

Operating System

Assignment - I.

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Date	

1. Write a short note on Evolution and Generations of an operating system.

→ There are four generations of Operating System.

(1) The first Generation (1945-1955):

Vacuum Tubes and Plugboards!

1. Digital computers were not constructed until the second world war. Calculating engines with mechanical relays were build at that time.

2. However, the mechanical relays were very slow and were later replaced with vacuum tubes. These machines were enormous but were still very slow.

3. These early computers were designed, built and maintained by single group of people. Programming languages were unknown and there were no operating system so all the programming was done in machine language. All problems were simple numerical calculations.

(2) The second Generation (1955-1965):

Transistors And Batch System:

1. Transistor led to the development of the computers system that could be manufactured and sold to paying customers.

2. These machines were known as mainframes and were locked in air-conditioned computer room with staff to operate them.

3. The batch system was introduced to reduce the wasted time in the computer. A tray full of jobs was collected in the input room and read into magnetic tape.

4. The output was written on the second tape. After the whole batch was done, the input and output tapes were removed and the output tape was printed.

(3) The Third Generation (1965-1980)

Integrated Circuits and Multiprogramming

1. Until the 1960's there were two types of computers system i.e. the scientific and the commercial computer. These were combined by IBM in the System/360. This used integrated circuit and provided a major price and performance advantage over the second generation system.

(2) The third generation also introduced multiprogramming.

That means the processor was not idle while a job was completing its I/O operation.

(4) The Fourth Generation (1980-Present) :-

Personal Computers:

1. Personal Computers were easy to create with development of large-scale integrated circuits. These were chips containing thousands of transistors on a square centimeter of silicon. Because of these, microcomputer and that made it possible for single individual to own one of them.

2. The advent of computers also led to the growth of network. This created network operating system and distributed operating systems. The users were aware of networks while using network operating system.

2. Describe Operating System in details.

- 1. An operating system (os) is system software that manages computer hardware, software resources, and provides common services for computer programs.
- 2. For hardware functions such as input and output and memory allocation, the operating system acts as intermediary between programs and the computer hardware. although the application code is usually executed directly by hardware and frequently makes system calls to an OS function or is interrupted by it.
- 3. Operating Systems are found on many devices that contain a computer.
- 4. There are so many operating systems, the general purpose desktop operating system is Microsoft Windows with ~~market share of~~, macOS by Apple Inc. the Linux ~~are~~, the Android share smartphone is dominant.
- 5. Some operating systems require installations or may come pre-installed with purchased computers, while others may run directly from media, or flash memory (usb disk).
- 6. There are so many types of operating system.
 - ① Single tasking and multi-tasking.
 - ② Single and multi user.
 - ③ Distributed.
 - ④ Embedded.
 - ⑤ Library.
 - ⑥ Real time.

- Q. List the different types of functions of an operating system.
→ There are some important functions of an operating system.

① Memory Management :-

1. Memory Management refers to management of primary memory or Main memory. Main memory is large array of word or byte where each word or byte has its own address.
2. Main memory provides a fast storage that can be accessed directly by the CPU for a programme to be executed. It must be in the main memory. An operating system does the following activities for memory management.
 - (i) keep tracks of primary memory.
 - (ii) In multiprogramming
 - (iii) Allocates memory when process request it to do.

② Process Management :-

1. In multiprogramming environment the OS decides which process gets the processor when and for how much time. The function is called process scheduling.
 - (i) keeps track of processor and status of process.
 - (ii) Allocates the processor (CPU) to a process.

③ Device Management :

1. An operating system manages device communication via their respective drivers. It does the following activities for device management.
 - (i) keep track of all devices.
 - (ii) Decides which process get device when and

(iii) Allocate device in the efficient way.

④ File Management :

1. A file system is normally organised into directories for easy navigation and usage. These directories may contain files and other directories.

(i) Keeps track of info, locn, user, etc.

(ii) Decides who gets the resources.

(iii) Allocates the resources.

(iv) De-allocates the resources.

⑤ Batch Operating System:

1. The users of batch operating system do not interact with the computer directly. Each user prepares his job on an off-line device like punch cards and submits it to the computer operator. To speed up processing jobs with similar needs are batched together and run as a group.

The problems with batch system are as follows:-

1. Lack of interaction between the user and job.

2. CPU is often idle, because the speed of the mechanical I/O devices is slower than CPU.

⑥ Time sharing operating system:-

1. Time sharing is a technique which enables many people, located at various terminals, to use a particular system at the same time.

1. provides advantage of quick response

2. Avoid duplicate S/W.

3. Reduces CPU idle time.

4. What do you mean by Batch Processing System? Explain.

→ Batch processing is a technique in which an operating system collects the programmes and data together in batch before processing starts. An operating system does the following activities related to batch processing.

- (i) The OS defines a job which has predefined sequence of commands, programs and data as single unit.
- (ii) The OS keeps a number of jobs in memory and executes them without any manual info.
- (iii) Jobs are processed in the order of submission i.e. first come first served fashion.
- (iv) When job completes its execution, its memory is released and the O/P for the job gets copied into an O/P spool for later printing or processing.

