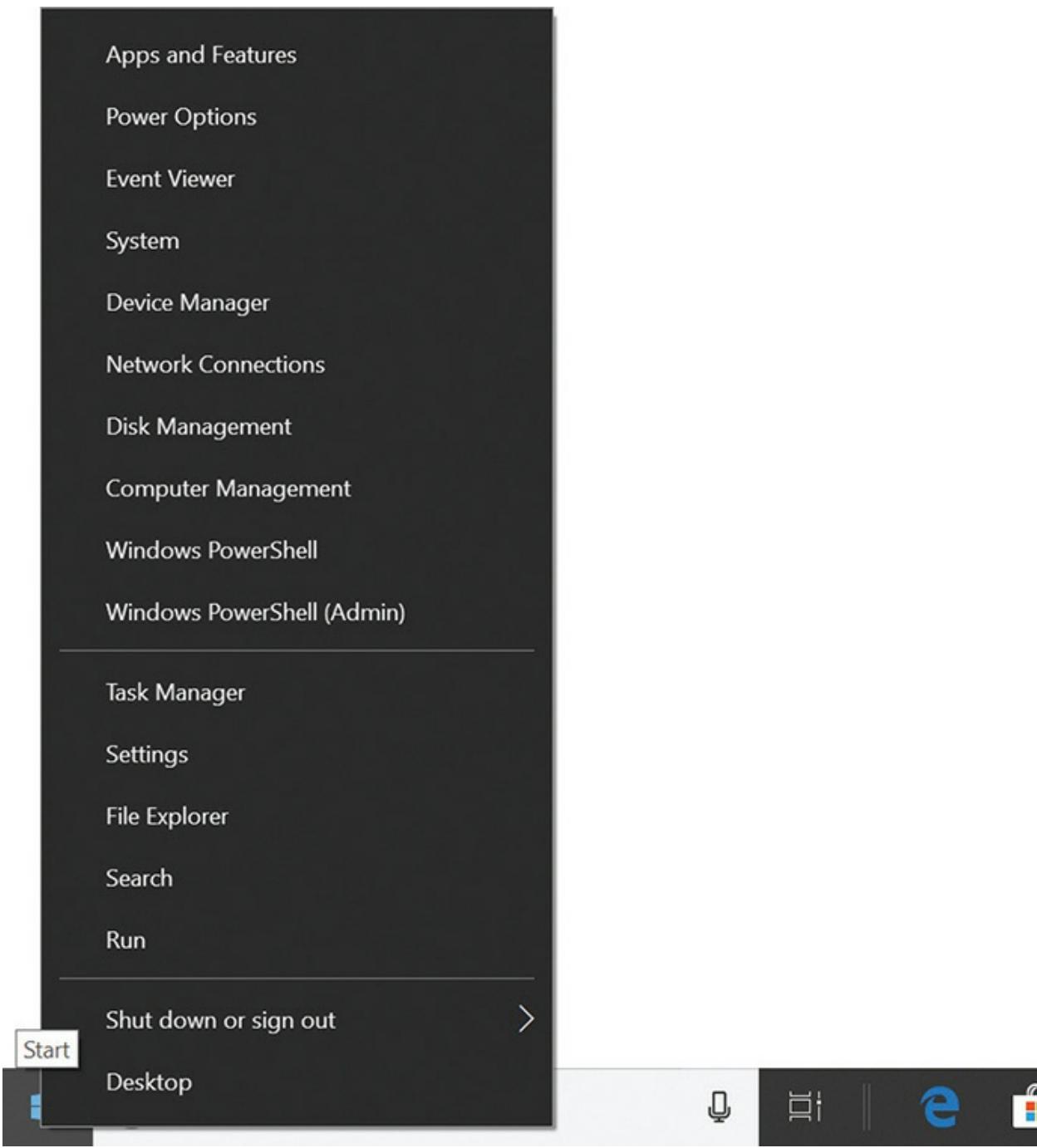


Figure 2-52 Accessing Settings in Windows 10 (note PowerShell as default command line)

macOS

macOS has two key launch points for techs: the System Preferences app and the Utilities folder. You can access both quickly.

