

# Software

## System software vs. Application software

- ▶ Computers run two types of software: system software and application software.
- ▶ System software consists of the operating system and utility programs that control your computer and allow you to use it. These programs enable the computer to boot, to launch application programs, and to facilitate important jobs, such as transferring files from one storage medium to another, configuring your computer to work with the hardware connected to it, connecting your computer to a network, managing files on your hard drive, and protecting your computer from unauthorized use.
- ▶ Application software includes all the programs that allow you to perform specific tasks on your computer, such as writing a letter, preparing an invoice, viewing a Web page, listening to a music file, checking the inventory of a particular product, playing a game, preparing financial statements, designing a home, and so forth.

# Operating system

A computer's operating system is a collection of programs that manage and coordinate the activities taking place within the computer and it is the most critical piece of software installed on the computer. The operating system boots the computer, launches application software, and ensures that all actions requested by a user are valid and processed in an orderly fashion. For example, when you issue the command for your computer to store a document on your hard drive, the operating system must perform the following steps:

- 1) make sure that the specified hard drive exists.
- 2) verify that there is adequate space on the hard drive to store the document and then store the document in that location, and
- 3) update the hard drive's directory with the filename and disk location for that file so that the document can be retrieved again when needed.

In addition to managing all of the resources associated with your local computer, the operating system also facilitates connections to the Internet and other networks

## Functions of an operating system

Operating systems have a wide range of functions— some of the most important are:

### Interfacing with users

One of the principal roles of every operating system is to translate user instructions into a form the computer can understand. It also translates any feedback from hardware—such as a signal that the printer has run out of paper or that a new hardware device has been connected to the computer—into a form that the user can understand. The means by which an operating system or any other program interacts with the user is called the user interface; user interfaces can be text-based or graphics-based, as discussed in more detail shortly. Most, but not all, operating systems today use a graphical user interface (GUI).

## **Booting the computer**

the first task your operating system performs when you power up your computer is to boot the computer. During the boot process, the essential portion, or core, of the operating system (called the kernel) is loaded into memory. The kernel remains in memory the entire time the computer is on so that it is always available; other parts of the operating system are retrieved from the hard drive and loaded into memory when they are needed. Before the boot process ends, the operating system determines the hardware devices that are connected to the computer and configured properly, and it reads an opening batch of instructions. These startup instructions (which the user can customize to some extent when necessary) assign tasks for the operating system to carry out each time the computer boots, such as launching a security program to run continually in the background to detect possible threats. Typically, many programs are running in the background all the time, even before the user launches any application software. The Windows Task Manager lists all the programs and processes (program tasks) currently running on a computer. Some of these programs are startup programs that are launched automatically by the operating system during the boot process; regardless of how programs are launched, they all consume memory and processing power.

To view the programs that will run each time the computer boots or to remove a program from this startup list, Windows users can use the Startup tab on the Task Manager. To avoid creating a problem with your computer, however, do not disable a program from the startup list without knowing absolutely what the program does and that it can be safely disabled. Other system configuration information is stored in the Windows registry files, which should be modified only by the Windows program or by advanced.

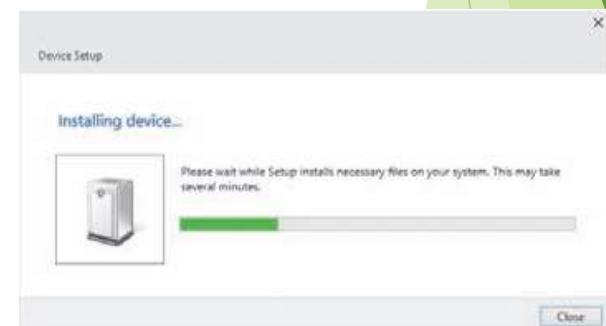
The image shows two side-by-side windows of the Windows Task Manager. The top window is titled 'Task Manager' and has its title bar highlighted. It features a tab bar with 'File', 'Options', 'View', 'Processes', 'Performance', 'App history', 'Startup' (which is selected and highlighted in blue), 'Users', 'Details', and 'Services'. Below the tab bar is a table with columns 'Name', 'Publisher', 'Status', and 'Startup impact'. Two entries are listed: 'Ad-Aware tray' by LavaSoft with 'Enabled' status and 'High' startup impact, and 'Microsoft OneDrive' by Microsoft Corporation with 'Enabled' status and 'High' startup impact. A callout line points from the text 'STARTUP TAB' to the 'Startup' tab in the top window's title bar. The bottom window is also titled 'Task Manager' and has its title bar highlighted. It has the same tab bar. Below the tab bar is a table with columns 'Name', 'Status', 'CPU', 'Memory', 'Disk', and 'Network'. The table is divided into sections: 'Apps (4)' containing Microsoft Word, Paint, Task Manager, and Windows Explorer; and 'Background processes (30)' containing Ad-Aware service, Ad-Aware tray, Microsoft OneDrive, and Microsoft Outlook. A callout line points from the text 'PROCESSES TAB' to the left edge of the bottom window's table area. Both windows have a standard Windows interface with minimize, maximize, and close buttons in their title bars.