Advantages :-

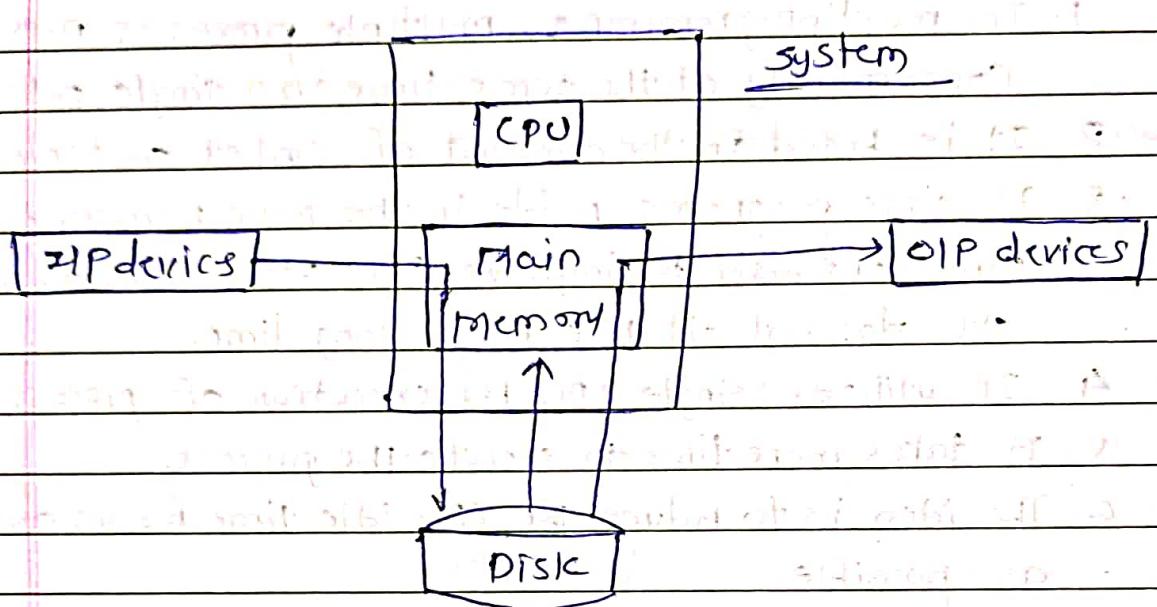
1. Batch processing takes much of the work of the operator to the computer.
2. Increased performance as a new job get started as soon as previous job finished.

Disadvantages :-

1. Difficult to debug programs.
 2. A job could enter an infinite loop.
 3. Due to lack of protection scheme, one batch job can affect pending job.
4. Describe spooling with dig.

→ 1. Spooling stands for "Simultaneous Peripheral Operations Online", so in that Spooling, more than one I/O operations can be performed simultaneously.

i.e. at the time when the CPU is executing some process then more than one I/O operation can also be done at the same time. The following image will help us in understanding the concept.



In above dia, I/O data stored in some kind of secondary device and this data is then fetched by the main memory. The benefit of this approach is that, in general, the CPU works on the data stored in the main memory. since we have a number of I/O devices can put the data into disk or secondary memory. The main memory will fetch the data one by one from the secondary memory and CPU will execute some instruction on that data. Both main and secondary memory are digital in nature. so taking data from the main to secondary very fast.

Advantages :-

1. Since there is no interaction of I/O devices with CPU so the CPU need not wait for the I/O operation to take place.
2. CPU is kept busy most of the time and hence is not in the idle state which is good to have a situation.

6. State the difference between Multiprogramming and Multitasking Operating System.



* Multiprogramming :-

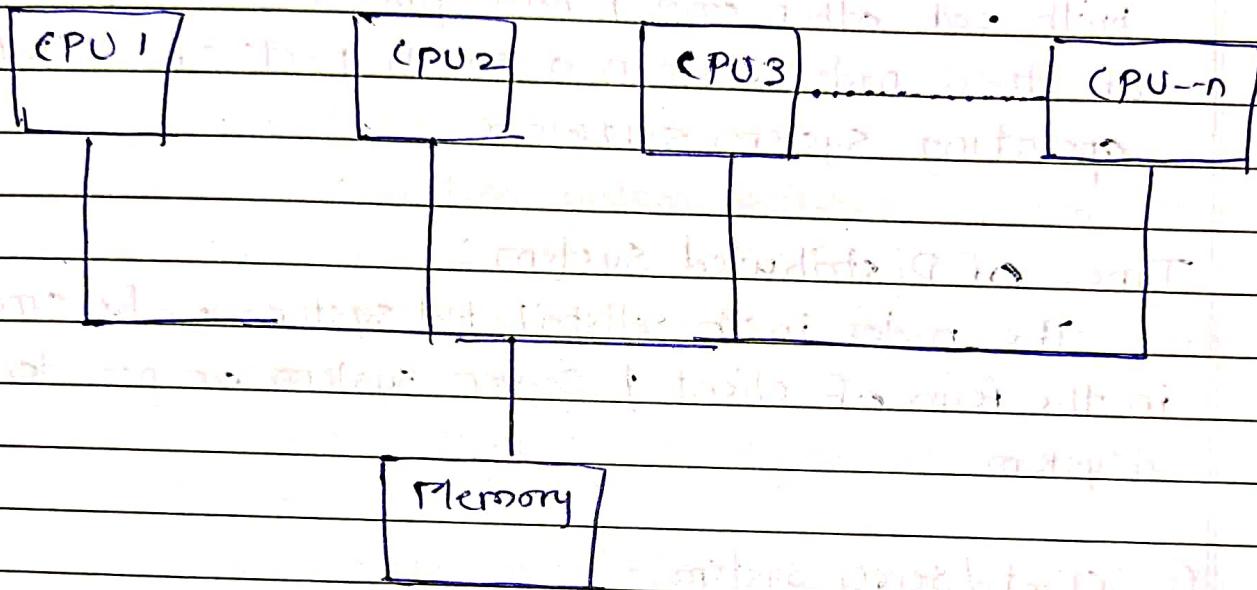
1. In multiprogramming, multiple processes run concurrently at the same time on a single processor.
2. It is based on the concept of context switching.
3. Multiple programs reside in the main memory simultaneously to improve CPU utilization so that CPU does not sit idle for a long time.
4. It utilizes single CPU for execution of process.
5. It takes more time to execute the process.
6. The idea is to reduce the CPU idle time for as long as possible.

