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Introduction to
Operating System

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Introduction to Operating System

Q1: What is Operating System?

Ans: An operating system acts as an intermediary between the user of a computer and the computer hardware.The purpose of an operating system is to provide an environment in which a user can execute programs in a convenient and efficient manner.

An operating system is software that manages the computer hardware.The hardware must provide appropriate mechanisms to ensure the correct operation of the computer system and to prevent user programs from interfacing with the proper operation of the system.

Q2: What are the components of a Computer System?

Ans:

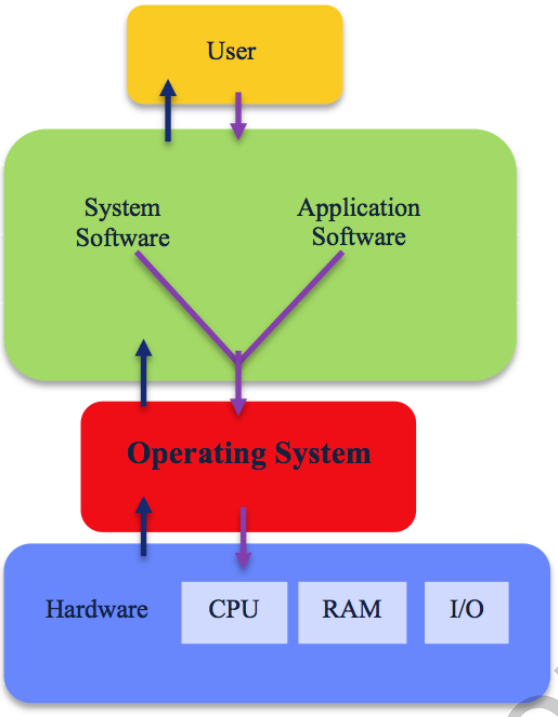
There are four components of Computer System:

- The hardware,
- The operating system,
- The application programs and
- The users

➔ The hardware- The central processing unit(CPU),the memory,and the input/output(I/O) devices- provides the basic computing resources for the system.

➔ The operating system controls the hardware and coordinates its use among the various application programs for the various users.

➔ The application programs-such as word processors, spreadsheets,compilers,and web browsers-define the ways in which these resources are used to solve user's computing problems.



(Figure 1.1: Abstract view of the components of a Computer System)

Q3: What is Kernel?

Ans: Operating system is the one program running at all times on the computer usually called the kernel.

The core component of the OS is known as a kernel. Kernel helps the OS manage the operations of the computer system and hardware, basically the memory and CPU time. It uses inter-process communication and system calls to act as a bridge between applications and data processing performed at hardware level.

Q4: What is System Booting?

Ans: The procedure of starting a computer by loading the kernel is known as booting the system.On most computer systems,a small piece of code known as the bootstrap program or bootstrap loader locates the kernel,loads it into main memory and starts its execution.Some computer systems,such as PCs,use a two-step process in which a simple bootstrap loader fetches a more complex boot program from disk,which in turn loads the kernel.

Q5: Discuss the Dual-Mode Operation.

Ans: The approach taken by most computer systems is to provide hardware support that allows us to differentiate among various modes of execution.

There are two modes of operation:

i)User mode and

ii) Kernel mode

A bit,called the mode-bit,is added to the hardware of the computer to indicate the current mode : Kernel(0) or user (1).

- When the computer system is executing on behalf of a user application,the system is in user mode.
- When a user application requests a service from the operating system (via a system call),it must transition from user to kernel mode to fulfill the request.

  At system boot time,the hardware starts in kernel mode.The operating system is then loaded and starts user application in user mode.Whenever a trap or interrupt occurs,the hardware switches from user mode to kernel mode.The system always switches to user mode (by setting the mode bit to 1) before passing control to user program.

  The dual mode of operation provides us with the means for protecting the operating system from errant users and errant users from one another.

Q6: What are the types of Operating System?

Ans:

Following are the types of Operating System:

i) Batch Operating System

ii) Multitasking/Time Sharing OS

iii) Multiprocessing OS

iv) Real Time OS

v) Distributed OS

vi) Network OS

vii) Mobile OS

i). Batch Operating System :

- Some computer processes are very lengthy and time-consuming. To speed the same process, a job with a similar type of needs are batched together and run as a group.

- The user of a batch operating system never directly interacts with the computer. In this type of OS, every user prepares his or her job on an offline device like a punch card and submits it to the computer operator.

ii)Multitasking/Time Sharing OS:

-Time-sharing enables many people, located at various terminals, to use a particular computer system at the same time.

- Multitasking or Time-Sharing Systems is a logical extension of multiprogramming. Processor's time is shared among multiple users simultaneously and is termed as time-sharing.

iii) Multiprocessing OS:

- A multiprocessing operating system (OS) is one in which two or more central processing units (CPUs) control the functions of the computer. Each CPU contains a copy of the OS, and these copies communicate with one another to coordinate operations.

-The use of multiple processors allows the computer to perform calculations faster, since tasks can be divided up between processors.

iv)Real Time OS:

-A Real Time Operating System, commonly known as an RTOS, is a software component that rapidly switches between tasks, giving the impression that multiple programs are being executed at the same time on a single processing core.

