OSY - Notes


V2V EDTECH LLP
Online Coaching at an Affordable Price.
OUR SERVICES:
• Diploma in All Branches, All Subjects
• Degree in All Branches, All Subjects
• BSCIT / CS
• Professional Courses
+91 93260 50669
V2V EdTech LLP
v2vedtech.com
v2vedtech

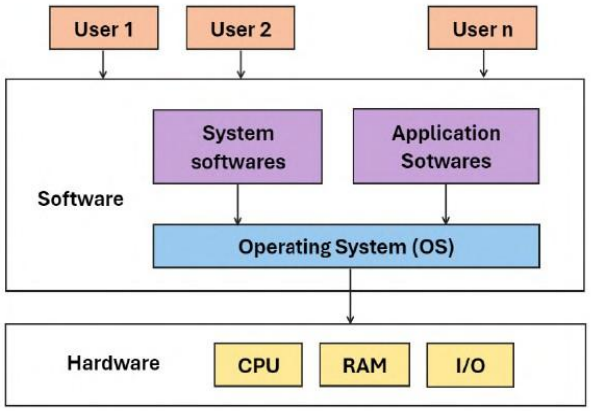
UNIT 1 - Operating System services and components

➢ 1.1 Operating System :

• Concept of Operating System :

Q. Explain the concept of an Operating System .

An operating system (OS) is the most essential system software that manages the operations of a Computer. Without on operating operating system, it is not possible to use the computer. An operating system (OS) containing instructions (set of programs) that work together to co-ordinate all the activities among computer hardware resources. An operating system is an intermediary between user and the computer hardware. The purpose of an operating System is to provide on environment in which a user may execute program.



Interaction among Hardware, OS, Sotware and Users

- **User:**

  This is the human interacting with the computer system. The user provides input and receives output. They are at the top of the hierarchy.

- **Application Software:**

  These are programs designed to perform specific tasks for the user. They are what the user directly interacts with to achieve a goal.

- **System Software:**

  This acts as an intermediary between the application software and the operating system. It includes utilities, language translators (like compilers), and device drivers that help run the computer and its applications.

- **Operating System (OS):**

  This is the core software that manages all the computer's hardware and software resources. It provides a platform for application software to run and handles fundamental tasks like memory management, process scheduling, and input/output operations.

- **Hardware:**

  These are the physical components of the computer system. They are the actual electronic circuits and devices that perform computations and store data.

  Example:

  - **CPU (Central Processing Unit):** The "brain" of the computer that executes instructions.
  - **RAM (Random Access Memory):** Volatile memory used for temporary storage of data and programs currently being used.
  - **I/O (Input/Output Devices):** Devices that allow the computer to interact with the outside world (e.g., keyboard, mouse, monitor, printer, speakers).

Following are the objectives of OS:

Q. What are the different objectives of an operating system ?

i] Convenience

ii] Efficiency

iii] Ability to Evolve

i] Convenience:

An Operating System makes a computer more convenient to use.

ii] Efficiency:

An operating system allows the computer system resources to be used in an efficient manner.

iii] Ability to Evolve:

An operating system should be constructed in such a way as to permit the effective development, testing, executing and introduction of new system functions without interfacing with service.

- **Functions of Operating System :**

Q. Explain different functions of operating system.

1) Memory Management:

An operating system deals with the allocation of main memory and other storage areas to the system programs as well as user programs and data.

2) Processor Management:

An operating system deals with the assignment of processors to different tasks being performed by the computer system

3) Device Management:

An operating system deals with the co-ordination and assignment of the different output and input device white one or more programs are being executed

4) File Management

An operating system deals with the storage of file of various storage devices to another. It also allows all files to be easily changed and modified through the use of text editors or some other files manipulation routines.

5) Error Detection Aids:

Production of dumps, traces, error messages and other debugging and error detecting aids.

6) security:

By means of password and similar other techniques, preventing unauthorized access to programs and data.

7) Control over system performance:

An OS performs recording delays between request for a service and response from the system.

8) co-ordination between other software and Users:

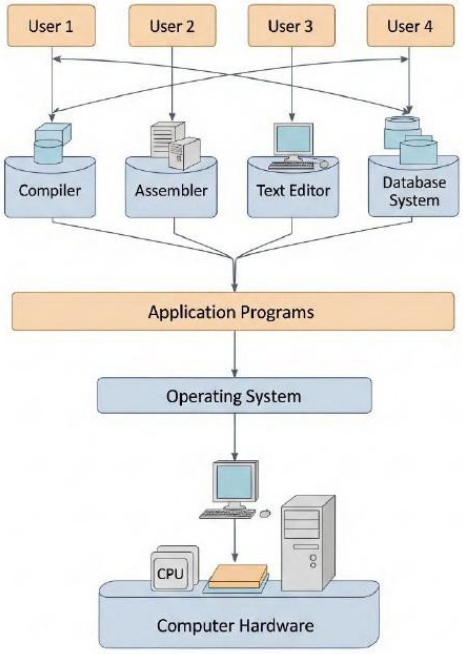
Co-ordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

9) Job Accounting

An OS keeping the track of time resources used by various jobs and users.

- **Computer system :**

Q. Explain Computer operating system and it's components .



A computer system is a collection of hardware and software components. Hardware refers to the physical computing equipment. Software refers to the programs written to provide services to the users of the system.

A computer system can be divided roughly into four component namely :

i. Hardware
ii. Operating system
iii. Application programs
iv. Users

Following are the components of computer system :

1. Hardware:

Hardware is physical parts of machine which provides basic computing resources. The hardware devices are central processing unit (CPU), memory, input devices, networking devices and devices like motherboard, power supply, DVD writer etc.

2. Operating System:

An operating system is a software program that enables the computer hardware to communicate and operate with the computer software. Without a computer operating system, a computer and software programs would be useless. Examples of computer operating systems are Microsoft Windows 7/8/10, Apple Mac-os, Ubuntu Linux, Google Android, iOS and so on.

3. Application Programs:

Word processors, spreadsheets, compilers, web browsers, database systems, video games etc., are examples of application programs. Application programs are the programs that define the way in which these resources are used to solve the computing problem of the users.

4. Users:

On the basis of the role of the users, they can be categorized as:

- Programmers
- Operational Users
- End Users

Generations of operating system :

Q. What are the different generations of operating system ?

* The 1940's - First Generations
* The 1950's - Second Generation
* The 1960's - Third Generation
* The 1980's - Fourth Generation

1. First generation 1945 – 1955:

The earliest electronic digital computers has no operating System. Machines of that time were so primitive that programs were often entered one bit at time on rows of mechanical switches (plug boards). Programming languages were unknown (not even assembly languages).

2. Second generation 1955 - 1965:

In second generation there is the introduction of punch card. The General Motors Research laboratories implemented the first operating systems in early 1950's for their IBM 701. The system of the 80's generally run one job at a time. These were called single-stream batch processing systems because program and data were submitted in group of batches.

3. Third generation 1960-1980:

The system of the 1960's were also batch processing system, 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.

4. Fourth generation 1980:

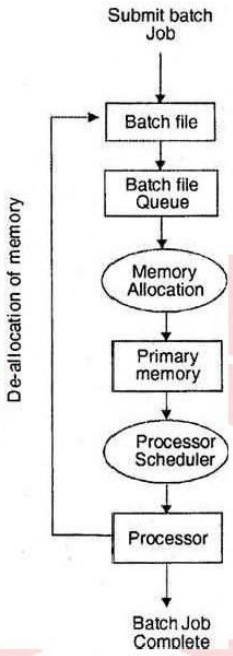
With the development of LSI (Large Scale Integration) circuits, chips, operating system entered in the system entered in the personal computer and the workstations. Microprocessor technology evolved to the point that it becomes possible to build desktop computers as powerful as the mainframes of the 1970's.