**STARTUP TAB**  
Enabled programs are launched during the boot process.

**PROCESSES TAB**  
Shows launched apps and the processes running in the background.

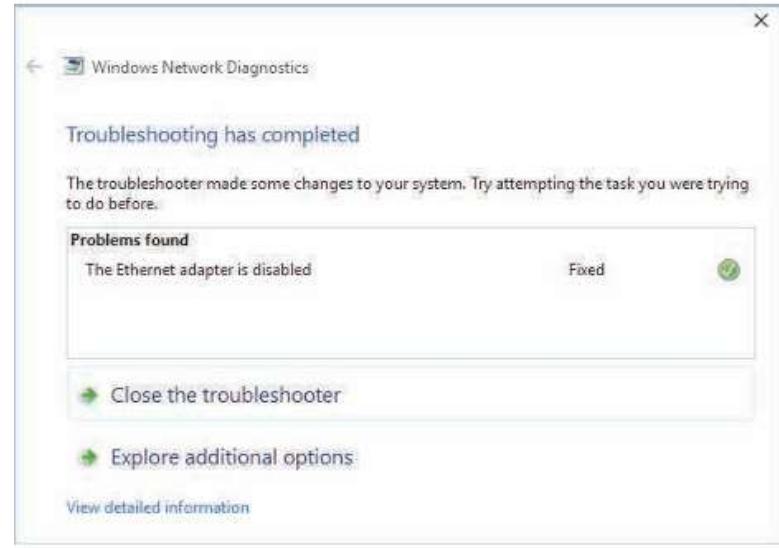
## Configuring devices

The operating system also configures all devices connected to a computer. Small programs called device drivers (or simply drivers) are used to communicate with peripheral devices, such as monitors, printers, portable storage devices, and keyboards. Most operating systems today include the drivers needed for the most common peripheral devices. In addition, drivers often come on a CD packaged with the peripheral device or they can be downloaded from the manufacturer's Web site. Most operating systems today look for and recognize new devices each time the computer boots. If a new device is found, the operating system typically tries to install the appropriate driver automatically in order to get the new hardware ready to use.



## Managing network connections

The operating system is also in charge of managing your network connections, such as a wired connection to a home or office network or wireless connections at home, school, work, or on the go. For instance, as you move into range of a wireless network, the operating system will notify you that a new wireless network is available and then either connect your device to that network or wait for your instruction to connect to the network, depending on your device's wireless network settings. If at any time you lose a network connection, the operating system can try to fix it, such as by resetting your device's network adapter.



## **Managing and monitoring resources and jobs**

As you work on your computer, the operating system continuously manages your computer's resources (such as software, disk space, and memory) and makes them available to devices and programs when they are needed. If a problem occurs—such as a program stops functioning or too many programs are open for the amount of memory installed in the computer—the operating system notifies the user and tries to correct the problem, often by closing the offending program. If the problem cannot be corrected by the operating system, then the user typically needs to reboot the computer.

As part of managing system resources, the operating system schedules jobs (such as documents to be printed or files to be retrieved from a hard drive) to be performed using those resources. Scheduling routines in the operating system determine the order in which jobs are carried out, as well as which commands get executed first if the user is working with more than one program at one time or if the computer (such as a server or main frame) supports multiple users.

## **File management**

Another important task that the operating system performs is file management—keeping track of the files stored on a computer so that they can be retrieved when needed.

