

Solved Questions Module-1

1. Define Operating System. Mention its purpose and objectives.

Operating System Definition- 1 mark

An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.

OS is a resource allocator – 1 mark

Manages all resources

Decides between conflicting requests for efficient and fair resource use.

OS is a control program - 1mark

Controls execution of programs to prevent errors and improper use of the computer

No universally accepted definition.

Everything a vendor ships when you order an operating system is good approximation

- A program that controls the execution of application programs.
- An interface between applications and hardware.
- Controls and coordinates the usage of hardware among various applications and users.
- It is responsible for the execution of all the processes, Resource Allocation, CPU management, File Management and many other tasks.
- The purpose of an operating system is to provide an environment in which a user can execute programs in a convenient and efficient manner.
- **Main objectives of an OS:**
 - convenience
 - efficiency
 - ability to evolve

• An operating system (OS) is the program that, after being initially loaded into the computer by a boot program, manages all of the other application programs in a computer.

- The application programs make use of the operating system by making requests for services through a defined application program interface (API).
- In addition, users can interact directly with the operating system through a user interface, such as a command-line interface (CLI) or a graphical UI (GUI).

2. Which are the three methods used to pass parameters to operating system?

Three general methods used to pass parameters to the OS – 3 marks

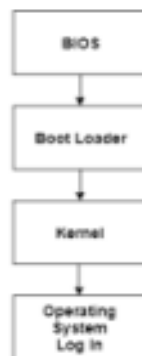
- Simplest: pass the parameters in registers
- In some cases, may be more parameters than registers Parameters stored in a block, or table, in memory, and address of block passed as a parameter in a register. This approach taken by Linux and Solaris.
- Parameters placed, or pushed, onto the stack by the program and popped off the stack by the operating system. Block and stack methods do not limit the number or length of parameters being passed

3. Describe the role of bootstrap loader in booting a computer system.

4. Write the operations taking place during the booting of a system.

Bootstrap loader, located in ROM, can perform various tasks – run diagnostics to determine the state of the system, initializes all aspects of the system, locate the kernel in memory, loads it into memory and starts its execution.

1.5 System Boot Process



- 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 the system clock.
- After this, the CPU looks for the system's ROM BIOS to obtain the first instruction in the start-up program.
- This first instruction is stored in the ROM BIOS and it instructs the system to run POST (Power On Self Test) in a memory address that is predetermined.
- 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.
- POST also checks the hardware devices, secondary storage devices such as hard drives, ports etc. And other hardware devices such as the mouse and keyboard.
- This is done to make sure they are working properly.
- After POST makes sure that all the components are working properly, then the BIOS finds an operating system to load.
- In most computer system's, 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.
- The order of the different drives that CMOS looks at while finding the operating system is known as the boot sequence.
- This sequence can be changed by changing the CMOS setup.
- After finding the appropriate boot drive, the BIOS first finds the boot record which tells it to find the beginning of the operating system.
- After the initialization of the operating system, the BIOS copies the files into the memory. Then the operating system controls the boot process.
- 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.
- The users can access the system applications to perform various tasks.

5. How is distinction of kernel code from user code achieved at hardware level?

Using dual mode of operations – user mode and kernel mode

❖ Dual-Mode Operation

- To ensure proper operation, we must protect the operating system and all other programs and their data from any malfunctioning program. Protection is needed for any shared resource.

➤ The two separate modes of operations are:

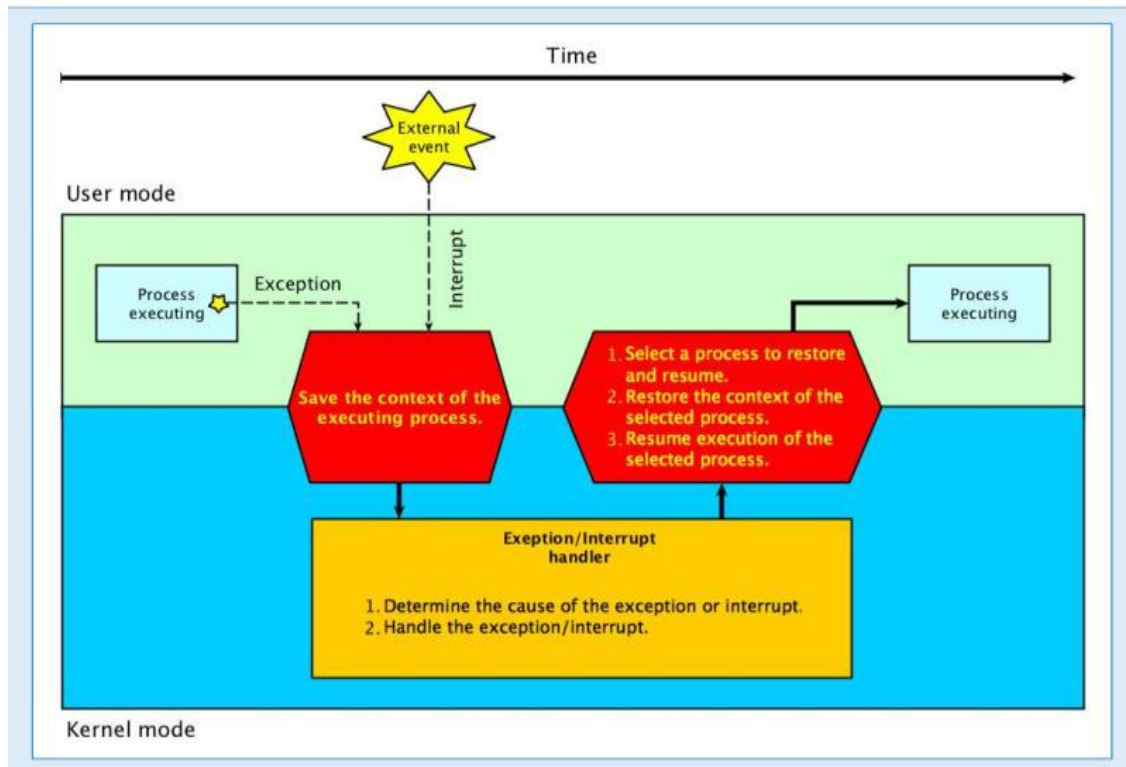
- **User mode**

- **Monitor mode** (also called **Kernel mode**, **supervisor mode**, **system mode**, or **privileged mode**).

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

- At system **boot time**, the hardware starts in **monitor mode**. The operating system is then loaded, and starts user processes in user mode.
- Whenever a **trap or interrupt** occurs, the hardware switches from user mode to monitor mode (that is, changes the state of the mode bit to 0).
- Thus, whenever the operating system gains control of the computer, it is in monitor mode.
- The system always switches to user mode (by setting the mode bit to 1) before passing control to a user program.

- The **dual mode** of operation provides us with the means for **protecting the operating system from errant users**.
- We accomplish this protection by **designating some of the machine instructions** that may cause harm as **privileged instructions**.
- The hardware allows **privileged instructions** to be **executed only in monitor mode**.
- If an attempt is made to execute a privileged instruction in user mode, the hardware does not execute the instruction, but rather treats the instruction as illegal and traps it to the operating system.



6. Differentiate symmetric and asymmetric multiprocessor systems.

Symmetric multiprocessing (SMP) (1.5 marks)

- Each processor performs all tasks within the operating system.
- All processors are peers; no boss–worker relationship exists between processors

Asymmetric multiprocessing: (1.5 marks)

- Each processor is assigned a specific task.
- A boss processor controls the system; the other processors either look to the boss for instruction or have predefined tasks.
- This scheme defines a boss–worker relationship.
- The boss processor schedules and allocates work to the worker processors.

7. Explain the two modes of operations of operating system.

User mode (1.5 marks)

Kernel mode (1.5 marks)

Kernel model also called supervisor mode, system mode, or privileged 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). With the mode bit, we can distinguish between a task that is executed on behalf of the operating system and one that is executed on behalf of the user. When the computer system is executing on behalf of a user application, the system is in user mode. However, when a user application requests a service from the operating system (via a system call), the system must transition from user to kernel mode to fulfil the request.

8. What are the major activities of an operating system with regard to file management?

File Management –

- A file system is organized into directories for efficient or easy navigation and usage.
- OS keeps track of where information is stored, user access settings and status of every file and more...
- These facilities are collectively known as the file system.