* Multitasking :-

1. Multitasking is when more than one task is executed at a single time utilizing multiple CPU.
2. It is based on the concept of time sharing.
3. It enables execution of multiple tasks and processes at the same time to increase CPU performance.
4. It utilizes multiple CPU's for task allocation.
5. It takes less time to execute the tasks or process.
6. The idea is to allow multiple processes to run simultaneously via time sharing.

7. With the help of diagram, explain Multiprocessor systems (parallel).
→ Most Computer system are single processor system, i.e. they only have one processor, However

multiprocessor or parallel system are increasing in importance nowadays. These systems have multiple processor working in parallel that share the computer clock, memory bus, peripheral devices etc.



There are two types of Multiprocessor :-

1. Symmetric Multiprocessor
2. Asymmetric Multiprocessor

1. Symmetric Multiprocessor :-

In these type of system, each processor contains a similar copy of the operating system and they all communicate with each other. All the processors are in peer to peer relationship.

2. Asymmetric Multiprocessor.

In asymmetric system, each processor is given a predefined task. There is a master processor that gives instruction to all the other processors. Asymmetric multiprocessor system contains a master slave relationship.

8. Write short note on Distributed system.

→ A Distributed System contains multiple nodes that are physically separate but linked together using the network. All the nodes in this system communicate with each other and handle processes in tandem. Each of these nodes contain a small part of distributed operating system software.

Types of Distributed System :

The nodes in the distributed system can be arranged in the form of client / Server system or peer to peer system.

(1) Client / Server system :-

In Client Server system, the client requests a resource and Server provides that resource. A server may serve multiple clients at the same time while client is in contact with only one server. Both the client and server usually communicate via a computer network and so they are a part of distributed system.

(2) Peer to Peer System :-

The peer to peer system contains nodes that are equal participants in data sharing. All the tasks are equally divided between all the nodes. The node interact with each other as required as share resources. This is done with help of network.

