

# OPERATING SYSTEMS

## *What is an Operating System?*

An **Operating System (OS)** is the mediator between the user and the computer hardware. It is the **most important software** that runs on a computer. It manages the computer's **memory, processes**, and all of its **software and hardware**. It also allows the user to **communicate** with the computer. **Without an operating system, a computer is useless.** In short, the OS -

- Manages the computer's resources (hardware, softwares and abstract resources),
- It's a resource allocator,
- It is also used to control programs to prevent errors and improper computer use,
- It is interrupt driven.

## *Working of Operating Systems*

You've probably heard the phrase **boot your computer**, but do you know what that means? **Bootting** is the process that occurs when you press the power button to turn your computer on. During this process (which may take a minute or two), the computer does several things:

- It **runs tests** to make sure everything is working correctly.
- It **checks for new hardware**.
- It then **starts up the operating system**.

Once the operating system is turned on, it **manages all the software and hardware on the computer**. Most of the time, there are many different programs running in the computer simultaneously, and they all need to access your computer's **Central Processing Unit (CPU), memory, and storage**. The operating system coordinates all

of this to make sure that each program gets what it needs. Without the operating system, the software wouldn't even be able to talk to the hardware, and the computer would be useless.

An operating system must be made up of different parts: (these can change depending on the operating system)

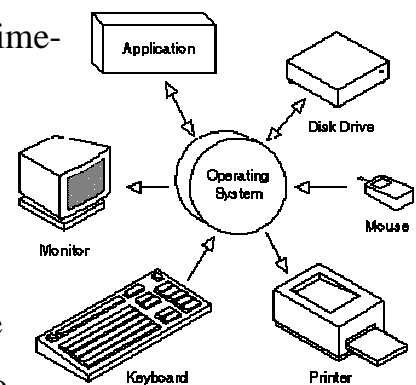
- Kernel and drivers
- Computer programs and software

**Note:** Kernel also known as Heart of an Operating system

**Kernel and drivers:** Kernel is a computer program that manages input/output requests from software and translates them into data processing instructions for the central processing unit and other electronic components of a computer. The kernel is a fundamental part of a modern computer's operating system. That's why **Kernel is called "Heart of an Operating System"**.

**Computer programs and Software:** When a computer program in this case called a *process* makes requests of the kernel, the request is called a system call. Various kernel designs differ in how they manage system calls (time-sharing) and resources.

**For example** kernel executes all the operating system instructions in the same address space to improve the performance of the system. A kernel runs most of the operating system's background process in user space to make the operating system more modular and, therefore, easier to maintain.



**Figure 1: General Block Diagram of Operating System**

## **Brief History of OS:**

Historically Operating Systems have been intimately related to the computer architecture, it is good idea to study the history of operating system from the architecture of the computers, up on which they run. Operating systems have evolved through a number of distinct phases or generations which corresponds roughly to the decades.

**The 1940's - First Generation:** The earliest electronic digital computers had no operating systems. Machines of the time were so primitive that programs were often entered one bit at a time on rows of mechanical switches (plug boards). Programming languages were unknown (not even assembly languages).

**The 1950's - Second Generation:** By the early 1950's, the routine had improved somewhat with the introduction of punch cards. **The General Motors Research Laboratories** implemented the first operating system called **GM-NAA I/O** in early 1950's for their **IBM 701**. **General Motors' Research** division produced **GM-NAA I/O General Motors and North American Aviation** Input/output for its **IBM 701** in 1956, **GM Operating System**, developed in 1955, and updated it for the 701's successor. In 1960, the **IBM** user association **SHARE** took it over and produced an updated version, **SHARE Operating System**. The system of the 50's generally ran one job at a time. These were called single-stream batch processing systems because programs and data were submitted in groups or batches.

**The 1960's - Third Generation:** The systems of the 1960's were also batch processing systems, but they were able to take better advantage of the computer's resources by running several jobs at once. So operating systems designers developed the concept of multiprogramming in which several jobs are in main memory at once; a processor is switched from job to job as needed to keep several jobs advancing while keeping the peripheral devices in use. The **“THE” multiprogramming system**

was a computer operating system designed by a team led by Edger W. Dijkstra, described in monographs in 1965-66 and published in 1968. Dijkstra never named the system; "THE" is simply the abbreviation of "Technische Hogeschool Eindhoven", then the name (in Dutch) of the Eindhoven University of Technology of the Netherlands. The THE system was primarily a batch system that supported multitasking; it was not designed as a multi-user operating system. It was much like the SDS 940, but "the set of processes in the THE system was static.