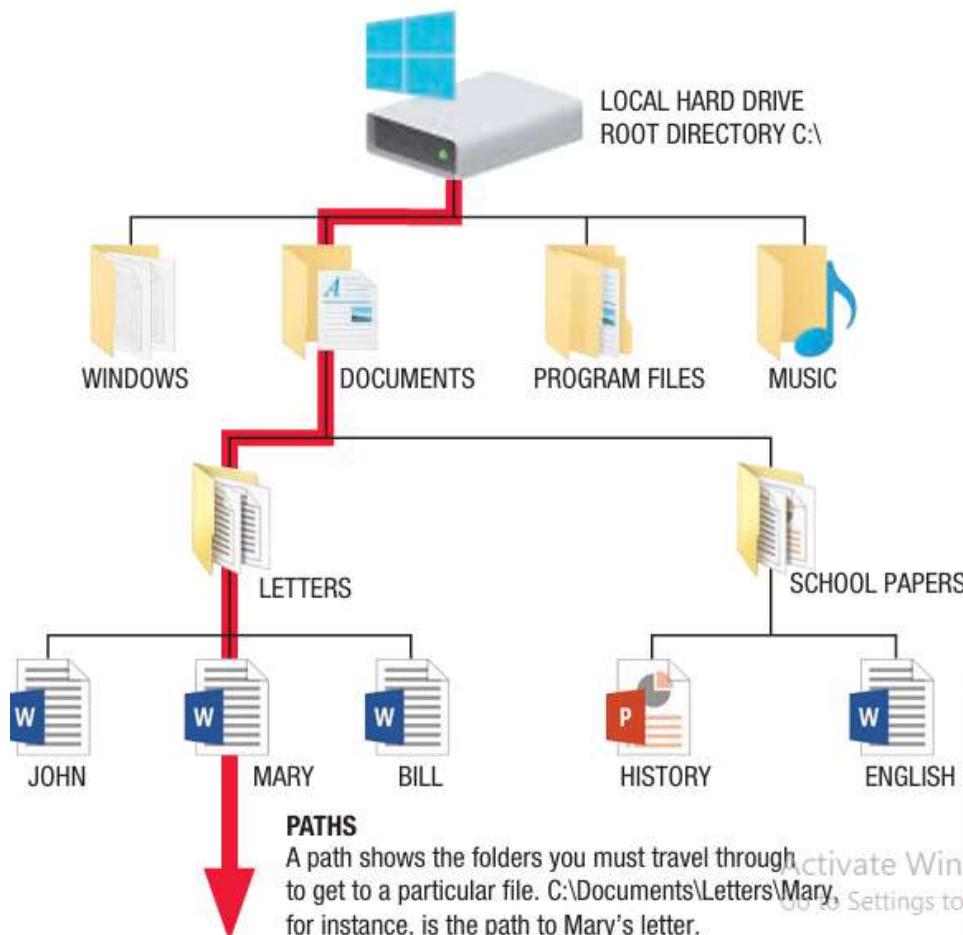
Usually the operating system files are stored inside one folder (such as the Windows folder), and each application program is stored in its own separate folder inside a main programs folder (such as Program Files). Other folders designed for storing data files are typically created by the operating system for each user (such as Documents, Music, and Pictures folders); individuals may create additional folders, as desired, to keep their files organized. Folders can contain both files and other folders (called subfolders).

Files and folders are usually viewed in a hierarchical format; the top of the hierarchy for any storage medium is called the root directory .



Filename rules vary with each operating system. For instance, Windows supports filenames that are from 1 to 260 characters long (the length includes the entire path to the file's location) and may include numbers, letters, spaces, and any special characters except \ / : \* ? " < > and |. Filenames typically include a file extension (usually three or four characters preceded by a period) at the end of the filename, which indicates the type of file.

File extensions should not be changed by the user because the operating system uses them to identify the program that should be used to open the file. For instance, if you issue a command to open a file named Letter to Mom.docx, the file will open using the Microsoft Word program (assuming the device being used has access to a recent version of that program) because the .docx file extension is associated with recent versions of the Microsoft Word program. Files can be opened, as well as moved, copied, renamed, and deleted, using a file management program such as File Explorer. You may not be able to see file extensions in your file management program, however, because they are usually hidden by default. The File Explorer file management program and other utilities typically included in an operating system.



## DOCUMENTS

- .doc .docx .txt .rtf .htm .html
- .mhtml .xml .xls .xlsx .mdb .accdb
- .ppt .pptx .pdf .sxc .sxi .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

## **Security**

A computer's operating system can use passwords, biometric characteristics (such as fingerprints), and other security procedures to limit access to the computer and other system resources to only authorized users. Most operating systems also include other security features, such as an integrated firewall to protect against unauthorized access via the Internet or an option to download and install security patches (small program updates that correct known security problems) automatically from the operating system's manufacturer on a regular basis.