➢ 1.2 Different types of Operating System :

Q. Enlist / List types of operating system . (W-19, S-24)

1. Batch
2. Multi-programmed
3. Time Shared
4. Multiprocessor System
5. Distributed System
6. Real Time System
7. Mobile OS (Android OS)
8. Multitasking
9. Serial processing

- **Batch Operating System :**



Batch Operating System

In batch operating system, jobs with similar need batched together by operator and run as a computer system. A job is predefined sequence of commands, programs and data that are combined in to a single unit. Memory management in batch system is very simple. Memory is usually divided into two areas namely, operating system and user program area. With the use of this type of operating system, the user no longer has direct access to the machine, rather the user submits the job on cards or tape to a computer operator, who batches the jobs together sequentially and places the entire batch on an input device for use by the monitor.

Advantages of Batch OS:

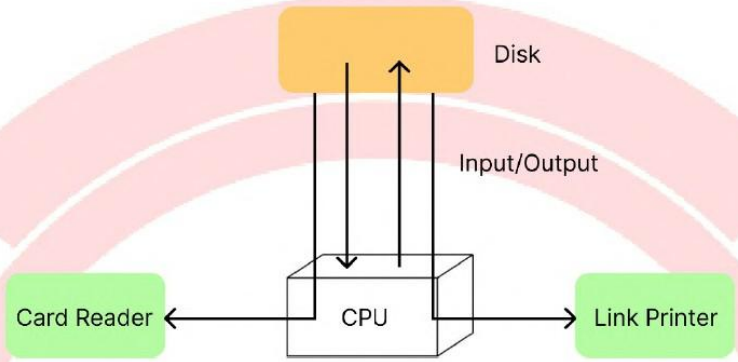
- Increase performance since it was possible for job to start as soon as the previous job finished.
- In batch OS huge amount of a data can be processed efficiently.

Disadvantages of Batch OS:

- As monitor needs to be in main memory, it results in certain wastage of memory.
- Program having large I/O operation wasted huge amount of CPU time.
- Difficult to debug program.
- No interaction is possible with the user while the program is being executed.

Concept of SPOOLing :

Spooling (Simultaneous Peripheral Operations On-Line) is a technique used by operating systems to handle the differences in speed between the CPU and I/O devices. When a job needs to use a peripheral device (like a printer or card reader), the data for that job is first stored on a faster device, typically a hard disk, acting as a large buffer. This process allows the CPU to continue working on other tasks without waiting for the slower I/O device to complete its operation.



How Spooling Works:

- **Buffering:** When a job requires an output, such as printing, the data is written into a system buffer on the disk. This buffer is essentially a temporary storage area.
- **Decoupling:** Once the data is in the buffer, the job is considered complete from the CPU's perspective, and the CPU is freed up to process other tasks.
- **Background Processing:** A separate process, often referred to as a "spooler," then handles the actual transfer of data from the buffer to the slow output device (e.g., the printer) in the background. Similarly, for input, data from a card reader is first read into a disk buffer, and then the CPU can access it from there.

Advantages of SPOOLing :

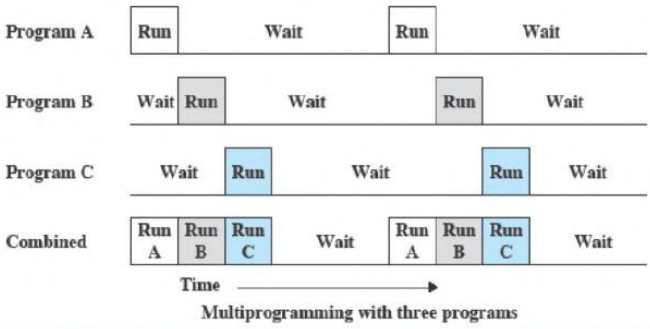
- Uses disk as a very large buffer.
- Improves I/O operation for jobs with processor operations.

Disadvantages of SPOOLing:

- Extra overhead due to maintaining tables of card images.
- Risk of wear on the magnetic tape and the tape itself if the disk and CPU access it frequently.

- **Muti-programmed Operating System :**

Q. Explain multiprogramming operating system in detail. (W-19)



Multiprogramming with three programs

In multiprogramming, more than one program lies in the memory. The shedular selects the job to be placed in ready queue from a number of programs. The ready queue is placed in memory and the existence of more than one program in main memory is known as multiprogramming. Since there is only one processor, there multiple programs cannot be executed at a time. Instead, the operating system executes part of one program, then the part of another and so on.

Advantages of Multiprogramming OS:

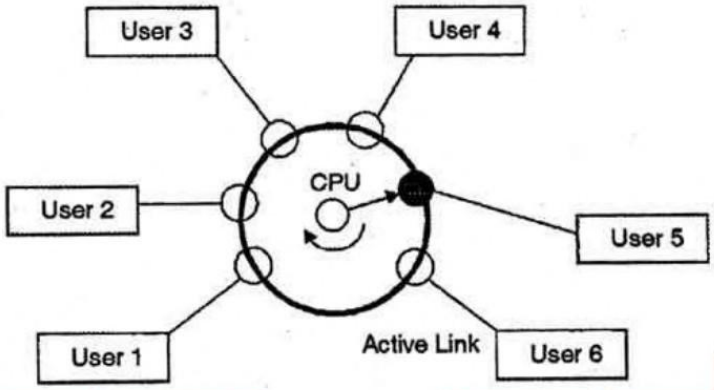
- CPU is used efficiently without sitting idle.
- System handles more jobs in less time.
- Memory is shared and used effectively.

Disadvantages of Multiprogramming OS:

- Programs may face security issues.
- Some tasks get delayed due to sharing.
- Debugging becomes difficult.

- **Time Shared Operating System :**

Q. Describe working of time sharing system with neat diagram. (S-22, W-22)



The main idea of time sharing Systems is to allow a large number of users to interact with a single computer (System) concurrently. A time sharing System is one that allows a number of different users to share the single computer System for a variety of applications at the time. In other words a time - sharing System is basically a multiprogramming, multitasking and multi-user environment of a large computer System. In time sharing a small time slots are available for each user. This short period of time during that a user gets attention of the CPU (known as a time slice or a quantum). The time allowed is extremely small and the users are given the impression that each of them has their own CPU and they are the sole owner of the CPU.

Advantages of time sharing System:

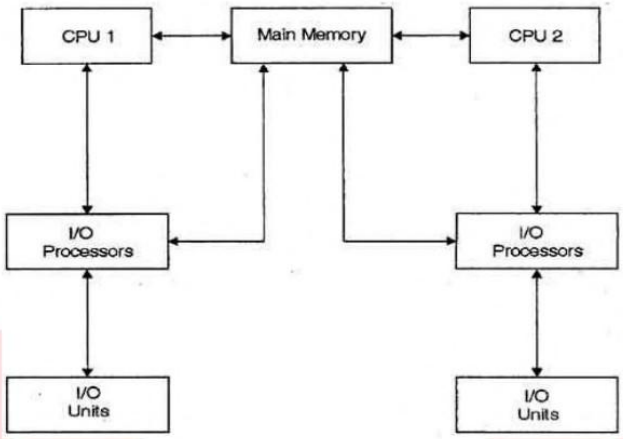
- Efficient CPU utilization.
- A time shared operating system uses CPU scheduling and multi programming to provide each user with a small portion of a time shared computer.
- Time-sharing OS may be more cost-effective for businesses because they permit multiple users to use they System without needing to purchase individual license.

Disadvantages of time sharing System.

