**Operating System**

 As the brand of new computer comes over assembly, it can do nothing. The hardware needs software to make it work. That means we need applications software such as word processing or spreadsheet software .

Hardware

Application Software

User

Operating System

Figure 1: The Operating System in a Hierarchy

But an applications software package does not communicate directly with the hardware. As shown in Figure 1, Operating system is the interface between the hardware and the application software. An operating system is a set of programs that lies between applications software and the computer hardware. Incidentally, the system software is sometimes used interchangeably with operating system, but system software means all programs related to coordinating computer operations. System software does include the operating system, but it also includes the BIOS software, drivers, and service programs, which we will discuss briefly in this chapter (see Figure 2).

USER

OPERATING SYSTEM

HARDWARE

Figure 2: System Software

So an operating system is a set of programs. The most important program in the operating system, that manages the operating system, is the supervisor program. The supervisor controls the entire operating system and loads into memory, other operating system programs from disk storage whenever needed.

The main functions of operating system are:

(1) manage the computer's resources, such as the central processing unit, memory, disk drives, and printers.

(2) establish a user interface.

(3) execute and provide services for applications software.

(4) Some operating system provides security and maintenance of data.

Most of the work of an operating system is hidden from the user. In particular, the first function, managing the computer's resources, is taken care of without the user being aware of the details. Further, all input and output operations, although invoked by an applications program, are actually carried out by the operating system. Although much of the operating system functions are hidden from view, as we are using an applications software package, thus we invoke-call into action-the operating system. Thus, we both establish a user interface and execute software.

Operating systems for mainframe and other large computers, that they must keep track of several programs from several users, are running in the same time. Although some personal computer operating systems found in business or learning environments, can support multiple programs.

**Operating Systems for Personal Computers**:

Generally, an application program can run on just one operating system. just as you cannot place a Nissan engine in a Ford truck, you cannot take a version of WordPerfect designed to run on an IBM machine and run it on an Apple Macintosh. The reason is that IBM personal computers and others like them have Intel-compatible microprocessors and usually use Microsoft's operating system, called MS-DOS (Microsoft disk operating system) on older computers, and Windows95 or Windows98 on more modern computers. Computers that have come out since the year 2000 often come with Windows ME (Millennium Edition), or Windows2000. Macintoshes use an entirely different operating system, called the Macintosh operating system, which is produced by Apple. Over 80 percent of personal computers use a version of Windows as their operating systems. Macintosh comprises about 15 percent of the market, with other operating systems such as Linux comprising the rest.

Users do not set out to buy operating systems; they want computers and the applications software to make them useful. However, since the operating system determines what software is available for a given computer, many users observe the high volume of software available for MS-DOS machines and make their computer purchases accordingly. Others prefer the user-friendly style of the Macintosh operating system and choose Macs for that reason.

Although operating systems differ, many of their basic functions are similar. We will show some of the basic functions of operating systems.

MS-DOS:

Most users today have a computer with a hard disk drive. When the computer is turned on, the operating system will be loaded from the hard drive into the computer's memory, thus making it available for use. The process of loading the operating system into memory is called bootstrapping, or booting the system. The word booting is used because, the operating system pulls itself up by its own bootstraps. When the computer is switched on, a small program (in ROM-read-only memory) automatically pulls up the basic components of the operating system from the hard disk. From now on, we will refer to MS-DOS.

The net observable result of booting DOS is that the characters C> (or possibly C:\>) appear on the screen. The C refers to the disk drive; the > is a prompt, a signal that the system is prompting the user to do something. At this point the user must give some instruction to the computer. It could be more complicated that, C> is actually a signal for direct communication between the user and the operating system.

Although the prompt is the only visible result of booting the system, DOS also provides the basic software that coordinates the computer's hardware components and a set of programs that lets the user to perform the tasks need to do. To execute a given DOS program, a user must issue a command, a name that invokes a specific DOS program.

**Microsoft Windows:**

Microsoft Windows started out as a shell. Windows uses a colourful graphics interface that, among other things, eases access to the operating system. The feature that makes Windows so easy to use is a graphical user interface (GUI), in which users work with on-screen pictures called icons and with menus. They are called pull-down menus because they appear to pull down like a window shade from the original selection. Some menus are called pop-up menus originate from a selection on the bottom of the screen. Again icons and menus encourage pointing and clicking with a mouse, an approach that can make computer use both fast and easy.

To enhance ease of use, Windows is usually set up the colourful Windows display, is the first thing a user sees when the computer is turned on. DOS is still there, under Windows, but a user need never see C> during routine activities. The user points and clicks among a series of narrowing choices until arriving at the desired software.