System Preferences To access *System Preferences*, click the Apple icon (top-left corner of screen). Select System Preferences from the permanent Apple menu to open the app (see [Figure 2-53](#)). From System Preferences you have access to almost all settings you will need to administer a macOS system.

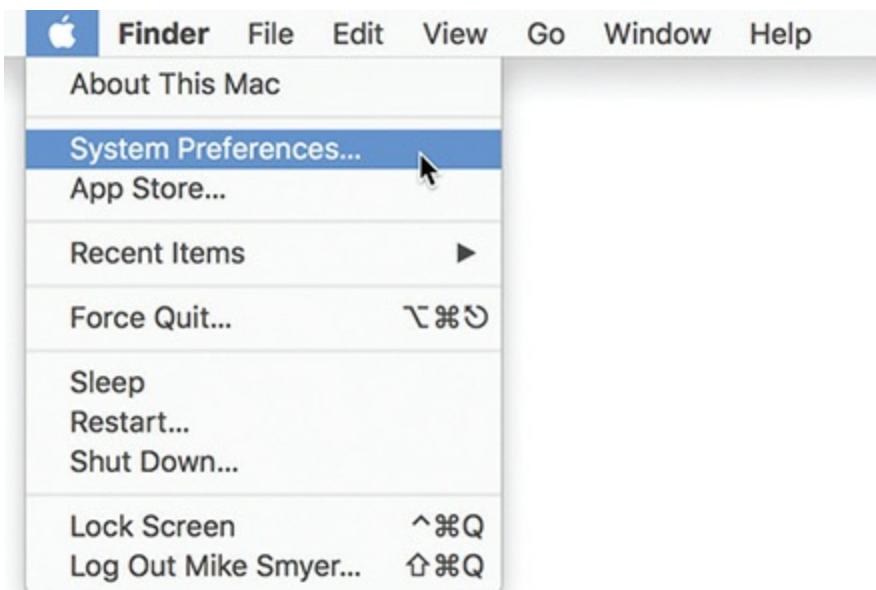


Figure 2-53 Accessing System Preferences

Utilities Folder The second launch point is the *Utilities* folder, located neatly in the Applications folder. Because of its importance, Apple provides a quick shortcut to access it. With the Finder in focus, click Go on the menu bar and select Utilities (see [Figure 2-54](#)). Alternatively, use the hot-key combination: COMMAND-SHIFT-U. This gives you access to the tools you need to perform services on a Mac beyond what's included in System Preferences, including Activity Monitor and Terminal. The latter is the command-line interface for macOS, a very powerful tool for techs that we explore in detail in [Chapter 15](#).

