Operating System [CS-301]

Tutorial 1

1119CS012

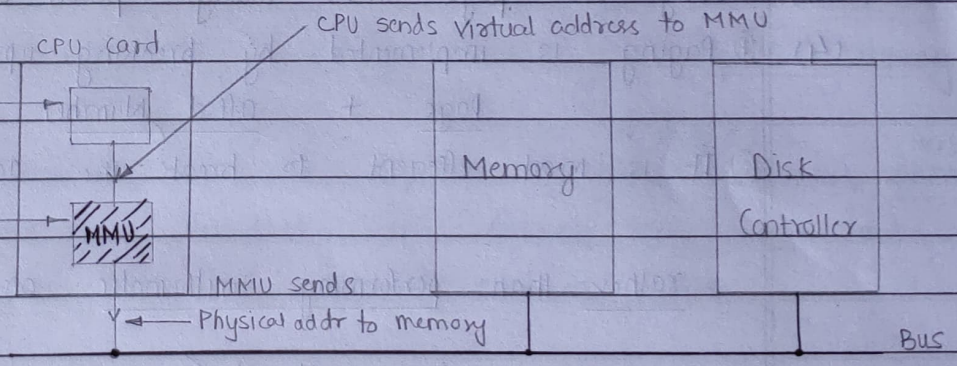
(1) An address generated by the CPU is also referred to as Physical address. True or False?

(1) False.

Since the address generated by CPU is called Logical address [Virtual Address], whereas the physical address is computed by the Memory Management Unit (MMU). [Address seen by memory unit is a physical address.

(2) What is the hardware device that maps virtual to Physical address?

(2) Memory Management Unit (MMU)



- In MMU scheme, the value in relocation register is added to every address generated by user process at the time it is sent to memory.
- The user program deals with logical address (it never sees the real physical address.

(3) Name two differences between logical and physical address.

BASICS: A Logical address does not refers to an actual existing address, rather it refers to an abstract address in an abstract address space.

A physical address refers to actual physical address in memory.

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Paramater	LOGICAL ADDRESS	PHYSICAL ADDRESS
① Basic	generated by CPU	Location in a memory unit
② Address space	Logical address space is set of all logical addresses generated by CPU in reference to a program	Physical address is set of all physical addresses mapped to corresponding logical addresses.
③ Visibility	User can view logical address of a program.	User can never view physical address of a program.
④ Generation	generated by the CPU	Computed by MMU
⑤ Access	The user can use the logical address to access the physical addr	The user can indirectly access Physical addr but not directly

(4) Why are page sizes always power of 2?

(4) ① Paging is implemented by breaking up an address into a

Page + Offset Number = Page Address

② It is most effecient to break the address into → X Page bits &
→ Y offset bits

rather than performing arithemetic on address to calculate Page no. & offset.

③ Page Number = (Virtual address) / (Page size) & Page offset = (virtual addr) % Page size

④ So, if page size is not of form (2^k), there would be extra computation for the same.

Eg: if address is 84 (10 10 100) & Page size = 16 (2^4)
(n-k) (k)
No. offset

the page no ⇒ 101

page offset = 0100

$VA/2^k = VA \gg K$

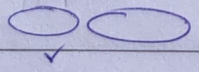
$VA \% (2^k) = VA \& (2^k - 1)$

[each bit position represents a power of 2]

⑤ Therefore, page sizes are always in power of 2

[Avoid extra computation]

address



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(5) An application Program is being designed and developed for a microprocessor based controller for an automobile. The application is required to perform the following functions:

- Monitor and display speed of the automobile
- Monitor the fuel level and raise an alarm (if necessary)
- Display the Fuel effeciency
- Monitor the engine condition and raise an alarm if unusual condition is detected
- Periodically record some auxillary information like speed, fuel etc.

(a) Is this a real time application. Justify your answer.

(a) Yes, this is a Real time application.

Real time system is a system that is put through real time which means response is obtained within a specified timing constraint.

In above Application, we are required to monitor (& record) various parameters like engine, Speed and fuel Periodically in current time frame and also raise alarm if unusual condition arises.