# TYPES OF OPERATING SYSTEMS

There are different types of operating systems available to meet different needs. Some of the major distinctions among operating systems include the type of user interface utilized, the category of device the operating system will be used with, and the type of processing the operating system is designed for.

## TYPE OF USER INTERFACE UTILIZED

## Graphical User Vs. Command Line Interface

As mentioned earlier in this chapter, a user interface is the manner in which an operating system interacts with its users. Most operating systems today use a graphical user interface (GUI). The older DOS operating system and some versions of the UNIX and Linux operating systems use a command line interface, although graphical versions of UNIX and Linux are available. Command line interfaces require users to input commands using the keyboard; graphical user interfaces allow the user to issue commands by selecting icons, buttons, menu items, and other graphical objects—typically with a mouse, pen, or finger.



### **GRAPHICAL USER INTERFACE**

Objects (such as icons, buttons, menus, and tiles) are selected with the mouse, pen, or finger to issue commands to the computer.

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

C:\Users\Debbie>DIR
Volume in drive C has no label.
Volume Serial Number is 9693-C87D

Directory of C:\Users\Debbie

06/12/2015  06:19 PM    <DIR>   .
06/12/2015  06:19 PM    <DIR>   ..
05/23/2015  06:06 AM    <DIR>   3D Objects
06/12/2015  06:15 PM    <DIR>   Contacts
06/12/2015  06:15 PM    <DIR>   Desktop
06/12/2015  06:15 PM    <DIR>   Documents
06/12/2015  10:44 PM    <DIR>   Downloads
06/12/2015  06:15 PM    <DIR>   Favorites
06/12/2015  06:15 PM    <DIR>   Links
06/12/2015  06:15 PM    <DIR>   Music
06/13/2015  12:51 AM    <DIR>   OneDrive
06/12/2015  09:26 PM    <DIR>   Pictures
06/12/2015  06:18 PM    <DIR>   Searches
06/12/2015  06:15 PM    <DIR>   Videos
                           0 File(s)   0 bytes
                           15 Dir(s)  23,087,920,128 bytes free
```

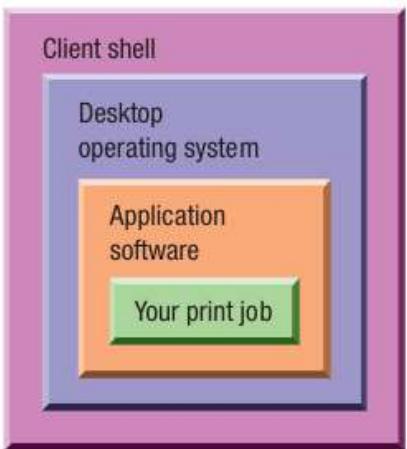
### **COMMAND LINE INTERFACE**

Commands are entered using the keyboard.

## **THE CATEGORY OF DEVICE THE OPERATING SYSTEM WILL BE USED WITH**

Operating systems are typically designed for a particular type of device. For example, operating systems used with personal computers are typically referred to as personal operating systems (also called desktop operating systems) and they are designed to be installed on a single computer. In contrast, server operating systems (also called network operating systems) are designed to be installed on a network server to grant multiple users access to a network and its resources. Each computer on a network has its own personal operating system installed (just as with a stand-alone computer) and that operating system controls the activity on that computer, while the server operating system controls access to network resources. Computers on a network may also need special client software to access the network and issue requests to the server.

1. The client software provides a shell around your desktop operating system. The shell program enables your computer to communicate with the server operating system, which is located on the network server.



2. When you request a network activity, such as printing a document using a network printer, your application program passes the job to your desktop operating system, which sends it to the client shell, which sends it on to the server operating system, which is located on the network server.

Desktop computer running Windows and client software for the server operating system being used.



Igor Klimov/Shutterstock.com

3. The server operating system then lines up your job in its print queue and prints the job when its turn comes.



Prymat/Shutterstock.com

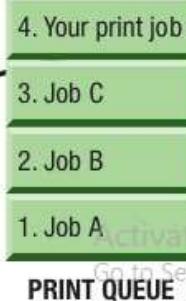
Your print job

Network server running a server operating system.



kavione/Shutterstock.com

Network printer



**FIGURE 5-11**  
How network operating systems work.



In addition to personal operating systems and server operating systems, there are mobile operating systems that are designed to be used with smartphones and other mobile devices, and embedded operating systems that are built into consumer kiosks, cash registers, cars, consumer electronics, and other devices.