Although the screen presentation and user interaction are the most visible evidence of change, Windows offers changes that are even more fundamental. To understand these changes more fully, it is helpful at this point to make a comparison between traditional operating systems for large computers and Windows.

In addition to adding a friendly GUI, Windows operating systems added another important feature to DOS - multi-tasking. Multi-tasking occurs when the computer has several programs executing at one time. PCs that ran under DOS could only run one program at a time. Windows-based computers can have multiple programs (e.g. a browser, a word processor, and several Instant Messaging instances) running at the same time. When programs are executing at the same time, they are said to be executing concurrently.

As we learned, personal computers have only one CPU that handles just one instruction at a time. Computers using the MS-DOS operating system without a shell are limited not only to just one user at a time but also to just one program at a time. If, for example, a user were using a word processing program to write a financial report and wanted to access some spreadsheet figures, he or she would have to perform a series of arcane steps: exit the word processing program, enter and use and then exit the spreadsheet program, and then re-enter the word processing program to complete the report. This is wasteful in two ways: (1) the CPU is often idle because only one program is executing at a time, and (2) the user is required to move inconveniently from program to program.

Multi-tasking allows several programs to be active at the same time, although at an instant in time the CPU is doing only one instruction for one of the active programs. The Operating System manages which instructions to send to the CPU. Since computers are so fast, the operating system can switch the program that gets to execute on the CPU so quickly, the user can not tell. This is what allows your computer to be "listening" for incoming instant messages, for instance, while you use a word processor to write a paper.

How The Operating System Works:

When you turn on your computer, it's nice to think that you're in control. There's the trusty mouse, which you can move anywhere on the screen, summoning up your music library or internet browser at the slightest whim. Although it's easy to feel like a director in front of your desktop or laptop, there's a lot going on inside, and the real person behind the curtain handling the necessary tasks is the operating system.

Microsoft windows powers most of the computers we use for work or personal use. Macintosh computers come pre-loaded with macOS. Linux and UNIX operating systems are popular for digital content servers, but many distributions or distros, have become increasingly popular for everyday use. Regardless of your choice, without an operating system, you're not going to get anything done.

Other devices have their own operating systems. Google's Android and Apple's iOS are the most common smartphone OSes as of the 2020s, although some manufacturers have developed their own, mostly based on the Android operating system. Apple ships iPads with iPadOS, Apple watches with watch OS and Apple TV uses tvOS. And there are all kinds of other devices that have their own operating systems — think Internet of Things devices, smart TVs and the systems that run car info tent system. And that doesn't even include the complex system needed. in self-driving cars.

The purpose of an operating system is to organize and control hardware and software so that the device it lives in behaves in a flexible but predictable way. In this article, we'll tell you what a piece of software must do to be called an operating system, show you how the operating system in your desktop computer works and give you some examples of how to take control of the other operating systems around you.

**What Is an Operating System?**



A Windows 11 logo is also seen on a smartphone screen with a Microsoft website in the background. Windows is probably the most common operating system.

Not all computers have operating systems. The computer that controls the [microwave oven](https://home.howstuffworks.com/microwave.htm) in your kitchen, for example, doesn't need an operating system. It has one set of tasks to perform, very straightforward input to expect (a numbered keypad and a few pre-set buttons) and simple, never-changing hardware to control. For a machine like this, an elaborate operating system would be unnecessary baggage, driving up the development and manufacturing costs significantly and adding complexity where none is required. Instead, the computer in a microwave oven simply runs a single hard-wired program called an [embedded system](https://www.allaboutcircuits.com/technical-articles/what-is-embedded-design-embedded-system-design-firmware/) all the time.

For other devices, an operating system creates the ability to:

 Serve a variety of purposes.

 Interact with users in more complicated ways.

 Keep up with needs that change over time.

All desktop computers have operating systems. The most common are the Windows family of operating systems developed by [Microsoft](https://computer.howstuffworks.com/microsoft.htm), the Macintosh operating systems developed by Apple and the UNIX family of operating systems developed by a whole history of individuals, corporations and collaborators. There are hundreds of other operating systems available for special-purpose applications, including specializations for mainframes, robotics, manufacturing, real-time control systems and so on.

In any device that has an operating system, there's usually a way to make changes to how the device works. This is far from a happy accident; one of the reasons operating systems use portable code rather than permanent physical circuits is so that they can be changed or modified without having to scrap the whole device.

For a desktop computer user, this means you can add a new security update, system patch, new application or even an entirely new operating system rather than junk your computer and start again with a new one when you need to make a change. As long as you understand how an operating system works and how to get at it, in many cases you can change some of the ways it behaves.