-Examples of the real-time operating systems: Airline traffic control systems, Command Control Systems, Airlines reservation system, Heart Pacemaker, Network Multimedia Systems, Robot etc.

v) Distributed OS:

-Multiple central processors are used by Distributed systems to serve multiple real-time applications and multiple users. Accordingly, Data processing jobs are distributed among the processors.

-Processors communicate with each other through various communication lines (like high-speed buses or telephone lines). These are known as loosely coupled systems or distributed systems.

vi)Network OS:

-Network Operating System is a computer operating system that facilitates the connection and communication of various autonomous computers over a network.

-The Network O.S. mainly runs on a powerful computer that runs the server program. It facilitates the security and capability of managing the data, user, group, application, and other network functionalities.

vii)Mobile OS:

-A mobile operating system is an operating system for mobile phones, tablets, smartwatches, 2-in-1 PCs, smart speakers, or other mobile devices.

-Mobile operating systems combine features of a personal computer operating system with other features useful for mobile or handheld use, and usually including a wireless inbuilt modem and SIM tray for telephony and data connection.

Q7: Discuss the functions of the Operating System.

Ans:

Functions of the operating system:

i) Memory Management

ii)Processor Management/Scheduling

iii) Device Management

iv) File Management

v)Security

vi)Accounting

vii)Other functions

i)Memory Management: It is the management of the main or primary memory. Whatever program is executed, it has to be present in the main memory. Therefore, there can be more than one program present at a time. Hence, it is required to manage the memory.

ii)Processor Management/Scheduling: When more than one process runs on the system the OS decides how and when a process will use the CPU. Hence, the name is also CPU Scheduling.

iii)Device Management: Device management in an operating system means controlling the Input/Output devices like disk, microphone, keyboard, printer, magnetic tape, USB ports, camcorder, scanner, other accessories, and supporting units like supporting units control channels. A process may require various resources, including main memory, file access, and access to disk drives, and others. If resources are available, they could be allocated, and control returned to the CPU. Otherwise, the procedure would have to be postponed until adequate resources become available.

iv)File Management: A file management system is used for file maintenance (or management) operations. It is a type of software that manages data files in a computer system.A file management system has limited capabilities and is designed to manage individual or group files, such as special office documents and records. It may display report details, like owner, creation date, state of completion and similar features useful in an office environment.A file management system is also known as a file manager.

v)Security: The term operating system (OS) security refers to practices and measures that can ensure the confidentiality, integrity, and availability (CIA) of operating systems. The goal of OS security is to protect the OS from various threats, including malicious software such as worms, trojans and other viruses, misconfigurations, and remote intrusions.

vi)Accounting: As the operating system keeps track of all the functions of a computer system. Hence, it makes a record of all the activities taking place on the system. It has an account of all the information about the memory, resources, errors, etc. Therefore, this information can be used as and when required.

vii)Other functions: Some other functions of the OS can be:

- Error detection.
- keeping a record of system performance.
- Communication between different software etc.

Q8: Define System calls. What are the categories of System calls?

Ans: A system call is a routine that allows a user application to request actions that require special privileges. Adding system calls is one of several ways to extend the functions provided by the kernel.

Followings are the main categories of System calls:

i) Process Control: A running program needs to be able to stop execution either normally or abnormally. When execution is stopped abnormally, often a dump of memory is taken and can be examined with a debugger.

ii) File Management: Some common system calls are create, delete, read, write, reposition, or close. Also, there is a need to determine the file attributes – get and set file attributes. Many times the OS provides an API to make these system calls.

iii)Device Management: Processes usually require several resources to execute, if these resources are available, they will be granted and control returned to the user process. These resources are also thought of as devices. Some are physical, such as a video card, and others are abstract, such as a file.

User programs request the device, and when finished they release the device. Similar to files, we can read, write, and reposition the device.

iv)Information Management: Some system calls exist purely for transferring information between the user program and the operating system. An example of this is time, or date.

The OS also keeps information about all its processes and provides system calls to report this information.

v)Communication: There are two models of interprocess communication, the message-passing model and the shared memory model.

- Message-passing uses a common mailbox to pass messages between processes.
- Shared memory uses certain system calls to create and gain access to create and gain access to regions of memory owned by other processes. The two processes exchange information by reading and writing in the shared data.

Q9: What is User interface? What are the types of user interface?

Ans: A user interface (UI) refers to the part of an operating system, program, or device that allows a user to enter and receive information. A text-based user interface displays text, and its commands are usually typed on a command line using a keyboard. With a graphical user interface,the functions are carried out by clicking or moving buttons, icons and menus by means of a pointing device.

Types of user interface:

- **Form-based user interface:** Used to enter data into a program or application by offering a limited selection of choices. For example, a settings menu on a device is form-based.
- **Graphical user interface:** A tactile UI input with a visual UI output (keyboard and monitor).
- **Menu-driven user interface:** A UI that uses a list of choices to navigate within a program or website. For example, ATMs use menu-driven UIs and are easy for anyone to use.
- **Touch user interface:** User interface through haptics or touch. Most smartphones, tablets and any device that operates using a touch screen use haptic input.
- **Voice user interface:** Interactions between humans and machines using auditory commands. Examples include virtual assistant devices, talk-to-text, GPS and much more.