(b) It is proposed to create multiple processes to reduce the response time of the application. Enlist the process that should be in it. Specify the priorities.

① Monitor Engine Condition
② Alarm if Engine is in unusual condition
③ Monitor Fuel levels
④ Display Fuel levels
⑤ Monitor Speed
⑥ Display Speed
⑦ Repeat the step ① to ⑥ periodically.

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(6) Explain the differences between (a) single user single tasking OS
(b) Multitasking OS
(c) Multiprogramming OS

(6) (a) Single user single tasking OS

① An operating system that allows a single user to perform only one task at a time is called single user single tasking OS.

② Function like printing a document, downloading images can be performed only one at a time.

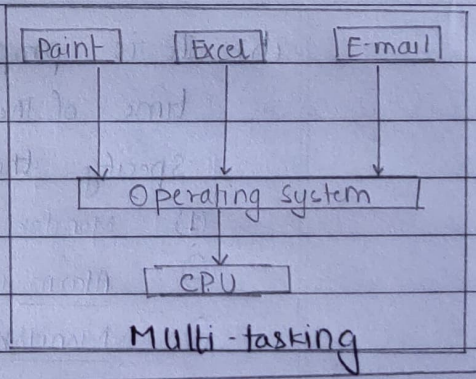
③ Eg: MS-DOS & Palm OS.

Advantage = uses less memory

Disadvantage = CPU is super fast device and keeping it occupied for a single task is never a good idea.

(b) Multi-tasking OS

① Multi-tasking is a logical extension of multiprogramming. In multi-tasking, the CPU executes multiple jobs by switching among them typically using a small time quantum, and the switches occur so frequently that the user can interact with each program while it is running.

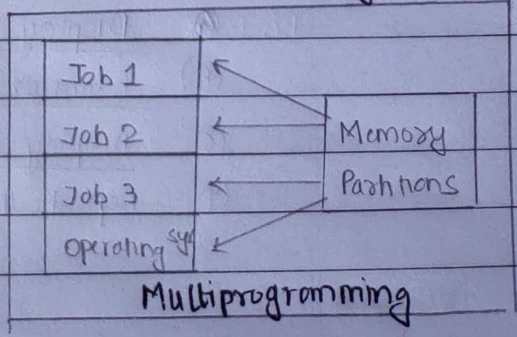


Multi-tasking

(c) Multi programming OS

① Multiprogramming increases CPU utilization by organizing jobs (code and data) so that CPU always has one to execute.

② The idea is to keep multiple jobs in main memory. If one job gets occupied with IO, CPU can be assigned to other job.



Multiprogramming

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Single tasking	Multiprogramming	Multi-tasking
① No concept of Context switching (only 1 task)	① Concept of context switching is used.	① Context switching & Time sharing is used.
② OS simply focussed on one task until its completed.	② The OS simply switches to, and executes, another job when current job when current job needs to wait.	② The processor is typically used in time sharing switching happens when either allowed time expires or process need IO.
③ CPU utilization & effeciency is decreased	③ It increases CPU utilization by organization jobs	③ It increases responsiveness and also increase CPU utilization.
④ CPU idle time is maximum among all three OS.	④ The idea is to reduce CPU idle time for as long as possible.	④ The idea is to further extend the CPU utilization concept by increasing responsiveness Time sharing

(7) What do you mean by Kernel and Microkernel?

(7) Kernel (i) Manages communication between hardware and software

(ii) Responsible for managing memory, I/O to memory, cache, hard drive.

(iii) Handles device signals, task scheduling, & other essential duties

(iv) The kernel is one of the first components loaded into memory during the boot process and remain active as long as computer is operational

(v) Kernels are Flexible, ie (UNIX, administrators, can tweak the kernels to best suit their requirments). [kernels affects OS's capabilities]

computers.

Microkernel (i) It is compact, performing only basic functions universal to all

functions

(ii) Microkernel works with OS-specific servers that provide higher level

(iii) This component-based structure improves a system's portability, but at expense of performance. Eg: Tru64 UNIX, GNU Hurd, Mac OS X.