9. What do you mean by Worst Case Response Time? Explain!

10. State the difference between Time sharing system and Real Time system.

1. Time sharing Operating System:-

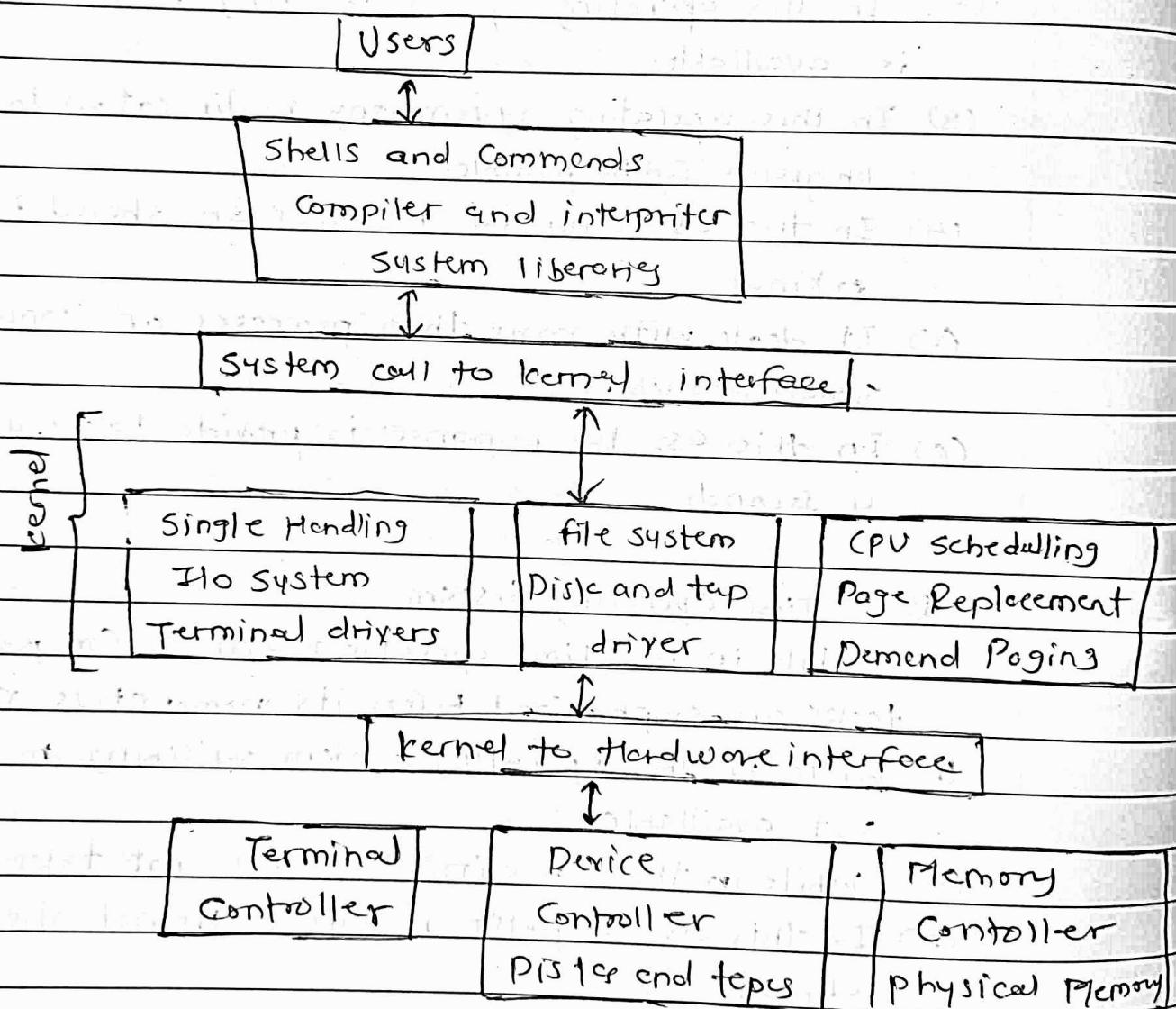
- (1) In time sharing operating system quick response is emphasized for a request.
- (2) In this operating system switching method / function is available.
- (3) In this operating system any modification in the programme can be possible.
- (4) In this OS computer resources are shared to the external.
- (5) It deals with more than processes or applications simultaneously.
- (6) In this OS, the response is provided to the user within a second.

2. Real-Time Operating System:

- (1) While in real time operating system, computation times are emphasized before its nominative point.
- (2) While in this operating system switching method / f not available.
- (3) While in this modification does not take place.
- (4) In this OS computer resources are not shared to the external.
- (5) It deals with only one process or application at a time.
- (6) While in real time OS, the response is provided to the user within the constraint.

11. With the help of dia, describe UNIX Layered Structure.

→ UNIX is multiuser, multitasking operating system that was developed by Bell Laboratories in 1969. In multiuser system many user can use the system simultaneously. A multitasking system is capable of doing multiple jobs. Each user can interact with their own shell instance in this type of operating system and can start application as required.



The main component of the Unix operating system structure are the kernel layer, the shell layer and the application layer.

kernel :

The kernel provides a bridge between the hardware and the user. It is a SW application that is central to the operating system. The kernel handles the files, memory, devices, processes and network of operating system. It is responsibility of the kernel to make sure all the system and user tasks are performed correctly.

Shell :

The programs between kernel and user is known as shell. It translates the many commands that are typed into the terminal session. These commands are known as shell script. There are two major types of shell of Unix. These are Bourne shell and C shell.