- The time-shared Systems are more complex than the multi-programming Systems.
- In time-shared systems multiple processes are managed simultaneously which requires an adequate management of main memory so that the processes can be swapped in or swapped out within a short time.
- Time-sharing operating systems may have data security and integrity issues with user programs and data.

- **Multiprocessor Operating System :**

Q. Describe multiprocessor OS with it's advantages. (any two) (S-22, S-23, W-23)



Multiprocessing is the use of two or more Central Processing Units (CPUs) within a single computer system. The term multiprocessing also refers to the ability of a system to support more than one processor and/or the ability to allocate tasks between them. Multiprocessor System means more than one processor in close communication. All the processors share common bus, clock, memory and peripheral devices. Multiprocessor system is also called Parallel Systems. These types of systems are used when very high speed is required to process a large volume of data. These systems are generally used in environment like satellite control, weather forecasting etc.

Advantages of Multiprocessor Systems:

- It increased throughput by increasing the number of processors, more work done in a shorter period of time.
- Multiprocessors can also save money (cost) compared to multiple single systems
- These systems provides higher performance due to parallel processing.
- It increases reliability, as failure of one processor will not halt the system.

Disadvantages of Multiprocessor Systems:

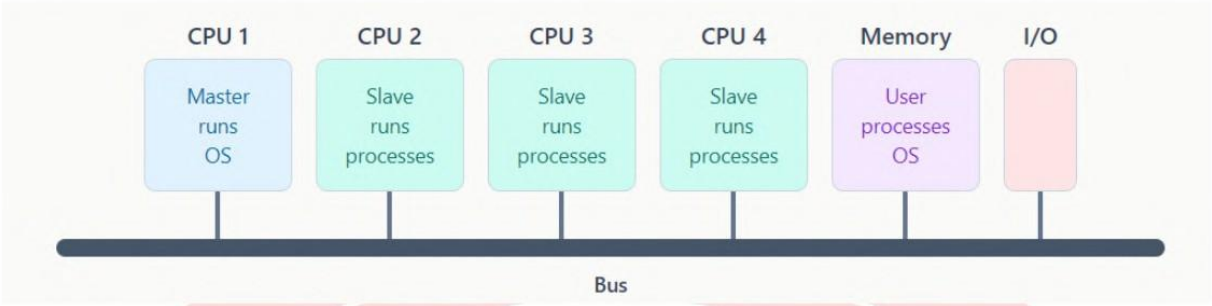
- If one processor fails then it will affect in the speed.
- Multiprocessor systems are expensive.
- Complex OS is required.
- Large main memory required.

Types of Multiprocessor Systems:

a. Asymmetric Multiprocessing

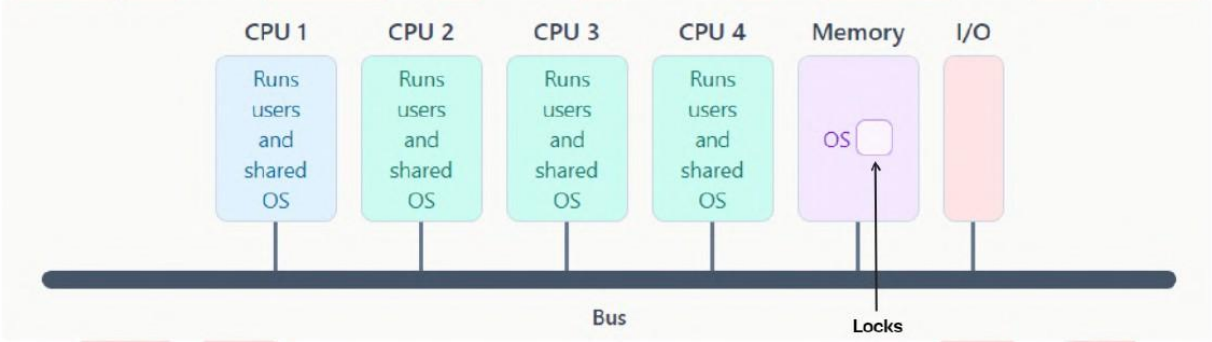
b. Symmetric Multiprocessing

a. Asymmetric Multiprocessing



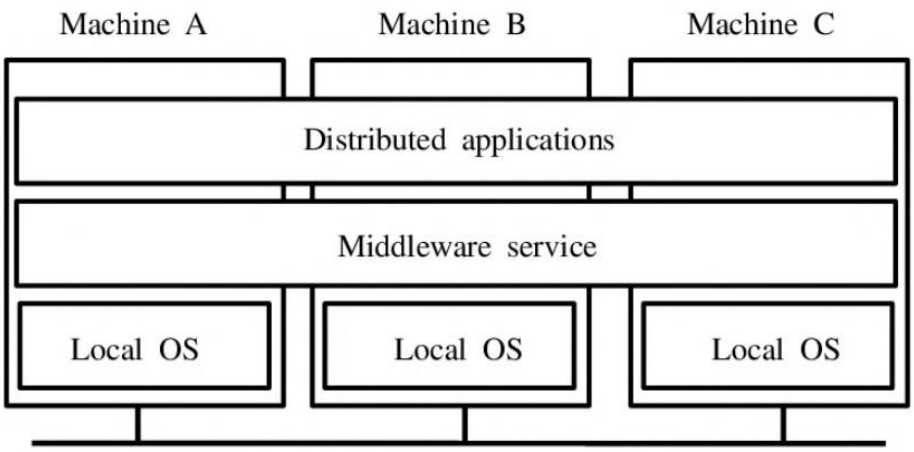
In this system, a specific task is assigned to each processor. The system has one master processor and others are slave processors. A master processor controls the System and slave processors follow the instructions of master or perform their predesigned task.

b. Symmetric Multiprocessing



In symmetric multiprocessing, there is no master-slave concept used. All the processors are peer processors. They perform all tasks within the operating system. The benefit of symmetric multiprocessing model is that many processes can run simultaneously.

- **Distributed Operating System :**



An operating system that manages a group of independent computers & makes them appear to be single computer is known as a distributed system. In this system the processors do not share memory or a clock; instead each processor has its own local memory, and clock. In such system, if one machine or site fails the remaining sites can continue operation, so these types of systems are the reliable systems. The processors communicate with one another through various communication lines, such as high speed buses or telephone lines. Distributed systems are also known as loosely coupled systems. In distributed system the middleware enable computers to coordinate their activities and to share the resources of the system.

Advantages of Distributed Systems:

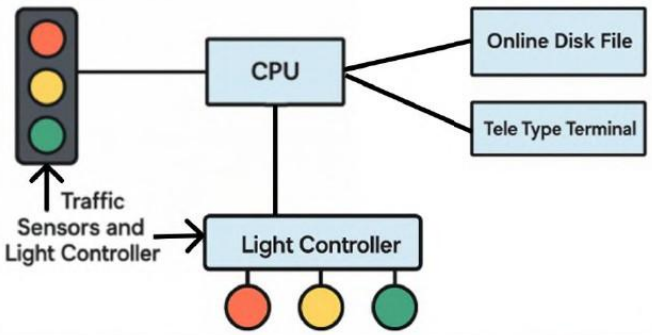
- It is more reliable than a single system. If one machine from system crashes the rest of the computer's remain unaffected.
- In distributed computing the computer power can be added in small increments.
- Distributed system is very flexible as it is very easy to install, implement and debug new services.

Disadvantages of Distributed System:

- In distributed system it is difficult to troubleshooting and diagnosing problems.
- Distributed operating system is less secure. The sharing of data creates the problem of data security.
- Distributed systems are more complex than centralized systems.
- In distributed system more effort required for system management.