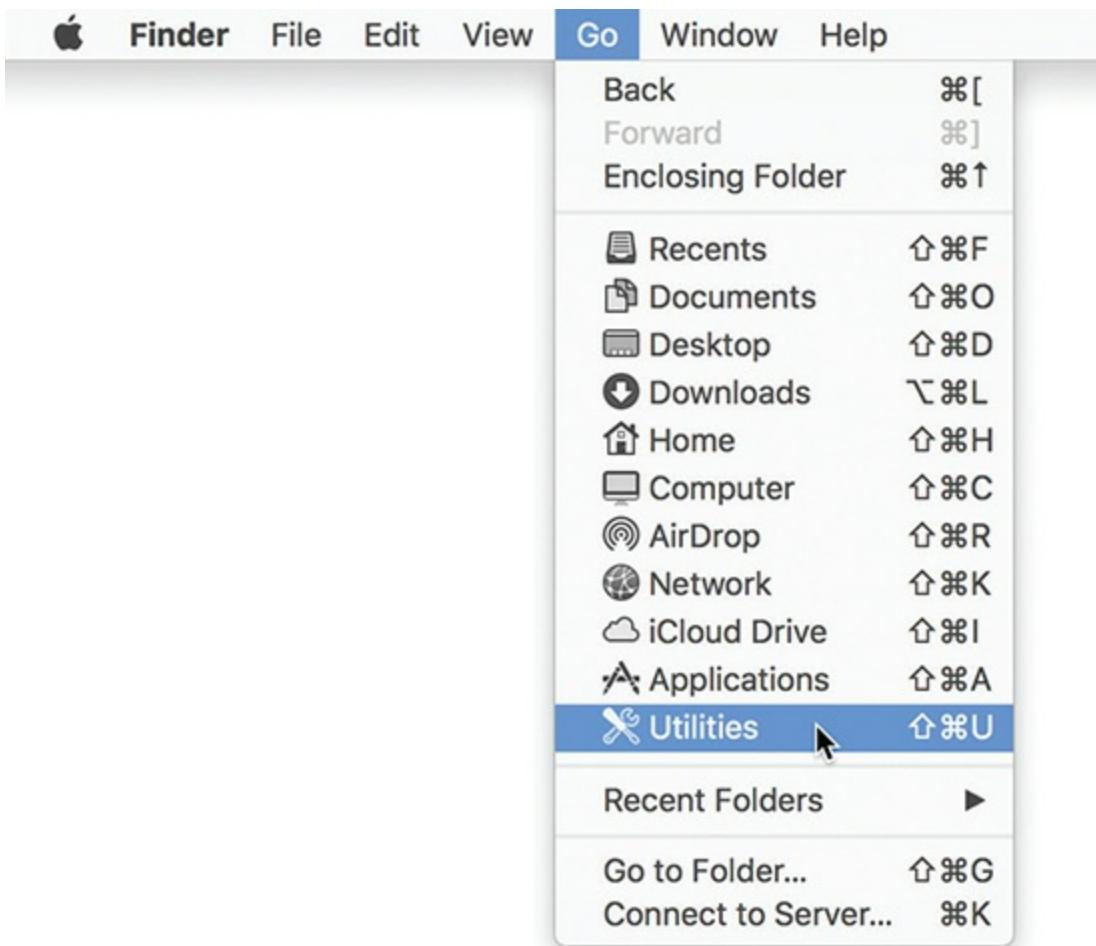


Figure 2-54 Accessing the Utilities folder

Linux

An essential tool in Linux for techs is the command line, called Terminal. You can get there in most distros by pressing CTRL-ALT-T. (See [Chapter 15](#) for a lot of details about essential Linux commands.)

Other launch points vary from distro to distro. Here are the locations of the launch points for common desktop environments.

GNOME 3 The first launch point in a GNOME 3 DE is the All Settings application. To access All Settings, click the down arrow icon on the far right of the menu bar and select the wrench and screwdriver icon (see [Figure 2-55](#)).