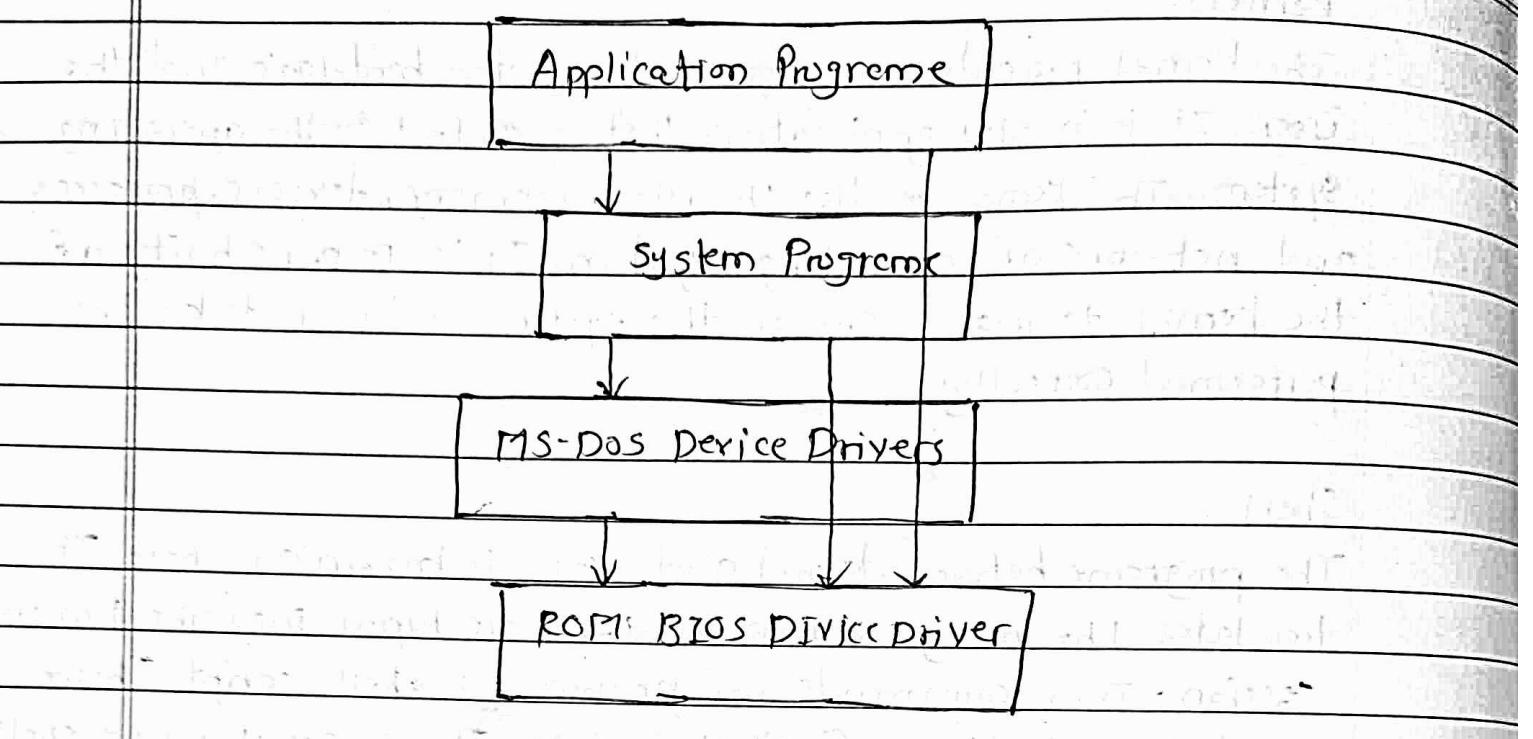
Application :

The applications and utility layer in Unix includes the word processors, graphics programs, PDBPIP, commands etc.

The application programs provide an application to the end users.

12. Explain MS-DOS layer structure and its Layered Approach.

- 1. MS-DOS is an operating system created for personal computers. It was developed by microsoft. It is classic example of an operating system with layered structure.
- 2. MS-DOS operating system is split into various layers and each of the layer have different functionalities.
- 3. Layering provides a distinct advantages in the MS-DOS operating system because all the layers can be defined separately and interact with each other required.



MS-DOS STRUCTURE

This is the layer of application programs, system programs, MS-DOS device drivers and ROM BIOS device drivers.

Application Program:

These programs perform a particular function directly for the user. In other words, these programs provide an application to the end user, so they are known as application programs.

System Program

The system programs are used to program the operating system software. While application programs provide SW that used directly by the user, system programs provide SW that used by other systems.

MS-DOS device drivers:

Most of the device drivers on MS-DOS are part of operating

system such as keyboard and screen console drivers, floppy and hard disk drivers, printer port drivers, serial port driver etc.

Q17 BIOS device drivers :

The BIOS drivers are the programs stored in the EPROM or EEPROM memory chips on the motherboard. These are the basic drivers needed to start the computer system. BIOS stands for Basic Input / output system.

18. Discuss Microkernel in details and draw diagram for some.

→ A microkernel is the minimum SW that is required to correctly implement an operating system. This includes memory process scheduling mechanisms and basic inter-process communication.

A - Application Server

Application inter-process Communication	file Server	Device Driver	Unix server
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Basic Inter-process Commun'

Virtual Memory

Scheduling

Hardware

Microkernel Based Operating System.

The microkernel contains basic requirements such as memory, process scheduling mechanism and basic interprocess communication. The only software executing at the privilege level. The microkernel makes sure that the code can be easily managed because the services are divided in the user space. This means that there is less code running in the kernel mode which result in increased security and stability.

Benefits of Microkernel :

1. Microkernels are modular and different modules can be replaced, relocated, modified, changed etc. as required.
2. Microkernels are quite secure as only those components are included that would disrupt the functionality of the system otherwise.
3. Microkernel contains fewer system crashes as compared to monolithic system. Also, the crashes that do occur can be handled quite easily due to the modular structure of microkernel.

14. What do you mean by Virtual Machines? Explain with the help of diagram.

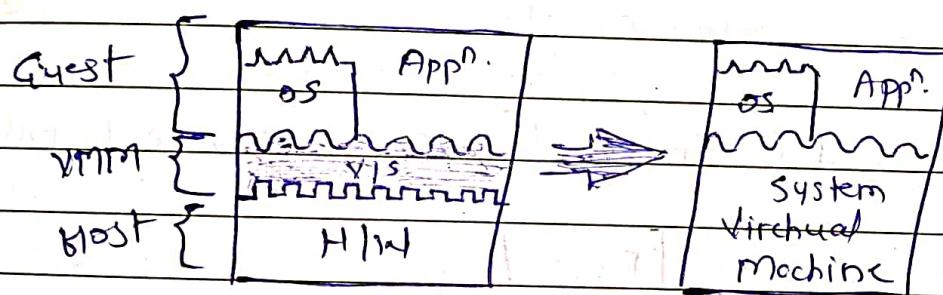
→ 1. A Virtual Machine is an emulation of computer system. Where these machines use computer architectures to provide the functionality of physical computer. The physical device on which virtual machine work is known as Host, whereas the virtual machine is known as Guest. A single Host can have multiple no. of guest.