- **Real Time Operating System (RTOS) :**

Q. Define real time operating system and its types. List its any four applications of it. (W-19, S-23, W-23)



A real time operating system has well defined fixed time constraints. Processing should be done within the defined constraints. The real time operating system used for a real-time application means for those applications where data processing should be done in the fixed and small quantum of time.

Types of Real Time Operating System:

- Hard real-time operating system
- Soft real-time operating system

Hard Real-time operating Systems

Hard real-time system guarantees that critical task complete on time. In hard real-time systems, secondary storage is limited or missing and the data is started in ROM. In these systems, virtual memory is almost never found.

Examples of hard real-time operating system are:

- Flight control system
- Missile guidance system
- weapons defence System
- Autopilot system in plane.

Soft real-time operating System

Soft real-time systems are less restrictive. A critical real-time task gets priority over other tasks and retain the priority until it completes. Soft real-time system have limited utility than hard real-time systems.

Examples of soft-real time operating system are :

- Personal Computer
- Multimedia system
- Web browsing

- Mobile communication

Advantages of real time operating system:

- A real-time OS gives a quick response.
- It schedules tasks on time.
- It uses system resources well.
- It can run many tasks at once.

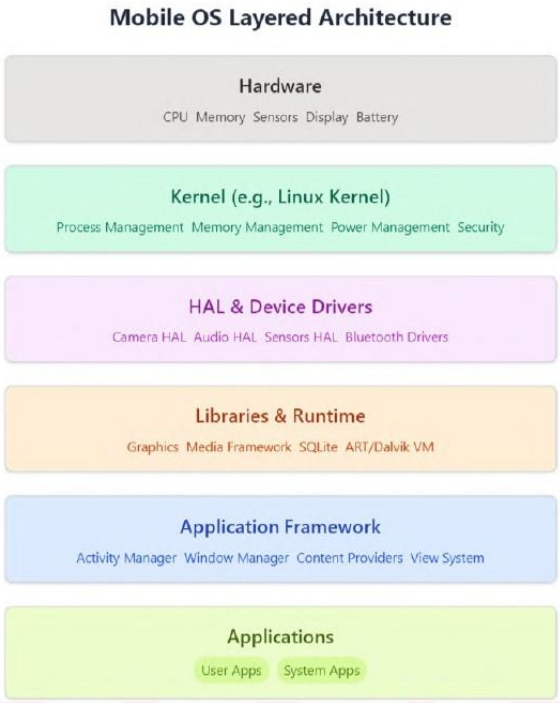
Disadvantages of real time operating system:

- It is hard to design.
- It can't handle too many tasks.
- It may need special hardware.

Applications:

- Flight Control System
- Simulations
- Industrial Control
- Military applications.
- Defence application system like RADAR
- Missile guidance system
- Network and Multimedia System
- Medical critical care System.

- **Mobile (Android) Operating System :**



A **mobile operating system** is software that manages all functions of a mobile device, such as a smartphone, tablet, or PDA (Personal Digital Assistant). It controls the hardware and enables other apps to run, just like Windows or macOS does on a computer. Mobile OS also handles features like touch screen gestures, camera access, Wi-Fi, Bluetooth, GPS, and more. These systems are designed to be lightweight and power-efficient compared to desktop operating systems. As mobile devices became more popular, many companies started developing their own mobile OS to stay competitive in the tech market.

Types of Mobile Operating Systems:

1. Android (by Google)

Android is developed by Google and is based on the Linux kernel. It is the most widely used mobile OS and supports a wide range of devices. Android apps are mainly built using Java or Kotlin and are available through stores like Google Play. It allows a high level of customization and supports widgets, multitasking, and voice commands.

Advantages:

- Open source and free.
- Easy to customize.
- Supports multitasking.
- Good stability and security.

Disadvantages:

- Some apps are of low quality.
- Can slow down with too many apps.
- Less secure if apps are installed from unknown sources.
- More complex and time-consuming to develop apps.

2. iOS (by Apple)

iOS is Apple's mobile OS for iPhone, iPad, and iPod Touch. It is known for its smooth performance, strong security, and clean design. Apps are built using Swift or Objective-C and are only available through the Apple App Store. iOS supports gestures like swipe, tap, and pinch.

Advantages:

- High security.
- Great performance.
- Good customer support.
- Many apps available.

Disadvantages:

- Only works on Apple devices.
- Not open source.
- App development is expensive.
- Less customizable.

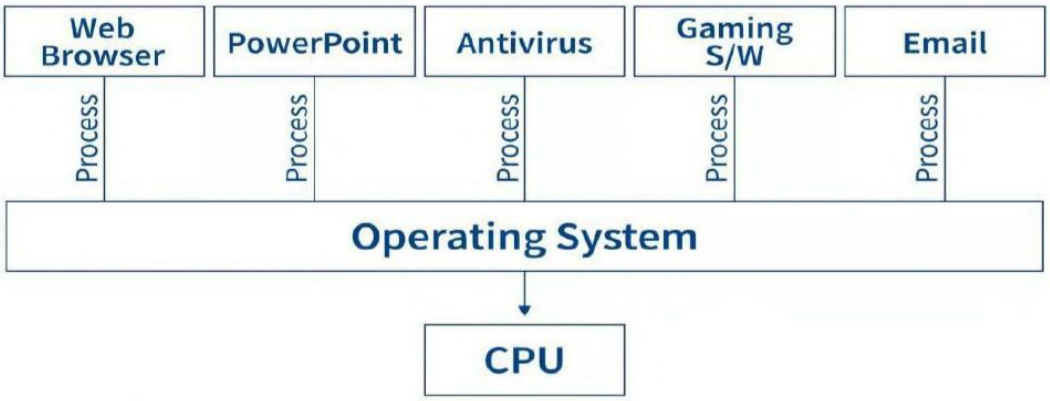
3. Windows Mobile (by Microsoft)

Windows Mobile was developed by Microsoft for smartphones. It included apps like Internet Explorer and Office Mobile. It was used mainly in business devices but is now discontinued and replaced by Windows Phone, which also ended support.

4. Symbian (Originally by Symbian Ltd., later Nokia)

Symbian was once a leading mobile OS used mainly in Nokia phones. It supported many programming languages and had good multitasking. It was the first to use a WebKit browser. However, it lost popularity with the rise of Android and iOS and is no longer used.

- **Multitasking Operating System :**



A CPU handling multiple tasks at a time is known as multitasking. A multitasking operating system can handle multiple tasks together by applying multiprogramming technique. Multitasking operating system is also known as multi-process operating system. Multitasking is the ability to support two or more active processes. In multitasking, only one CPU is involved, but it switches from one program to another so quickly that it gives the appearance of executing all of the programs at the same time. Multitasking is, on single processor machine, implemented by letting the running process own the CPU for a while (a time slice) and when required gets replaced with another process, which then owns the CPU.

Advantages of Multitasking OS:

- Multitasking helps in increasing the overall productivity of the user by performing a number of tasks at the same time.
- It helps in increasing the overall performance of the computer system.

Disadvantages of Multitasking OS:

- It requires more system resources. For example, a large amount of memory is required to execute several programs at the same time.
- For performing multiple tasks at a single time in multitasking, the CPU speed must be very high.

- **Serial processing Operating System :**

The serial processing operating systems are those which performs all the instructions into a sequence manners or the instructions those are given by the user will be executed by using the FIFO manner means first

in first out. For running the instructions the program counter is used which is used for executing all the instructions. In this the program counter will determines which instruction is going to execute and the which instruction will be execute after this. In this all the jobs are firstly prepared and stored on the card and after that card will be entered in the system and after that all the instructions will be executed one by one. But the main problem is that a user does not interact with the system while he is working on the system, means the user can't be able to enter the data for execution.

Advantages of Serial Processing OS:

- Very simple in operation.
- Although, machine dependent, but still gave rise to development of new interfacing software so as to make the programmer's task easier.