File Management

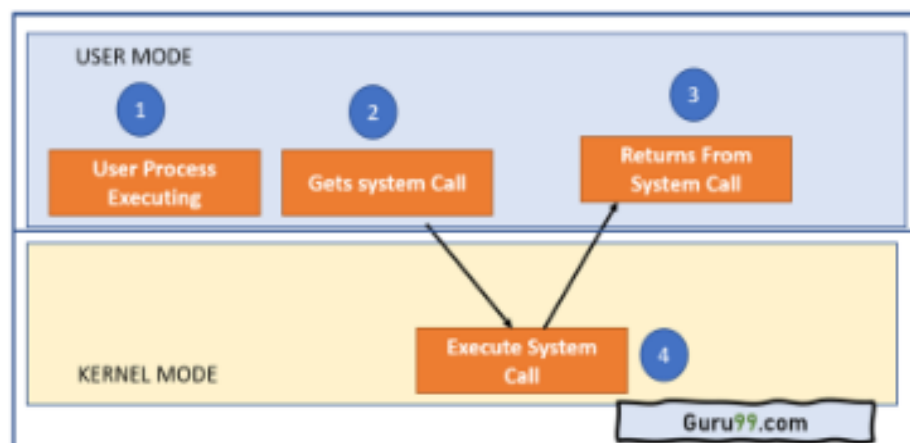
A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions. An Operating System does the following activities for file management – Keeps track of information, location, uses, status etc. The collective facilities are often known as file system. Decides who gets the resources, Allocates the resources and De-allocates the resources.

9. What are the operations taking place when a system call is executed?

- **How Does System Call Work?**

- **Step 1)** The processes executed in the user mode till the time a system call interrupts it.
- **Step 2)** After that, the system call is executed in the kernel-mode on a priority basis.

- **Step 3)** Once system call execution is over, control returns to the user mode.,
- **Step 4)** The execution of user processes resumed in Kernel mode.



10. What are multiprocessor systems? What are the advantages of multiprocessor systems?

❑ MultiProcessing System

| Asymmetric Multiprocessing | Symmetric Multiprocessing |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| In asymmetric multiprocessing, the processors are not treated equally. | In symmetric multiprocessing, all the processors are treated equally. |
| Tasks of the operating system are done by the master processor. | Tasks of the operating system are done individual processor |
| No Communication between Processors as they are controlled by the master processor. | All processors communicate with another processor by a shared memory. |
| In asymmetric multiprocessing, processes are master-slave. | In symmetric multiprocessing, the process is taken from the ready queue. |
| Asymmetric multiprocessing systems are cheaper. | Symmetric multiprocessing systems are costlier. |
| Asymmetric multiprocessing systems are easier to design | Symmetric multiprocessing systems are complex to design |

- **Advantages of Multiprocessor Systems**

- **More reliable Systems**

- In a multiprocessor system, even if one processor fails, the system will not halt.
 - This ability to continue working despite hardware failure is known as graceful degradation.
 - For example: If there are 5 processors in a multiprocessor system and one of them fails, then also 4 processors are still working.
 - So the system only becomes slower and does not ground to a halt.

- **Enhanced Throughput**

- If multiple processors are working in tandem, then the throughput of the system increases i.e. number of processes getting executed per unit

of time increase.

- If there are N processors then the throughput increases by an amount just under N.

- **More Economic Systems**

- Multiprocessor systems are cheaper than single processor systems in the long run because they share the data storage, peripheral devices, power supplies etc.
- If there are multiple processes that share data, it is better to schedule them on multiprocessor systems with shared data than have different computer systems with multiple copies of the data.

11. Write three advantages of peer-to-peer system over client server system.

Advantages of Peer-to-peer networking over Client –Server networking are :-



P2P technology behind torrents

- 1) It is easy to install and so is the configuration of computers on this network,
- 2) All the resources and contents are shared by all the peers, unlike server-client architecture where Server shares all the contents and resources.
- 3) P2P is more reliable as central dependency is eliminated. Failure of one peer doesn't affect the functioning of other peers. In case of Client –Server network, if server goes down whole network gets affected.
- 4) There is no need for full-time System Administrator. Every user is the administrator of his machine. User can control their shared resources.
- 5) The over-all cost of building and maintaining this type of network is comparatively very less.