Another major feature in third-generation operating system was the technique called spooling (simultaneous peripheral operations on line). In spooling, a high-speed device like a disk interposed between a running program and a low-speed device involved with the program in input/output. Instead of writing directly to a printer, for example, outputs are written to the disk. Programs can run to completion faster, and other programs can be initiated sooner when the printer becomes available, the outputs may be printed.

**Fourth Generation:** With the development of LSI (Large Scale Integration) circuits chips, operating system entered in the personal computer and the workstation age. Microprocessor technology evolved to the point that it becomes possible to build desktop computers as powerful as the mainframes of the 1970s. Two operating systems have dominated the personal computer scene: **MS-DOS**, written by **Microsoft, Inc.** for the **IBM PC** and other machines using the **Intel 8088 CPU** and its successors, and **UNIX**, which is dominant on the large personal computers using the **Motorola 6899 CPU** family

## Types of Operating Systems

Operating systems usually come **preloaded** on any computer that you buy. Most people use the operating system that comes with their computer, but it is possible to upgrade or even change operating systems.

The most common operating systems for personal computers are **Microsoft Windows, Apple Mac OS X, UNIX, Linux** and **MS-DOS** is use widely.



Figure 2: The Windows, Mac OS X, and Linux logos

Modern operating systems use a **Graphical User Interface** or **GUI**. A GUI lets you use your mouse to click on **icons, buttons, and menus** and everything is clearly displayed on the screen using a combination of **graphics** and **text**.

Each operating system's GUI has a different look and feel, so if you switch to a different operating system it may seem unfamiliar at first. However, modern operating systems are designed to be **easy to use**, and most of the basic principles are the same.

### Rise of Windows GUI

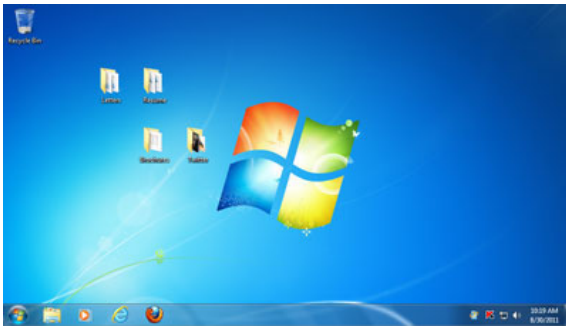
Before GUIs, computers had a **command-line interface**, which meant the user had to type every single command to the computer, and the computer would only display text.

**Example:** MS-DOS OS

### Microsoft Windows

Microsoft created the **Windows** operating system which is a series of graphical interface operating systems developed, marketed, and sold by Microsoft. Microsoft introduced an operating environment named **Windows** on November 20, 1985 as a graphical interest in graphical user interfaces (**GUI**). Microsoft Windows came to

dominate the world's personal computer market with over 90% market share, overtaking **Mac OS**, which had been introduced in 1984. Over the years, there have been many different versions of Windows, but the most recent ones are **Windows 8** (released in 2012), **Windows 7** (2009), and **Windows Vista** (2007). Windows comes **preloaded** on most new PCs, which helps to make it the **most popular operating system** in the world.



If you're buying a new computer or upgrading to a newer version of Windows, you can choose from several different **editions** of Windows, such as **Home Premium**, **Professional**, and **Ultimate**. You may need to do some research to decide which edition is right for you.

### Apple Mac OS X

**Mac OS** is a series of graphical user interface-based operating systems developed by **Apple Inc.** for their Macintosh line of computer systems. The original version was the integral and unnamed system software first introduced in 1984 with the original Macintosh, and referred to simply as the "System" software. The System was

renamed to Mac OS in 1996 with version 7.6. The System is credited with popularizing the graphical user interface concept. **Mac OS** is a line of operating systems created by Apple Inc. It comes preloaded on all new Macintosh computers or Macs. All of the recent versions are known as **Mac OS X** (pronounces as Mac O-S Ten) and their specific version names are **Mountain Lion** (released in 2012), **Lion** (2011), and **Snow Leopard** (2009).





Apple also offers a version called **Mac OS X Server**, which is designed to be run on servers.