Disadvantages of Serial Processing OS:

- The process of development and preparation of a program in such an environment is slow.
- Poor utilization of resources.

Classify Operating System.

Q. Enlist types of operating system / classify operating system. (W-19, S-24)

The operating system is classified in following different types.

1. Single-user, Single-tasking OS
2. Single-user, Multi-tasking OS
3. Multi-user, Multi-tasking OS
4. Real Time Operating System (RTOS)
5. Distributed Operating System
6. Time sharing OS
7. Multi-programming OS
8. Multi-processing OS
9. Batch-processing OS
10. Multi-tasking OS
11. Multi-threading OS
12. Network Operating System (NOS)
13. Embedded OS
14. Real Time OS
15. Mobile Operating System

1) Single - user, Single - tasking OS :

As the name implies, this operating system is designed to manage the computer so that one user can effectively do one thing at a time. The palm OS for palm handheld computers is a good example of a modern Single-user, Single-task operating System. Another examples include MS-Dos and windows OS.

2) Single-user, Multi-tasking OS.

This type of OS which allows a single user to execute two or more tasks at a time. Single-user, multi-tasking is the type of operating system most people use on their desktop and laptop computers today. Both windows 98 and the macintosh OS are the examples of single-user, multi-tasking OS.

3) Multi-user, Multi-tasking OS:

A multi-user operating system allows many different users to take advantage of the computer's resources simultaneously. UNIX, Linux, VMS (Virtual Memory System) are examples of Multi-user, Multi-tasking OS.

3) Real Time Operating System:

A real time operating system has well defined fixed time constraints. The real time operating system used for a real-time application means for those applications where data processing should be done in the fixed and small quantum of time. Examples of real time operating system are flight control system, simulations, industrial control and military applications etc.

Difference Between Multiprogramming and Multitasking

Q. Differentiate between Multi programmed and Multitasking operating system (Any two points) (W-22)

Multiprogramming	Multitasking
Multiprogramming is the capacity to run or handle several programs at the same time.	Multitasking is the ability of a computer to handle a number of tasks or jobs simultaneously.
It is impossible for CPU to run more than one program at the same time.	It is possible for the CPU to run more than one task at the same time.
Based on context switching mechanism.	Based on the time-sharing mechanism and context sharing mechanism.
In multiprogramming a user cannot interact with the system.	In multitasking a user can interact with the system.

It takes maximum time to execute the process.	It takes minimum time to execute the process.
For example, Let's say there are two programs waiting in the pool to be executed by the CPU. The OS picks the first program. If it has I/O operations, it puts this program in the queue and picks the second program and executes it. Meanwhile, the first program receives its input. Since the working of the OS and CPU will be fast, it looks as if both programs are executed simultaneously.	For example, Let's say you are printing a document of 100 pages, while your computer is performing that. You can still do other jobs like typing a new document. So, more than one task is performed.
In multiprogramming there is more CPU idle time as compared to multitasking.	In multitasking there is less CPU idle time as compared to multiprogramming.

Difference Between Time Sharing System and Real Time System

Q. Difference between Time sharing system and Real time system (any 2 points) (S-23)

Time Sharing System	Real Time System
In a time-sharing system, fixed time is given to each process, and all processes are arranged in a queue.	In a real-time system, a job has to be completed within a fixed deadline (time allowed).
It requires a more complicated CPU scheduling algorithm.	A real-time system has well-defined, fixed time constraints.
If a job is not completed within the given time, it jumps to the next job, leaving the previous job unfinished. After processing each job, it again gives the same time for the unfinished job.	If a job is not completed within the given time, the system may extend time for doing the operations.
Response time is not important.	Response time is important.
Process deals with more than one application simultaneously.	Process deals with a single application at a time.
Emphasis is on providing a quick response to a request.	It focuses on accomplishing a computational task before its specified deadline.

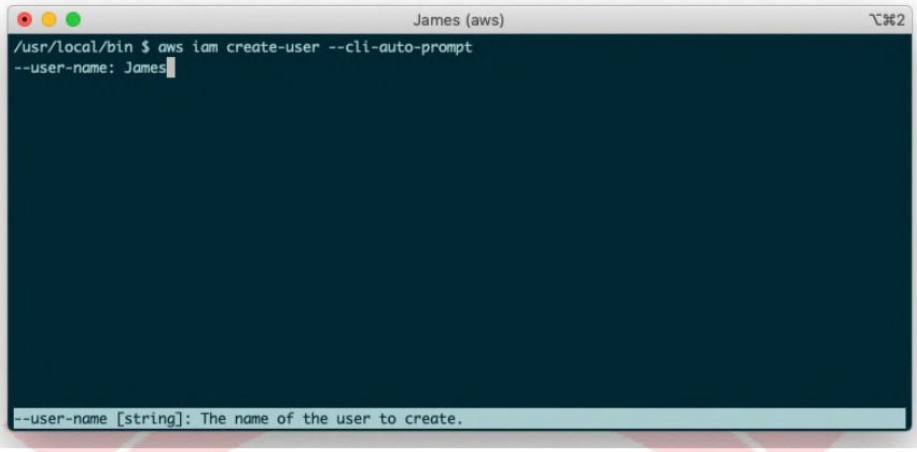
Difference between Time Sharing OS and Multiprogramming OS

Q. Compare between Time sharing operating system and multiprogramming operative system. (S-24)

Time Sharing OS	Multiprogramming OS
Time sharing OS system is more complex than multiprogramming OS.	Multiprogramming OS is less complex than Time Sharing OS.
In Time Sharing OS users can interact with system.	In Multiprogramming OS uses central interact with system.
It takes maximum time to execute a process.	It takes minimum time to execute a process.
Multiple processes can be executed simultaneously by using time slot.	Only a single process can be executed at a time.
Time sharing OS has fixed time slice.	Multiprogramming OS has no fixed time slice.
Time sharing system minimizes response time.	Multiprogramming OS has no maximize response time.
Example : Windows NT	Example : Mac OS

➢ 1.3 Command line, GUI based Operating System :

- **Command line Operating System :**



In CLI the user interacts with the operating system by typing commands/instructions on a command line. Various commands need to be typed for carrying out various jobs like creating, deleting, editing, renaming or printing a file. Usually in CLI each command represents an executable program, which is run when the command is typed with the proper parameters.

Advantages Command Line Interface (CLI):

1. If the user knows the correct commands then this type of interface can be much faster than any other type of interface.
2. This type of interface needs much less memory (Random Access Memory (RAM)) in order to use compared to other types of user interfaces.
3. CLI does not use as much CPU processing time as other UIs.

Disadvantages Command Line Interface (CLI):

1. CLI are not user-friendly because they require the user to remember a lot of commands.
2. Commands have to be typed precisely/correctly. If there is a spelling mistake then the command will not respond or fail or causes error.