2. There are two types of Virtual Machines:

1. System Virtual Machines

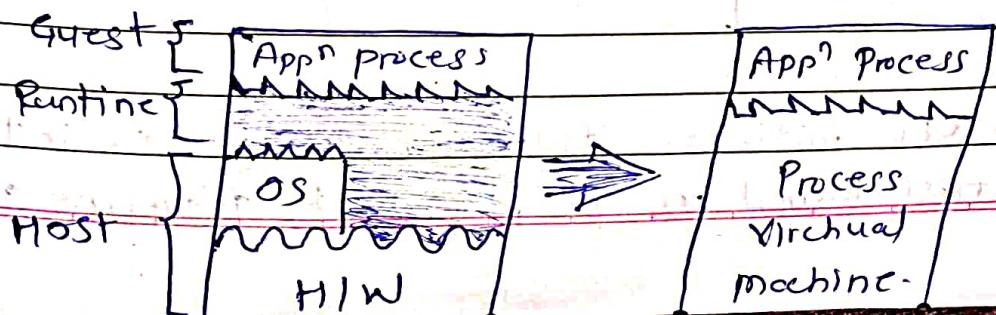
2. Process Virtual Machines.

1. System Virtual Machines:



This type of VM's provide full Virtualization. Acting as the substitute for the real machine. These will provide functions to execute an entire operating system. Hardware resources are shared and managed. forming multiple environment on the host system. This environment are isolated from each other but exist on the same physical host. These provide time sharing among several single-tasking operating system.

2. Process Virtual Machines:

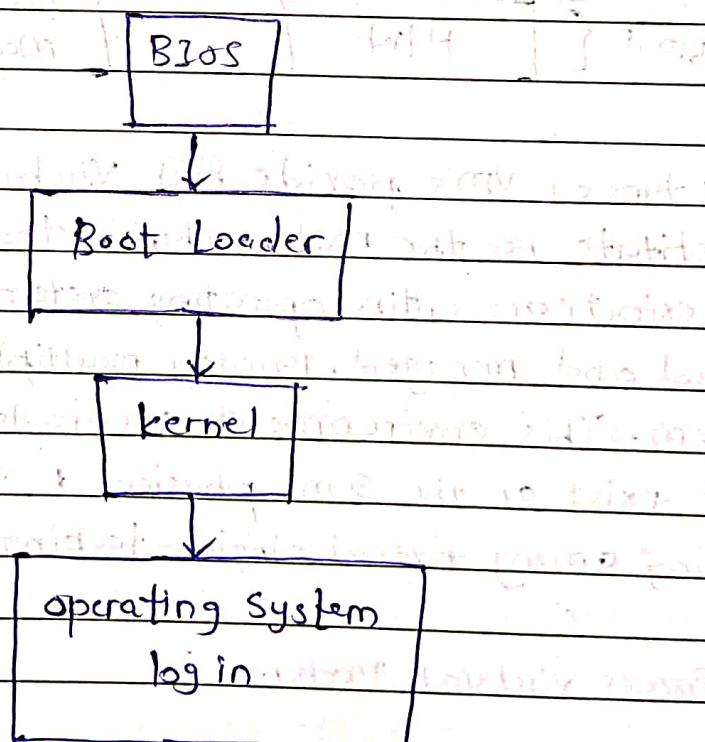


1. This is VM's or also known as Application Virtual machines- Managed runtime environment- This type of VM run as normal application inside the host operating system, supporting a single process. It is created with the starting of the apps. It is used to provide platform independent programme environment to the process allowing it to execute in the same manner on any of the other platform.

15. Write a note on system Boot.

→ The BIOS, operating system and hardware component of Computer should all be working correctly for it to boot. If any of these element fails, it leads to failed boot sequence.

The following steps involved in a system boot process:



1. The CPU initializes itself after the power in the computer is first turned on. This is done by triggering a series of

clock ticks that are generated by system clock.

2. After this, the CPU looks for the system ROM BIOS to obtain the first instruction in the start-up-program. This first instruction is stored in the ROM BIOS and it instruct the system to run POST in memory address that is predetermined.

3. POST first checks the BIOS chip and then the CMOS RAM. If there is no battery failure detected by POST, then it continues to initialize the CPU.

4. POST also checks the HW devices, secondary storage devices such as hard drivers, ports etc. And other HW devices such as the mouse and keyboard.

5. After POST makes sure that all the components are working properly; then BIOS finds an operating system to load.

6. In most computer systems the operating system loads from the C drive onto the hard drive. The CMOS chip typically tells the BIOS where the operating system is found.

7. The order of the different drives that CMOS looks at while finding the operating system is known as the boot sequence.

