Winter 2014

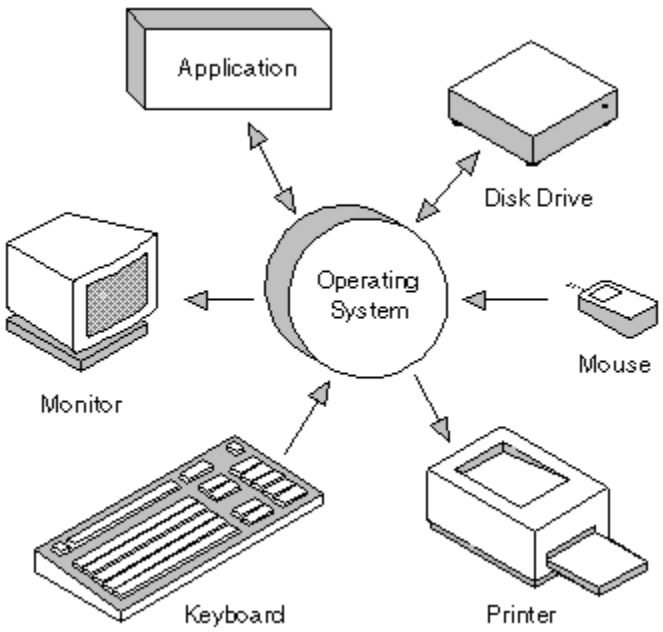
Master of Computer Application (MCA) – Semester 2
MCA2010 – Operating System

1. Define operating system. Explain any four major functions of Operating system.

Ans: Operating System

Operating System is a System Software (Set of system programs) which provides an environment to help the user to execute the programs. The Operating System is a resource manager which allocates and manages various resources like processor(s), main memory, input/output devices and information on secondary storage devices. The operating system is the most important program that runs on a computer. Every general-purpose computer must have an operating system to run other programs. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.

For large systems, the operating system has even greater responsibilities and powers. It is like a traffic cop -- it makes sure that different program and users running at the same time do not interfere with each other. The operating system is also responsible for security, ensuring that unauthorized users do not access the system.



Four major functions of operating system

Operating systems perform the following important functions:

1. **Processor Management:** It means assigning processor to different tasks which has to be performed by the computer system.
2. **Memory Management:** It means allocation of main memory and secondary storage areas to the system program, as well as user programs and data.
3. **Input and Output Management:** It means co-ordination and assignment of the different output and input devices while one or more programs are being executed.
4. **File System Management:** Operating system is also responsible for maintenance of a file system, in which the users are allowed to create, delete and move files.

2. Explain the different process states.

Ans: A process is executed sequentially, one instruction at a time. A program is a passive entity. Example: a file on the disk. A process on the other hand is an active entity. In addition to program code, it includes the values of the program counter, the contents of the CPU registers, the global variables in the data section and the contents of the stack that is used for subroutine calls. In reality, the CPU switches back and forth among processes.

A process being an active entity, changes state as execution proceeds. A process can be any one of the following states:

- New: Process being created.
- Running: Instructions being executed.
- Waiting (Blocked): Process waiting for an event to occur.
- Ready: Process waiting for CPU.
- Terminated: Process has finished execution.

Locally, the 'Running' and 'Ready' states are similar. In both cases the process is willing to run, only in the case of 'Ready' state, there is temporarily no CPU available for it. The 'Blocked' state is different from the 'Running' and 'Ready' states in that the process cannot run, even if the CPU is available.

These above states are arbitrary and very between operating systems. Certain operating systems also distinguish among more finely delineating process states. It is important to realize that only one process can be running on any processor at any instant. Many processes may be ready and waiting. A state diagram (Figure 2.1) is used to diagrammatically represent the states and also the events that trigger the change of state of a process in execution.

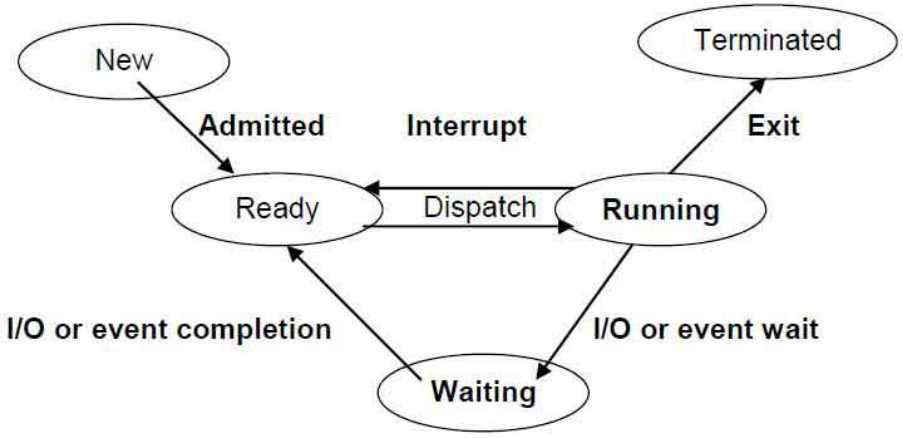


Fig. 2.1: Process state diagram

3. Define Deadlock. Explain necessary conditions for deadlock.

Ans: Deadlock occurs when we have a set of processes [not necessarily all the processes in the system], each holding some resources, each requesting some resources, and none of them is able to obtain what it needs, i.e. to make progress. We will usually reason in terms of resources R1, R2... Rm and processes P1, P2... Pn. A process Pi that is waiting for some currently unavailable resource is said to be blocked.

Resources can be pre-emptable or non-pre-emptable. A resource is pre-emptable if it can be taken away from the process that is holding it [we can think that the original holder waits, frozen, until the resource is returned to it]. Memory is an example of a pre-emptable resource. Of course, one may choose to deal with intrinsically pre-emptable resources as if they were non-pre-emptable. In our discussion we only consider non-pre-emptable resources.

Resources can be reusable or consumable. They are reusable if they can be used again after a process is done using them. Memory, printers, tape drives are examples of reusable resources. Consumable resources are resources that can be used only once, for example a message, a signal or an event. If two processes are waiting for a message and one receives it, then the other process remains waiting. To reason about deadlocks when dealing with consumable resources is extremely difficult. Thus we will restrict our discussion to reusable resources.

Necessary Conditions for Deadlock

A deadlock occurs in a system if the following four conditions hold simultaneously:

1) *Mutual exclusion*: At least one of the resources is non-sharable, that is, only one process at a time can use the resource.

2) *Hold and wait*: A process exists that is holding on to at least one resource and waiting for an additional resource held by another process.

3) *No preemption*: Resources cannot be preempted, that is, a resource is released only by the process that is holding it.

4) *Circular wait*: There exist a set of processes P0, P1… Pn of waiting processes such that P0 is waiting for a resource held by P1, P1 is waiting for a resource held by P2… Pn-1 is waiting for a resource held Pn and Pn is in turn waiting for a resource held by P0.

4. Differentiate between Sequential access and Direct access methods.

Ans:

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