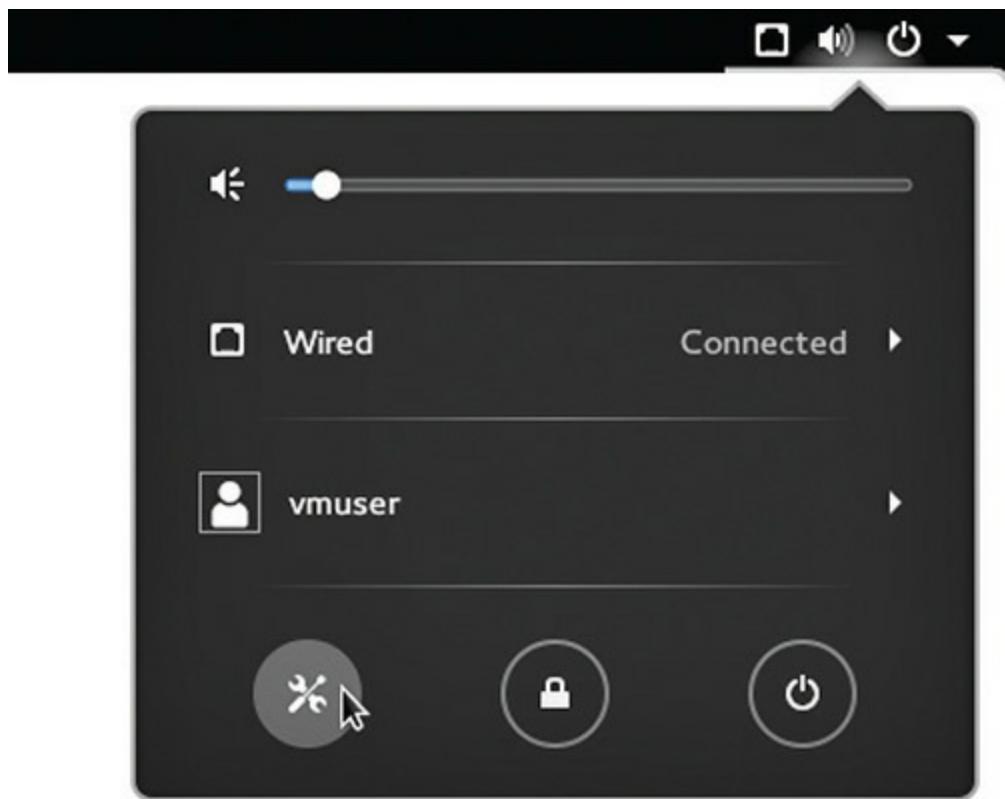


Figure 2-55 Accessing All Settings

For other system utilities such as System Monitor or Terminal, click the Activities button on the far left of the menu bar. From here you can search for the utility from the box at the top. This will open a menu showing all installed applications, and within this list is a folder for Utilities.

KDE Plasma Desktop “Choice!” could be the unofficial motto of Linux, and when you are working on a KDE-based distro, you are certainly spoiled for choices. The downside to this abundance is that the configuration utilities can vary among the different KDE-based distros.

The one thing that is the same in all the KDE-based distros is that everything you need to work on the system is accessible from the *Kickoff* menu on the far left of the Panel (see [Figure 2-56](#)). The Kickoff menu looks and works a lot like the Start menu in Windows 7, so it should be relatively easy to navigate. Once in the Kickoff menu, you can search for a needed utility or select the Applications tab at the bottom. From here, most distros have a Utilities or System menu that holds all the key system configuration and maintenance applications.