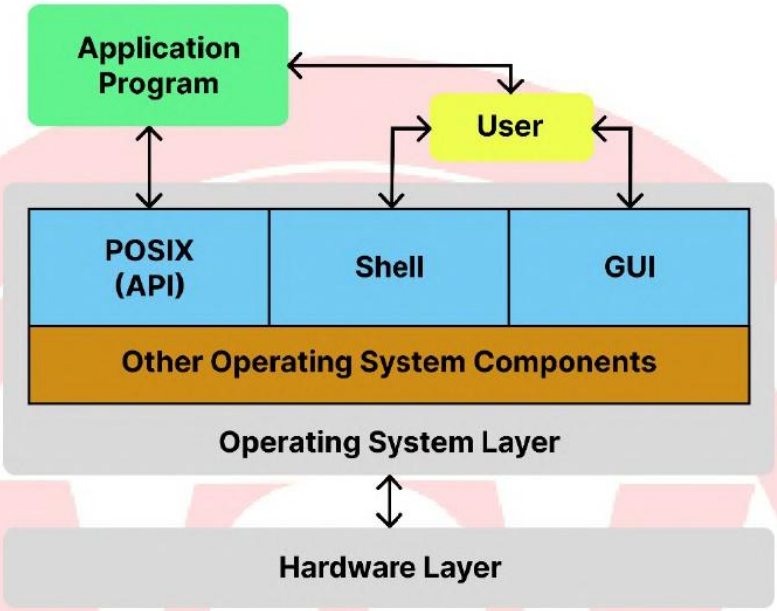
Types of CLI :

1. MS – DOS
2. UNIX

1. MS – DOS :

MS-DOS stands for Microsoft disk operating system. MS-DOS OS does not take much space for installation (about 8MB). MS-DOS OS give more control of the processes as it has a command line user interface. MS-DOS OS is a single user, single tasking operating system and not support graphics. It is not compatible with current browsers and the internet.

2. UNIX :



A Unix User has Several Options for Communicating With the Operating System

Unix is a multi-tasking, multi-processing, multi-user, and protected with built-in support for networking but not supported graphics. The Unix operating system was developed in 1969 by Ken Thompson, Dennis Ritchie and others at the AT&T Bell Laboratories. Unix is very flexible and can be installed on micro, mini, mainframe and Supercomputers. It is a very reliable, secured and robust operating system. It is a CLI based OS. The Unix shell is a command-Line Interface, similar in some ways to the old Dos prompt on the PC platform.

- **GUI (Graphical User Interface) Operating System :**

A Graphical User Interface (GUI) offers a user-friendly way to interact with an operating system by presenting information visually through windows and icons. This allows users to perform actions like opening files or running programs by simply clicking a mouse, eliminating the need to remember and type complex commands. The GUI streamlines user interaction, making computing more accessible and intuitive.

Advantages of GUI :

- GUIs are ease of use, operate and provides better accessibility.
- User can switch quickly between tasks on the GUI interface.
- GUI allows multiple programs and/or instances to be displayed simultaneously.
- GUI is convenient and user friendly. It also improved efficiency due to getting faster results.

Disadvantages of GUI :

- It uses more computer memory as the aim is to make it for user friendly.
- GUI becomes more complex if user needs to communicate with the computer directly.
- Difficulty of displaying all necessary controls because of limited Window space.
- GUIs has ambiguity of pictorial/graphical symbols.
- Slow speed because of long pointer operations.

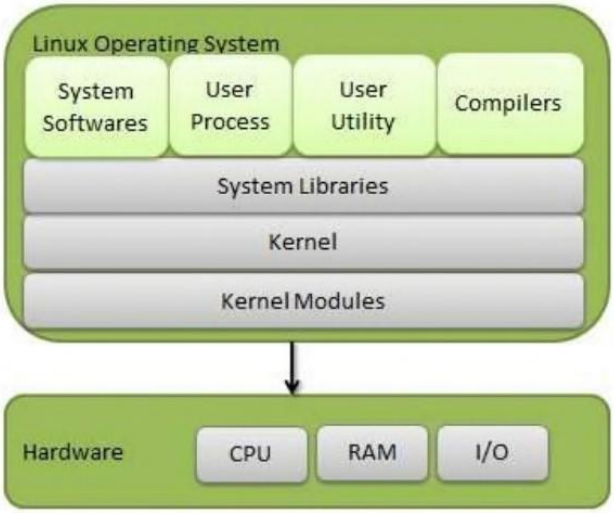
1. Windows :

The first version of windows was developed by Microsoft corporation in 1985. Windows OS has a Graphical User Interface (GUI) and is thus user-friendly. Windows OS is a multi-tasking operating system Some of the popular Windows OS are Windows 3.1, Windows 95, Windows 98, Windows 2000, Windows NT, Windows ME, Windows XP, Windows Vista and Windows 7, Windows 8, Windows 10, Windows 11 is the latest Windows operating system from Microsoft.

2. LINUX :

Linux is one of popular version of UNIX operating system. It is open source, portable, multi-user, multiprogramming operating system. Linux was developed by Linus Torvalds in 1992. Linux has both command line interface (CLI) and Graphical user Interface (GUI). Linux is a reliable and secure operating system.

Components of Linux Operating System :



- **Kernel :** Kernel is the core part of Linux. It is responsible for all major activities of this operating system. It consists of various modules and it interacts directly with the underlying hardware. Kernel provides the required abstraction to hide low level hardware details to system or application programs.
- **System Libraries :** System Libraries are special functions or programs using which application programs or system utilities accesses Kernel's features. These libraries implement most of the functionalities of the operating system and do not require kernel module's code access rights.
- **System Utility :** System Utility programs are responsible to do specialized, individual level tasks.

Features of Linux.

1) Open Source : Linux is free to use and its source code is open to everyone. Developers can study, modify, and share it.

2) Multitasking : Linux can run multiple tasks or applications at the same time without slowing down down.

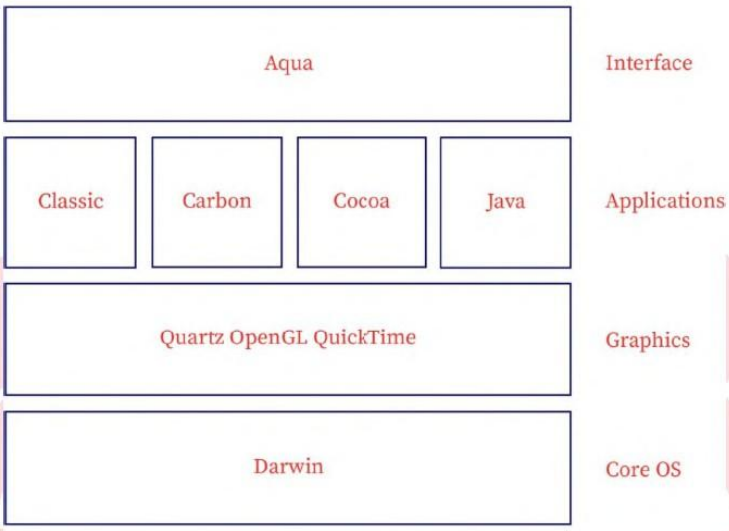
3) Multiuser : Many users can access the system simultaneously, each with their own accounts and permissions.

4) Portability : Linux can run on many types of devices, from phones to supercomputers, because it is highly adaptable.

5) Security : Linux is very secure, with features like file permissions, user authentication, and a strong firewall to protect against threats.

6) Lightweight : Linux can run on older or less powerful hardware, making it efficient and fast.

3. MaC OS :



Architecture of MAC OS

MacOS

The Macintosh operating system (Mac OS) is an operating system designed by Apple Inc. to be installed and operated on Apple Macintosh series of computers. It is a multi-user, multi-tasking operating system. Mac OS X was originally presented as the 10th major version of Apple's operating system for Macintosh computers and it is extremely secure, compatible, and easy to use.

Difference Between Command Line Interface (CLI) and Graphical User Interface (GUI)

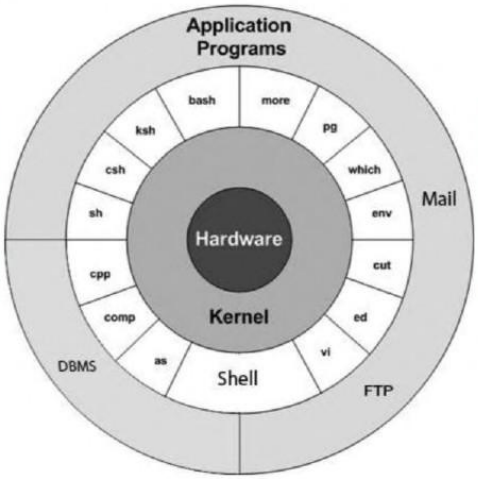
Q. Differentiate between command line based operating system and GUI based operating system (Any four points) (S-22, W-22, W-23)

Command Line Interface (CLI)	Graphical User Interface (GUI)
Interaction is by typing commands.	Interaction with devices is by graphics and visual components and icons.
Commands need to be memorized.	Visual indicators and icons are easy to understand.