According to Mac OS X users account for **7.5%** of the operating systems market as of January 2013 - much lower than the percentage of Windows users (over **90%**). One reason for this is that Apple computers tend to be more expensive. However, many people prefer the look and feel of Mac OS X.

### UNIX Operating System

**Unix** is a multitasking, multi-user computer operating system originally developed in 1969 by a group of AT&T employees at Bell Labs, including Ken Thompson, Dennis Ritchie, Brian Kernighan, Douglas McIlroy, Michael Lesk and Joe Ossanna. *UNIX* name derived from originally **Unics** stand for ***Uniplexed Information and Computing Service***. First developed in assembly language, by 1973 it had been almost entirely recoded in C, greatly facilitating its further development and porting to other hardware.

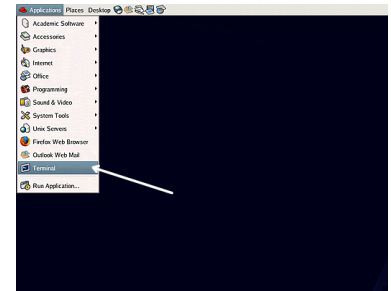
**UNIX** is a computer operating system - the base software that controls a computer system and its peripherals. In this sense, **UNIX** behaves in the same way that the perhaps more familiar **PC** operating systems **Windows** or **Mac OS** do. It provides the base mechanisms for booting a computer, logging in, running applications, storing and retrieving files, etc.

**UNIX** is an operating system which was first developed in the 1960s, and has been under constant development ever since. By operating system, we mean the suite of programs which make the computer work. It is a stable, multi-user, multi-tasking system for servers, desktops and laptops. **UNIX** systems also have a graphical user interface (**GUI**) similar to **Microsoft Windows** which provides an easy to use environment. However, knowledge of **UNIX** is required for operations which aren't

covered by a graphical program, or for when there is no windows interface available, for example, in a telnet session.

## Types of UNIX

Today, in addition to certified Unix systems such as those already mentioned, Unix-like operating systems such as **MINIX**, **Linux**, and BSD descendants (Free BSD, Net BSD, Open BSD, and Dragon Fly BSD) are commonly encountered. The term *traditional UNIX* may be used to describe an operating system that has the characteristics of either Version 7 Unix or UNIX System V. There are many different versions of **UNIX**, although they share common similarities. The most popular varieties of **UNIX** are **Sun Solaris**, **GNU/Linux**, and **Mac OS X**.



The UNIX operating system is made up of three parts; the kernel, the shell and the programs. To open an UNIX terminal window, click on the "Terminal" icon from Applications/Accessories menus.

## Linux Operating System

**Linux** (pronounces LINN-UX) is a family of **open source** operating systems, which means that they can be modified and distributed by anyone around the world. This is



very different from **proprietary software** like Windows, which can only be modified by the company that owns it (Microsoft). The advantages of Linux are that it is **free**, and there are many different **distributions** (or versions) that you can choose from. Each distribution has a different look



and feel, and the most popular ones include **Ubuntu**, **Mint**, and **Fedora**.

Linux is named after **Linus Torvalds**, who created the **Linux kernel** in 1991. The **kernel** is the computer code that is the central part of an operating system. According to Linux users account for less than **1%** of the operating systems market as of January 2013. However, it has occupied a huge market space when it comes to **Servers** as it is relatively easy to customize.

### MS-DOS Operating System:

MS-DOS, the acronym for Microsoft Disk Operating System, is an operating system with a command-line interface used on personal computers. DOS family of operating systems, and was the main operating system for IBM PC compatible personal computers during the 1980s to the mid-1990s, MS-DOS commands using a command prompt window. To end your MS-DOS session, type **exit** in the command prompt window at the blinking cursor.