8. After finding appropriate boot drive, the BIOS first finds the boot record which tells it to find the beginning of the operating system.

9. After initialization of operating system, the BIOS copies the files into the memory, then the operating system controls the boot process.

10. In the end, the operating system does a final inventory of the system memory and loads the device drivers needed to control the peripheral devices.

11. The user can access the system application to perform various tasks.

16. state and explain different services offered by OS.

→ An operating system provides services to both the user and to the programs.

1. It provides program environment to execute.

2. It provides user the services to execute the program in convenient manner.

following are few common services provided by an operating system:

1. Program execution:

(i) Operating system handles many kinds of activities from user programs to system programs like printer.

(ii) The process includes the complete execution context switch at start and end.

2. I/O operation:

An I/O subsystem comprises of I/O devices and their corresponding drivers. Drivers hide the peculiarities of specific hardware devices from the user.

An operating system manages the communication between user and device drivers.

3. File system manipulation:

A file represents a collection of related information.

Computers can store files on the disk for long-term storage purpose. Examples of storage media includes magnetic tape, magnetic disk and optical disk drivers like CD, DVD.

4. Communication:

In case of distributed system which are collection of processor that do not share memory, peripheral devices, or clock the operating system manages communication between all the processes. Multiple processes communicate with one another through communication lines in the network.

5. Error Handling:

Error can occur anytime and anywhere. An error may occur in CPU, in I/O devices or in the memory hardware. Following are the major activities of an operating system with respect to error handling.

1. The OS constantly checks for possible errors
2. The OS takes an appropriate action to ensure correct and consistent computing.

6. Resource Management:

In case of multi-user or multi-tasking environment, resources such as main memory, CPU cycles and file storage are due to be allocated to each user or job. Following are major activities of an operating system with respect to resource management.

- The OS manages all kinds of resources using schedulers.
- CPU scheduling algorithms are used for better utilization of CPU.

7. Protection:

Considering a computer system having multiple user and concurrent execution of multiple processes, the various

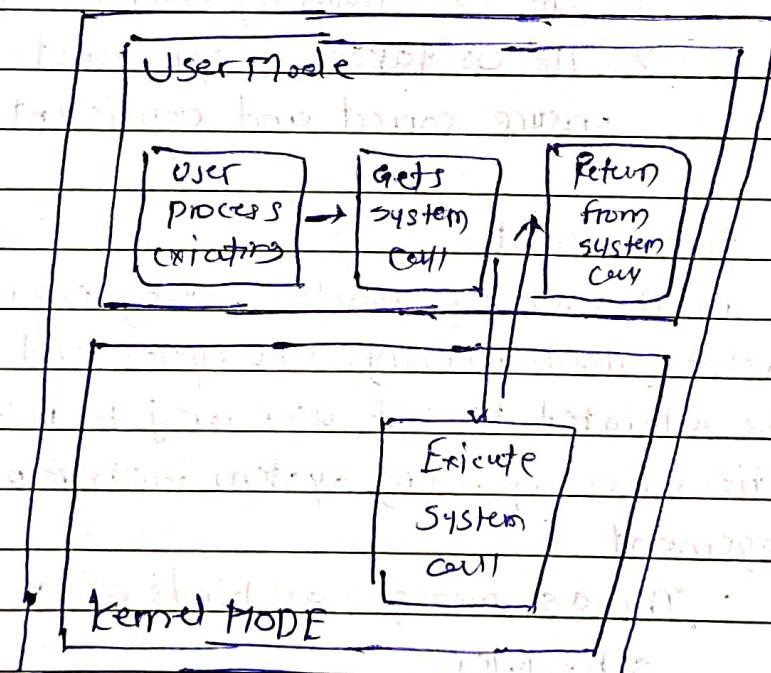
processes must be protected from each other's activities.

The OS ensures that all access to system resources is controlled.

The OS ensures that external communication is controlled.

Q17. What do you mean by system call?

→ The interface between a process and an operating system is provided by system calls. In general, system calls are available as assembly language instructions. They are also included in the manuals used by the assembly level programmers. System calls are usually made when a process in user mode require access to resource. Then it requests the kernel to provide the resource via a system call.



The process executes normally in the user mode until the system call interrupt. Then the system call is executed on priority basis in kernel mode. After the execution of system call, the control returns to the user mode and execution of user process can be resumed.

In general system calls are required in the following situations:

- If a file system requires the creation or deletion of files. Reading and writing from files also require a system call.
- Creation and management of new processes.
- Network connection also require system call. This includes sending and receiving packets.
- Access of hardware devices such as a printer, scanner etc, requires system calls.

Types of System Calls:

There are mainly five types of system calls.

1. Process Control:

This system call deal with processes such as process creation, process termination etc.

2. File Management:

These system calls are responsible for file manipulation such as creating, terminating etc. file, reading a file, writing into file etc.

3. Device Management:

These system calls are responsible for device manipulation such as reading from device buffers, writing into device buffers etc.

4. Information Maintenance:

These system calls handle information and its transfer between the operating system and the user programs.

5. Communication :

These system calls are useful for interprocess communication. They also deal with creating and deleting a communication channel.