Less memory is required for storage.	More memory is required as visual components are involved.
Use of keyboard for commands makes CLI quicker.	Use of mouse for interaction makes it slow.
Only keyboard is a resource used.	Mouse and keyboard both resources can be used.
Accuracy is high.	Accuracy is comparatively low.
Command line interface does not change, remains same over time.	Structure and design of Graphical user interface can change with updates.
Not much flexible.	GUI is more flexible.
Drag and drop features are usually absent. This makes the execution of certain commands lengthy or difficult.	Drag and drop features make certain command execution easier.
Examples: DOS, Unix etc.	Examples: Windows, Linux etc.

Structure of UNIX :

Q. Draw structure of UNIX operating system. (S-25)



Components of UNIX operating system :

- Kernel
- Shell
- Commands and utilities
- File and directories

1) Kernel:

The kernel is the heart of the operating system. It interacts with the hardware and performs most of the tasks like memory management, task scheduling and file management.

2) Shell:

The shell is the utility that processes your requests. When you type a command at your terminal, the shell interprets the command and calls the program that you want. The shell uses standard syntax for all commands. C Shell, Bourne Shell and Korn Shell are the most famous shells which are available with most of the Unix variant.

3) Commands and Utilities:

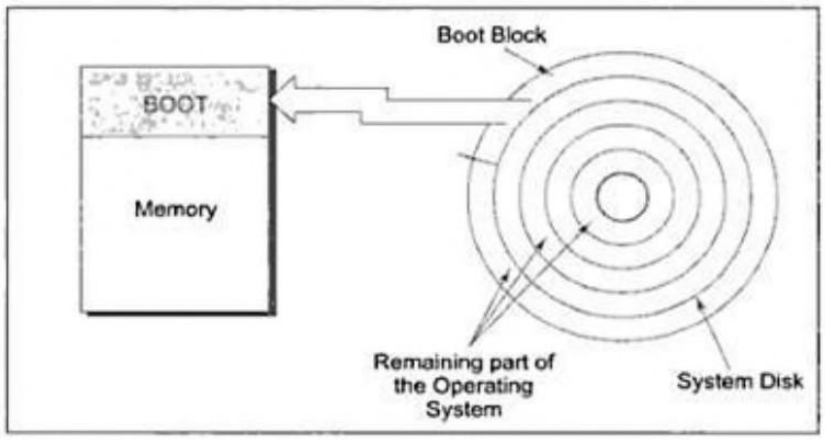
There are various commands and utilities which you can make use of in your day-to-day activities. CP, mv, cat and grep, etc. are few examples of commands and utilities. There are over 250 standard commands plus numerous others provided through 3rd party software. All the commands come along with various options.

4) Files and Directories:

All the data of Unix is organized into files. All files are then organized into directories. These directories are further organized into a tree-like structure called the file system.

Booting Process in UNIX :

Q. Explain Booting in UNIX.

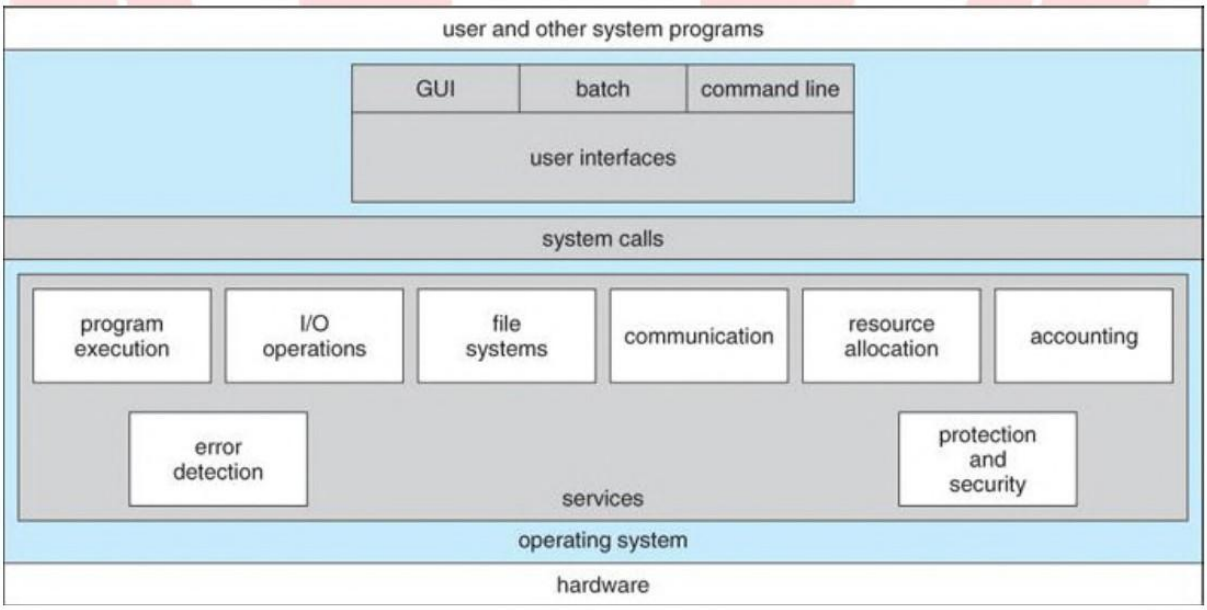


The loading of the operating system is achieved by a special program called BOOT. Generally, this program is stored in one (or two) sectors on the disk with a predetermined address. This portion is normally called "BOOT Block" as shown in dig. The ROM normally contains a minimum program. When one turns the computer "ON", the control is transferred to this program automatically by the hardware itself. This program in ROM loads the BOOT program in pre-determined memory locations. The beauty is to keep BOOT program as small as possible, so that the hardware can manage to load it easily and in a very few instructions. This BOOT program in turn contains to read the rest of the operating system into the memory. This is depicted in figures. The mechanism gives an impression of pulling oneself up. Therefore, its short form booting.

➢ 1.4 Different Services, System calls of Operating System :

- **Services of operating system :**

Q. Explain services provided by OS. (W-19, S-22, W-22, S-23, W-23, S-24)



a. User Interface:

All operating system have a user interface that allows users to communicate with the system. Three types of user interfaces are available:

i) Command Line Interface (CLI)

ii) Batch interface

iii) Graphical user interface (GUI).

b. Program execution:

The operating system provides an environment where the user can conveniently run programs. It also performs other important task like allocation and deallocation of memory, CPU scheduling etc. It also provides services to end process execution either normally or abnormally by indicating error.

c. I/O operations:

When a program is running, it may require input/output resources such as a file or devices such as printer. So the operating system provides a service to do I/O.

d. File system manipulation:

Programs may need to read and write data from and to the files and directories. Operating System makes it easier for user programs to accomplish their task such as: opening a file, saving a file and deleting a file from the Storage disk.

e. Communication:

In the system, one process may need to exchange information with another process. Communication can be implemented via shared memory or through message passing in which packets of information are moved between processes by the Operating System.

f. Error detection:

Operating Systems detects CPU and memory hardware such as a memory error or power failure, a connection failure on a network or lack of paper in the printer etc.

g. Resource allocation:

