



1) What is the difference between timesharing and multiprogramming systems?

→ Timesharing is the logical extension of multiprogramming only. The difference is that in multiprogramming we do achieve effective utilization of system resources (like C.P.U.) But we do not have any user interactions. While in multitasking we do have user interaction and then achieve effective utilization of system resources.

2) What is the difference between kernel and user mode? Explain how having two distinct modes aids in designing an operating system.

- when C.P.U in kernel mode, the code being executed can access any memory address and any hardware resource.
- Hence kernel mode is a very privileged and powerful mode.
 - If a program crashes in kernel mode, the entire system will be halted.
 - when CPU is in user mode the programs don't have direct access to memory and hardware resources.
 - In user mode, if any program crashes, only that particular program is halted. that means the system will be in a safe state even if a program in user mode crashes.
 - Hence, most programs in an OS run in user mode.

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3) which of the following instructions should be allowed only in kernel mode?

- For disable all interrupt kernel mode Required.
- In read the time of clock kernel mode not Required because it is for users.
- Set the time and change the memory map in both case kernel mode Required.

4) What is a trap instruction? Explain its use in operating systems.

- A trap instruction is basically a procedure call that synchronously transfers the control. It is thus a software interrupt and is generated by the user program or by the error when the operating system is needed by it so as to perform the system calls or an operation.
- Thus a trap instruction mainly switches from the user mode of the system to the kernel mode.

5) What is spooling? Do you think that advanced personal computers will have spooling as a standard feature in the future?

- Spooling is a process in which data is temporarily held to be used and executed by a device, program or the system. Data is sent to and store in memory or other volatile storage until the program or computer requests it for execution.
- Spool is technically an acronym for simultaneous peripheral operations online.
- It is maybe best feature like current time.



6) Briefly explain different design structures of the operating system.

→ i) monolithic r

Functionally of the O.S. is invoked with simple function calls within the kernel, which is one large program.

- Device drivers are loaded into the running kernel and become part of the kernel.

Ex Unix

ii) Layered Approach r

- This approach breaks up the operating system into different layers.
- This allows implementers to change the inner working and increases modularity.
- As long as the external interface of the routines don't change, developers have more freedom to change the inner working of the routines.
- Main advantage is easy to debugging.
- Disadvantage is that the O.S. tends to be less efficient than others implementations.

iii) microkernels r

- In this remove non-essential portions of the kernel and implementing them as system and user level programs.
- Generally provide minimal process and memory management and a communications facility.
- Advantage is extending the operating system become much easier, any changes to the kernel is smaller because it is small, The microkernel also provides more security and reliability.
- Main Disadvantage is poor performance due to increased system overhead from message passing.

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7) Briefly explain the steps involved in invocation of system call.

→ When a program in user mode requires access to RAM or a hardware resource, it must ask the Kernel to provide access to that resource. This is done via something called a system call.

- The system call constitutes of three parameters, file name, pointer to the buffer and number of bytes to read. The function call looks like,

Count = read (fd, buffer, nbytes)

- The Count consists of total number of bytes to read.

- 1st and 3rd Parameters are passed by value and 2nd is by reference i.e. buffer address.

- Now control is transferred to the read procedure.

- At this stage the parameters are pushed onto the stack.

- Then the system call number is put into the Register.

- TRAP instruction is executed that switches from user mode to kernel mode.

- Now the system call number is examined and then the dispatcher dispatches to the correct system call handler via table of pointers to the system call handler.

- After that the system call handler works.

- After the system call handler completes its task the control may be returned to the user-space library procedure.

- Then the control is transferred to the user program from the read procedure.

- Finally SP is incremented to clean up the stack. In this way the job of read system call is completed.



8) Compare Unix and Windows interface to use process.

→

Linux is free and open source operating system whereas windows is a commercial operating system whose source code is inaccessible.

- Windows is not customizable as against Linux is customizable and a user can modify the code and can change its look and feel.
- Linux provides high security than windows because Linux open source.
- Windows must boot from the primary partition. In contrast, there is no such constraint in Linux it can be booted from either primary or logical partition.
- The separation of the directories is done using a backslash ('\') in windows. On the contrary, in Linux these are separated by using forward slash.
- In Linux, file names are case sensitive while windows file names are case-insensitive.
- Linux uses the monolithic kernel which consumes more running space whereas windows uses the microkernel which takes less space but system running efficiency is lower than Linux.

→ What is difference between system call and Library function?

→ Library functions are portable which means an application using standard library function will run on all systems. While on the other hand an application relying on the corresponding system call interface may vary from system to system.

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- `malloc()` is library function call that further uses the `brk()` or `sbrk()` system call for memory allocation.
- A library function is linked to the user program and executes in user space while a system call is not linked to a user program and executes in kernel space.
- A library function execution time is counted in user level time while a system call execution time is counted as a part of system time.
- Library functions can be debugged easily using a debugger while system calls cannot be debugged as they are executed by the kernel.

10.) "Operating system as an extended machine" Justify.

- Users do not want to be involved in the programming of storage devices.
- Moreover, operating system provides a simple, high level abstraction such that these devices contain a collection of named files.
- Such files consist of the useful piece of information like a digital photo, email message or web pages.
- O.S. provides a set of basic commands for read, write, save, close.
- Also, dealing with them ~~then~~ is easier than directly dealing with hardware.
- Thus, operating system hides the complexity of hardware and presents a beautiful interface to users.
- Just as the O.S. shields the programmer from the disk hardware and presents a simple file oriented interface, it also conceals a lot of unpleasant business concerning interrupts, timers, memory management.



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- In each case, the abstraction offered by the operating system is simpler and easier to use than that offered by the underlying hardware.
- moreover, in this view, the function of the operating system is to present the user with the equivalent of an extended machine or virtual machine that is easier to work with than the underlying hardware.
- The operating system provides a variety of services that programs can obtain using special instructions called system calls.

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