The MS-DOS mode is a shell in which the MS-DOS environment is emulated in 32-bit systems, such as Windows. MS-DOS-based programs can run with Windows and might create a program information file (PIF) which

A screenshot of a black command prompt window with white text. The text shows the installation of CuteMouse v1.9.1 (DOS) at the PS/2 port, followed by the MS-DOS 7.10 prompt. The user enters 'command', and the prompt shows 'Microsoft(R) MS-DOS 7.1 (C)Copyright Microsoft Corp 1981-1999.' The user then enters '?', and the prompt displays 'MS-DOS 7.1 [Version 7.10.1999]'.

```
installed.  
CuteMouse v1.9.1 (DOS)  
Installed at PS/2 port  
Now you are in MS-DOS 7.10 prompt. Type 'HELP' for help.  
C:\>command  
Microsoft(R) MS-DOS 7.1  
(C)Copyright Microsoft Corp 1981-1999.  
C:\>uer /?  
Displays the MS-DOS version.  
UER  
C:\>uer  
MS-DOS 7.1 [Version 7.10.1999]  
C:\>
```

appears as a shortcut on your desktop with Open Command Prompt until it was gradually superseded by operating systems offering a **graphical user interface (GUI)**, in particular by various generations of the Microsoft Windows operating system.

MS-DOS grew out of a request placed by **IBM** in 1981 for an operating system to use in its IBM PC range of personal computers. Microsoft quickly bought the rights to **QDOS (Quick and Dirty Operating System)**, also known as **86-**

**DOS**, from Seattle Computer Products, and began work on modifying it to meet IBM's specification, who licensed and released it as PC DOS 1.0 to be used with their PCs in August 1981. Although MS-DOS and PC DOS were initially developed in parallel by Microsoft and IBM, years later the two products eventually went their separate ways.

### **Operating System can also be classified as:**

**Single User Systems:** These systems provide a platform for only one user at a time. They are popularly associated with Desk Top operating system which runs on standalone systems where no user accounts are required.

**Example:** MS-DOS OS

**Multi User Systems or Time Sharing Systems:** These systems provide regulated access for a number of users by maintaining a database of known users. Refer to computer systems that support two or more simultaneous users. Another term for multi-user is time sharing systems.

**Example:** Windows, UNIX, Linux Operating Systems.

### **Types of OS-based on Processing**

**Batch Processing System:** In this system, data or programs are collected grouped and processed at a later date.

**Example of Usage:** They are used in payroll, stock control and billing systems

**Example of Batch Processing OS:** Windows, Linux, UNIX.

**Real-time Systems:** In this kind of systems, inputs immediately affect the outputs. Timing is critical i.e. they are capable of influencing the source of the data e.g. control where data from sensors is processed immediately and affect the outputs - controlling some device. Timing is critical and the term real-time control system.

**Example of Use:** control of nuclear power plants, oil refining, chemical processing and traffic control systems, air.

**Example of Real Time OS:** Windows, UNIX and Linux are more popular RTOS (Real Time OS) because there's a ton of software utilities and support available for it.

**Real-time transaction:** Inputs immediately affect the outputs but timing is not critical. Each transaction is completed online as it arises. Ex. Booking systems - each booking is online and a database of bookings can be amended interactively and very quickly whilst another user is locked out so cannot double book or alter that record at the same time.

**Example of Use:** Holiday and airline booking system Real Time happens live and it means there's no turning back

**Example of RTT OS:** Windows, Linux, Unix OS's support this option.

## MODEL QUESTIONS

1. An **Operating System** acts as the \_\_\_\_\_ between the user and the computer hardware (**Mediator**)
2. Without an \_\_\_\_\_, a computer is useless (**Operating System**)
3. \_\_\_\_\_ Manages the computer's all resources (**Operating System**)
4. \_\_\_\_\_ is the primary process of Operating system's that occurs when you turn your computer on. (**Bootting**)
5. Kernel also called as a \_\_\_\_\_ of an Operating system (**Heart**)
6. Any OS instruction or command request is called as a \_\_\_\_\_ (**system call**)
7. OS programmes define as a \_\_\_\_\_ (**process**).
8. Kernel runs most of the operating system's \_\_\_\_\_ process. (**background**)

9. Operating systems have been tightly related to the\_\_\_\_\_ **(computer architecture)**.
10. First operating system called as \_\_\_\_\_in early 1950's. **(GM-NAA I/O)**
11. First operating system called GM-NAA I/O in early 1950's used for \_\_\_\_\_computer. **(IBM 701)**
12. First batch processing operating systems is \_\_\_\_\_. **(THE multiprogramming system)**
13. In starting days UNIX operating designed for \_\_\_\_\_ family which is dominant. **(Motorola 6899 CPU family)**
14. MS-DOS, written by Microsoft, Inc. for the IBM PC and other machines using the Intel\_\_\_\_\_. **(8088 CPU family)**

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