Operating System manages resource allocation to the processes. These resources are CPU, main memory, File Storage and I/O devices.

h. Accounting:

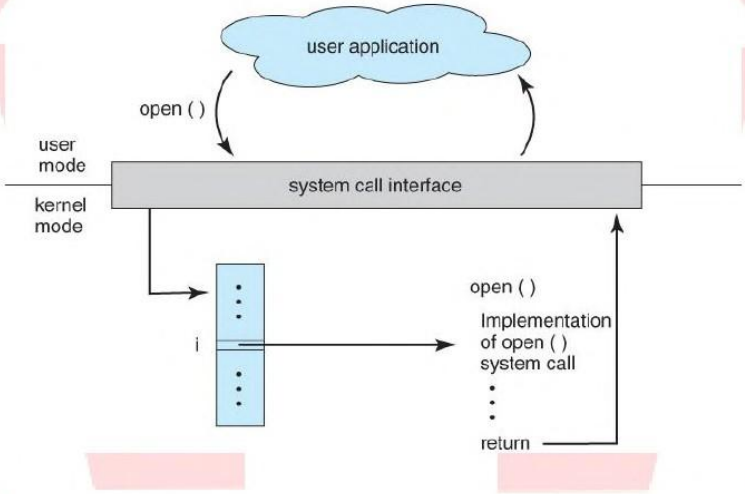
Operating System keeps track of usages of various computer resources allocated to users.

i. Protection & Security:

When several separate processes execute concurrently, one process should not interface with the other processes or operating system itself. Protection provides controlled access to system resources. Security is provided by user authentication such as password for accessing information.

- **System calls :**

Q. What is purpose of system call? State system calls with their functions. (W-19, S-22. W-22, S-23, W-23, S-24)



A system call is the programmatic way in which a computer system calls program requests a service from the kernel of the operating system it is executed on. System call provides an interface between a running program and operating system. It allows user to access services provided by operating system. This system calls are procedures written using C, C++ and assembly language instructions. Each system call is associated with a number that identifies itself.

- **Types of System calls :**

Process Control:

Program in execution is a process. A process to be executed must be loaded in main memory. While executing it may need to wait, terminate or create & terminate child processes.

Following are the functions of Process Control:

i. Create / terminate process
ii. Load / Execute process
iii. End / Abort process
iv. Ready / Dispatch process
v. Suspend / Resume process
vi. Get / Set process attributes
vii. Wait / Signal event
viii. Allocate and deallocate memory

File Management:

Q. Write any four systems call related to file management. (W-22)

System allows us to create and delete files. For create and delete operation System call requires the name of the file and other attributes of the file. File attributes include file type, file size, protection codes, accounting information and so on. System access these attributes for performing operations on file and directories.

Following are the functions of File management:

i. Create new file, delete existing file
ii. Open, close file
iii. Create and delete directories
iv. Read, write, reposition
v. Get/set file attribute

Device Management:

When a process is in running state, it requires several resources to execute. If the resource is available, it is assigned to the process. Once the resource is allocated to the process can read, write and reposition the device.

Following are the functions of Device management.

i. request device, release device
ii. read, write, reposition
iii. get/set device attributes
iv. logically attach or detach devices

Information Maintenance:

Transferring information between the user program and the operating system requires System call. Operating System keeps information about all its processes that can be accessed with System calls such as get process attributes and set process attributes.

Following are the functions of information maintenance.

i. get/set time or date
ii. get/set System data
iii. get/set process, file, or device attributes

Communication:

Processes in the system communicate with each other.
Communication is done by using two models:

i. message passing
ii. shared memory

For transferring messages, sender process connects itself to receiving process by specifying receiving process name or identity. Once the communication is over System close the connection between communicating processes.

Following are the functions of communication:

i. create, delete, communication connection.
ii. Send, receive messages.
iii. transfer status information.
iv. attach or detach remote device.

➢ 1.5 Operating System Components :

Q. Describe / List any components of O.S. (W-19, S-22, W-22, S-23, W-23, S-24)

Process management:

Q. List components of OS. Explain process management in detail. (W-19)

A program in execution is a process. The services provided through Process management are very important, if the Operating System supports multiple users as in the case of UNIX as MVS. The execution of a process must be sequential. A process needs various system resource including CPU time, memory, files and I/O devices to complete the job execution. These resources can be given to the process when it is created or allocated to it while it is running. The operating system responsible for the following activities in connection with process management.

a. Creation and deletion of user and system processes.

b. Suspension and resumption of processes

c. A mechanism for process synchronization

d. A mechanism for process communication

e. A mechanism for deadlock handling

Main memory management:

Q. Describe various activities performed by following operating system components. (S-22, W-23)

i) Main memory management ii) File management

Main memory is a large array of words or bytes, ranging in size from hundreds of thousands to billions. Each word or byte has its own address. Main memory is a repository of quickly accessible data shared by the CPU and I/O devices. The central processor reads instructions from main memory during the instruction fetch cycle and both reads and writes data from main memory during the data fetch cycle. The main memory is generally the only large storage device that the CPU is able to address and access directly. The operating system responsible for the following activities in connection with main memory management:

a. Keeping track of which parts of memory are currently being used and by whom.

b. Deciding which processes and data to move into and out of memory.

c. Allocating and deallocating memory space as needed.

File Management:

File management import component of all the operating, which deals with the management and organisation of various files in the system. Some examples of storage media are magnetic tape, magnetic disk and optical disk. Each of these media has its own properties like speed, capacity, and data transfer rate and access methods. A file system normally organized into directories to ease their use. These directories may contain files and other directories. The operating system responsible for the following activities in connection with file management:

a. The creation and deletion of files.

b. The creation and deletion of directories.

c. The support of primitives for manipulating files and directories.

d. The mapping of files onto secondary storage.

e. The backup of files on stable storage media.

I/O device management:

Input / output device management provides an environment for the better interaction between system and the I/O devices (such as printers, scanners, tape drives etc.) To interact with I/O devices in an effective manner, the operating system uses some special programs known as device drivers. The device drivers take the data that operating system has defined as a file and then translate them into streams of bits or a series of laser pulses (in regard with laser printer). The I/O subsystem consists of several components:

a. A memory management component that includes buffering, caching, spooling.

b. A general device driver interface.

c. Drivers for specific hardware device.

Secondary Storage Management:

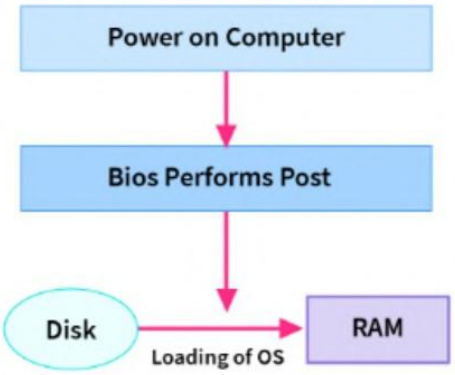
The computer system provides secondary storage to back up main memory. Secondary storage is required because main memory is too small to accommodate all data and programs. The data that it holds is lost when power is lost. Most of the programs including compilers, assemblers, word processors, editors, and formatters are stored on a disk until loaded into memory. Secondary storage consists of tapes drives, disk drives, and other media. The operating system is responsible for the following activities in connection with disk management.

(a) free space management

(b) storage allocation.

(c) disk scheduling.

- **Booting process :**



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 as bootstrap loader locates the Kernel. This program is in the form of read-only memory (ROM), because the RAM is in an unknown state at system startup. ROM is convenient because it needs no initialization and cannot be infected by a computer virus. When the full bootstrap program has been loaded, it can traverse the file system to find the operating system kernel, load it into memory, and start its execution. It is only at this point that the system is said to be running.