18. List the advantages of distributed operating system.

- The distributed system contains multiple nodes that are physically separate but linked together using the network. All the nodes in this system communicate with each other and handle process in tandem.

Advantages of distributed system are as follows :

1. All the nodes in the distributed system are connected to each other. So nodes can easily share data with other nodes.
2. More nodes can easily be added to the distributed system i.e. It can be scaled as required.
3. Failure of one node does not lead to the failure of the entire distributed system. Other nodes can still communicate with each other.
4. Resources like printers can be shared with multiple nodes rather than being restricted to just one.

19. Give any two benefit of Linux Operating System.

- There are so many benefits of Linux Operating System, but some of two benefits are as follows :-

1. Stability :

- (i) Linux is more stable than operating system.
- (ii) Linux does not require to reboot the system to maintain performance levels.
- (iii) It rarely hangs up or slow down. It has

• big up-times.

20. Explain multiprocessor system with advantages.

→ Multiprocessing operating system or the parallel system supports the use of more than one processor in close communication.

The advantages of multiprocesssing system are :

1. Increased Throughput :- By increasing the number of processor, more work can be completed in a unit time.

2. Cost saving :- Parallel system shares the memory, buses, peripherals etc. Multiprocessor system thus saves money as compared to multiple single system. Also if number of programs are to operate on the same data, it is cheaper to store that data on one single disk and shared by all processors instead of using many copies of some data.

3. Increased Reliability :- In this system, as the workload is distributed among several processors which results in increased reliability. If one processor fails its failure may slightly

21. What is virtual machine? Give two example of Virtual machine. List any three.

→ Virtual Machine is emulation of a computer system. Where these machines use computer architectures to provide the functionality of a physical computer. The physical device on which virtual machine works is known as Host.

Whereas the virtual machine are known as Guest. A single host can have multiple numbers of guests.

Types of Virtual Machines :-

There are two types of virtual machines :-

1. System Virtual Machine.
2. Process Virtual Machine.

1. System Virtual Machine:

These type of virtual machine provide full virtualization acting as the substitute for the real machine. These will provide functionalities to execute an entire operating system. Hardware resources are shared and managed forming multiple environments on host system. These environments are isolated from each other but exist on the same physical host. These provide time-sharing among several single-tasking operating systems. It allows memory sharing between different virtual machines on the computer operating system. Memory overcommitted system can be applied.

2. Process Virtual Machines:

These VMs are also known as applications virtual machines. Managed runtime environment. This type of VM runs as a normal application inside the host's operating system, supporting a single process. It is created with the starting of the process and is destroyed when the process ends. It is used to provide a platform-independent programming environment to the process.

allowing it to execute in the same manner on any of the other platform.

This are implemented using interpreters and provides high-level abstractions. These are popularly used for Java programming which uses Java virtual machines for execution of programs. These is a special case of the communication mechanism of computer cluster. This helps the programmers to focus on the algorithm instead of the communication process provided by the interconnect and virtual machine in OS.

The application running on these VMs has access to all the operating system services.

22. Benefits of Virtual Machine.

→ Benefits of using a virtual machine are as follows:

A virtual machine is essentially a computer within a computer. VM's have several advantages.

They allow multiple operating system (OS) environments to exist simultaneously on the same machine.

- They empower users to go beyond the limitations of hardware to achieve their end goals.
- Using VMs ensures application provisioning, better availability, easy maintenance and recovery.

23. What is operating system? Explain four operating system services.

→ The operating system is system software that manages computer hardware, software resources, and provides common services for computer programs.

Here is the services offered by an operating system:

1. User Interface:

Usually operating system comes in three forms of or type. Depending on the interface their type have been further subdivided. These are:

- command line Interface.
- Batch based Interface.
- Graphical User Interface.

2. Programs Execution:

The operating system must have an capability to load a program into memory and execute that program, furthermore, the program must be able to end its execution, either normally or abnormally / forcefully.

3. I/O operation:

A program which is currently executing may require I/O, which may involve file or other I/O device. for efficiency and protection. Users can not directly govern the I/O device. So, the OS provide a means to do I/O input / output operation which means read or write operation with any file.

4. Communication System:

Process needs to swap over information with other process. Processes executing on same computer system or on different computer system can communicate using operating system supports.

communication between two processes can be done using shared memory or via message passing.

Q4. Write the short note on Buffering.

- 1. The buffer is an area in the main memory that is used to store or hold the data temporarily that is being transmitted either between two devices or between device or application. In simple word buffer temporarily stores data that is being transmitted from one place to another.
"The act of storing data temporarily in the buffer is called buffering".
- 2. It helps in matching speed between two devices, between which the data is transmitted, for example, a hard disk has to store the file received from the modem.
- 3. It helps the devices with different data transfer size to get adapted to each other. It helps device to manipulate data before sending or receiving. In Computer networking, the large message is fragmented into small fragments and sent over the network.
- 4. It also supports copy semantics. With copy semantic, the version of data in the buffer is guaranteed to be the version of data at the time of system call irrespective of any subsequent change to data in the buffer.
- 5. Buffering increases the performance of the devices. It overlaps the I/O of one job with computation of some job.