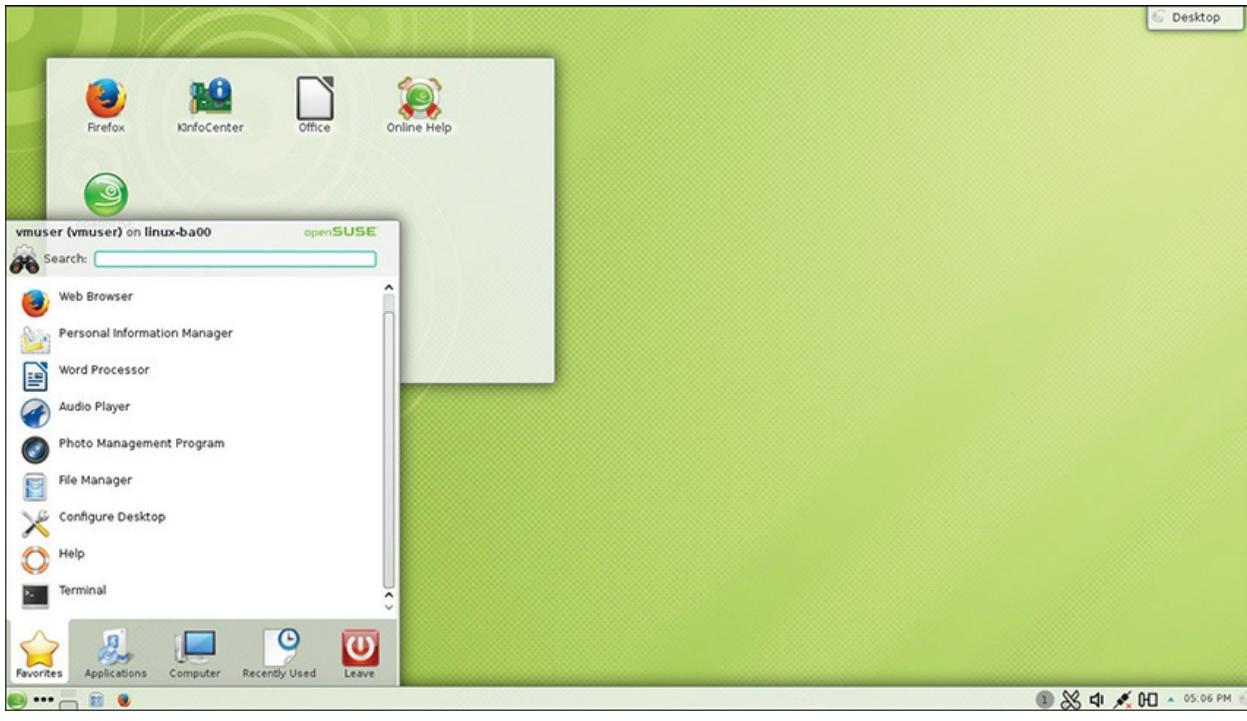


Figure 2-56 KDE Kickoff menu

Chapter Review

Questions

1. Which version of Windows introduced the Metro UI?
 - A. Windows 7
 - B. Windows 8
 - C. Windows 8.1
 - D. Windows 10
2. Which Windows 8 feature did Microsoft not include in Windows 10?
 - A. Metro/Modern UI
 - B. Start button
 - C. Control Panel
 - D. Charms bar
3. What macOS feature is essentially multiple Desktops?

- A. Charms
 - B. Desktop
 - C. Mission Control
 - D. Spaces
- 4. What KDE feature is essentially the Start button?
 - A. Metro UI
 - B. Kickoff
 - C. Terminal
 - D. GNOME 3
- 5. The user Mike has downloaded files with his Web browser. Where will they be stored by default?
 - A. C:\Downloads
 - B. C:\Mike\Desktop\Downloads
 - C. C:\Users\Mike\Downloads
 - D. C:\Users\Mike\Desktop\Downloads
- 6. 32-bit programs are installed into which folder by default in a 64-bit edition of Windows?
 - A. C:\Program Files
 - B. C:\Program Files (x32)
 - C. C:\Program Files\Wins\Old
 - D. C:\Program Files (x86)
- 7. Which macOS feature is functionally equivalent to Windows File Explorer?
 - A. Finder
 - B. Dock
 - C. Quartz
 - D. File Manager
- 8. Which of the following paths would open Administrative Tools in Windows 8.1?
 - A. Right-click the taskbar and select Administrative Tools from the context menu.

- B.** Right-click the Start button and select Administrative Tools from the context menu.
 - C.** Right-click anywhere on the Desktop and select Administrative Tools from the context menu.
 - D.** Press the WINDOWS KEY-L combination to open Administrative Tools.
- 9.** What feature of macOS is the equivalent of the command-line interface in Windows?
 - A.** Dock
 - B.** Spaces
 - C.** Terminal
 - D.** Unity
- 10.** What Windows app in Windows 10 combines many utilities into a unified tool?
 - A.** Settings
 - B.** Control
 - C.** Command Center
 - D.** Control Center

Answers

- 1.** **B.** Microsoft introduced Metro UI with Windows 8.
- 2.** **D.** Microsoft did not include the Charms bar in Windows 10. Bye!
- 3.** **D.** Spaces is the term Apple uses for multiple Desktops in macOS.
- 4.** **B.** Kickoff functions like a Start button for KDE desktops.
- 5.** **C.** The default download location in Windows is C:\Users\<user name>\Downloads.
- 6.** **D.** By default, 32-bit applications install into the C:\Program Files (x86) folder.
- 7.** **A.** Finder is the equivalent of File Explorer.
- 8.** **B.** To open Administrative Tools, right-click the Start button and select Administrative Tools. Easy!

- 9.** C. Terminal is the equivalent of the Windows command-line interface.
- 10.** A. The Settings app in Windows 10 offers many utilities in a unified interface.