## Operating System Functions

At the simplest level, an operating system does two things:

1. It manages the hardware and software resources of the system. In computers, tablets and smartphones these resources include the processors, memory, disk space and more.
2. It provides a stable, consistent way for applications to deal with the hardware without having to know all the details of the hardware.



The operating system controls every task the computer carries out and manages system resources to optimize performance.

The first task is managing the hardware and software resources, is very important, as various programs and input methods compete for the attention of the Central Processing Unit (CPU) and demand memory, storage and input/output (I/O) bandwidth for their own purposes. In this capacity, the operating system plays the role of the good parent, making sure that each application gets its necessary resources while playing nicely with all the other applications, as well as husbanding the limited capacity of the system to the greatest good of all the users and applications.

The second task is providing a consistent user interface, is especially important if there is more than one of a particular type of computer using the operating system, or if the hardware making up the computer is ever open to change. A consistent application programming interface (API) allows a software developer to write an application on one computer and have a high level of confidence that it will run on another computer of the same type, even if the amount of memory or the quantity of storage is different on the two machines.

Even when a particular computer is unique, an operating system ensures that applications continue to run when hardware upgrades and updates occur. This is because the operating system — not the application — is charged with managing the hardware and the distribution of its resources. One of the challenges facing developers is keeping their operating systems flexible enough to run hardware from the thousands of vendors manufacturing computer equipment. Today's systems can accommodate thousands of different printers, disk drives and special peripherals in any possible combination.

Types of Operating System: -

Operating system are the following types-

1. Single user operating system.
2. Multi-tasking operating system.
3. Time sharing operating system.
4. Multi programming operating system.
5. Multi-processing operating system.
6. Multi user operating system.
7. Real time operating system.
8. Network operating system.
9. Client-Server operating system.

**Single user operating system**

In single user operating system, the computers are used by individuals at a time. This type operating system is very easy to use and understand. Since there is only one user, there is no conflict of resource allocation. The CPU has to execute only one program in a given time.

**Multi-tasking operating system**

The multi-tasking operating system has the ability to run more than one program at a time. They appear to be running simultaneously, but they are actually switching between themselves. The OS schedule all the programs running under it in such a way that each program gets a slice of the total time.

Operating System

Application 1

Application 2

CPU

All Processes

Assigned Process

Application 3

 In the above figure, there are 3 programs are running. “Application 1” has been scheduled in the first slot, it will relinquish it’s time slice is over. The processor will note of whichever situation the program “Application 1” was in end and then give the control to program “Application 2”. Same situation will happen with the programs “Application 2” and “Application 3”. After “Application 3”, program “Application 1” get control and the processor will start of from where the program “Application 1” had left off in the previous time slice.

 **Time sharing operating system**

In time sharing operating system, the number of terminals are attached to a computer and each computer has direct access to the main computer. The main computer allocates for a fixed time slice to each program. Each program is executed for a fixed time period. As soon as the time allocated to this program is finished, the CPU starts executing another program.

User space 1

Progarm1

User space 2

Program 1

User space 3

Progarm2

System

 **Multi Programming Operating system**

The technique of this OS is reduce the idle time of CPU and increase the utilization of CPU. A number of programs are available in the main memory of the computer. The OS selects one of the program and instructs the CPU to execute. While this program is being executed, another program becomes available from the main memory simultaneously.

Free Memory

Program 2

Program 1

Operating System

Free memory

Program 1

Program 0

Operating System

Free memory

Program 0

Operating System

 **Multi-Processing operating system**

The operating system which is capable of using and manging more than one CPU is called multi-processing operating system. Inthis case each CPU is allocated for definite job. The controlling CPU uses the power of other CPUs as if they were peripheral devices of the computer.

 **Multi user operating system**

This operating system allows more than one user to access the computer at the same time. In this technique a network of computers is established. Multi terminals are connected with the host computer and more than one user can operate the terminals.

 **Real time operating system**

 The real time operating system provides random enquires from remote locations with instantaneous response. The OS instructs the computer to analyse the data and send appropriate response back to the sender. It is dynamic in nature.

 **Network Operating System**

A single operating system is assigned to all the computer on the network that is referred as distributed operating system. This is common on the LAN. A network operating system makes all the resources available even if attached to remote hosts. Shared files may be available on the central computer. Network operating system supports communication between user and between users and the system.

 **Client/Server System**

In client/ server system, each computer in the network is either a client or a server. Clients are those computers that make certain requests send to the server. Server is that computer which completes clients’ requests. A LAN can be considered as client/server system.