OPERATING SYSTEM

⇒ OPERATING SYSTEM

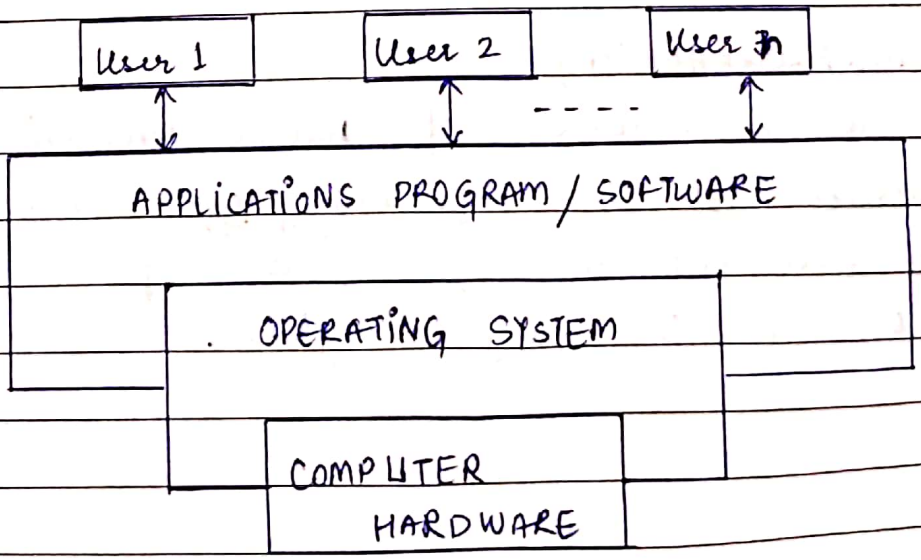
An operating system is a program that controls the execution of application programme and acts as an interface b/w applications and the computer hardware.

⇒ OBJECTIVES

- **Convenience** : An operating system makes a computer convenient to use.

- **Efficiency** : An operating system allows the computer system resources to be used in an efficient manner.

- **Ability to solve** : An operating system should be constructed in such a way as to permit the effective development, testing & introduction of new system functions without interferring with service.



⇒ EXAMPLES OF OS

- Linux ⇒ Federa, Ubuntu, Parrot OS
- Windows ⇒ 7, 8, 10
- Android
- iOS

TYPES OF OS

⇒ BATCH OS

Process requires 2 types of time for execution :
CPU time & I/O time

The users of Batch OS do not interact with the computer directly. Each user prepares the job of an offline device like punch cards, tape drives and submit it to the computer speed up processing. Jobs with similar needs are batched together & run as a group.

- Lack of interaction b/w the user & job.
- CPU is often idle (because speed of mechanical I/O device is slower than CPU)
- Starvation : When the jobs are in starve position (they may not find no. of resources immediately)

⇒ MULTIPROGRAMMING

It is an extension of batch processing system. Wherever job is requiring some I/O device, the CPU will pick next job. With the use of multiprogramming CPU will be busy everytime.

⇒ MULTITASKING (TIME SHARING)

It is an extension of multiprogramming. In this, CPU will choose from any of the job, each process will get the chance to execute in a periodic manner. Interaction with CPU is more and more. "With preemption, multiprogramming is similar to multitasking."

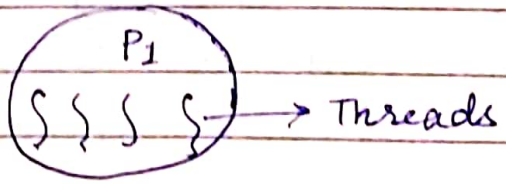
⇒ MULTIPROCESSING

It is the use of two or more CPUs within a single computer system. The term also refers to the ability of a system to support more than one processor or the ability to alocate tasks between them. Each sharing main memory and peripherals in order to simultaneously process programs. Reliability is very high.

e.g.: Dual core, quad core, octa core etc.

⇒ MULTI THREADING

It is the ability of a CPU or a single core to execute multiple threads concurrently. It slightly differs from multiprocessing. Multithreading aims to increase utilization of single core by using thread level as well as instruction level parallelism.



A process P_1 with four threads of execution running on single processor.

⇒ REAL TIME SYSTEM → Hard
→ Soft

It is an OS intended to serve real time applications that process data as it comes without buffer delays. Processing time requirements including any OS delay are measured in tenths of seconds or shorter time limit.

(I) Hard Real Time: If system won't execute in a certain deadline then any crash may happen in surroundings. e.g: devices used in medical industry, defence & airways.

(II) Soft Real Time: fractions of delay can be considerable. eg: domestic devices like automated AC, automated washing machine etc.

⇒ PROCESS SCHEDULING

It is the activity of the process manager that handles the removal of the running process from the CPU and selection of another process on the basis of a particular strategy or method.

⇒ SCHEDULERS

These are the special system softwares which handle process scheduling in various ways / method. Their main task is to select the job to be submitted into the system and to decide which process to run.

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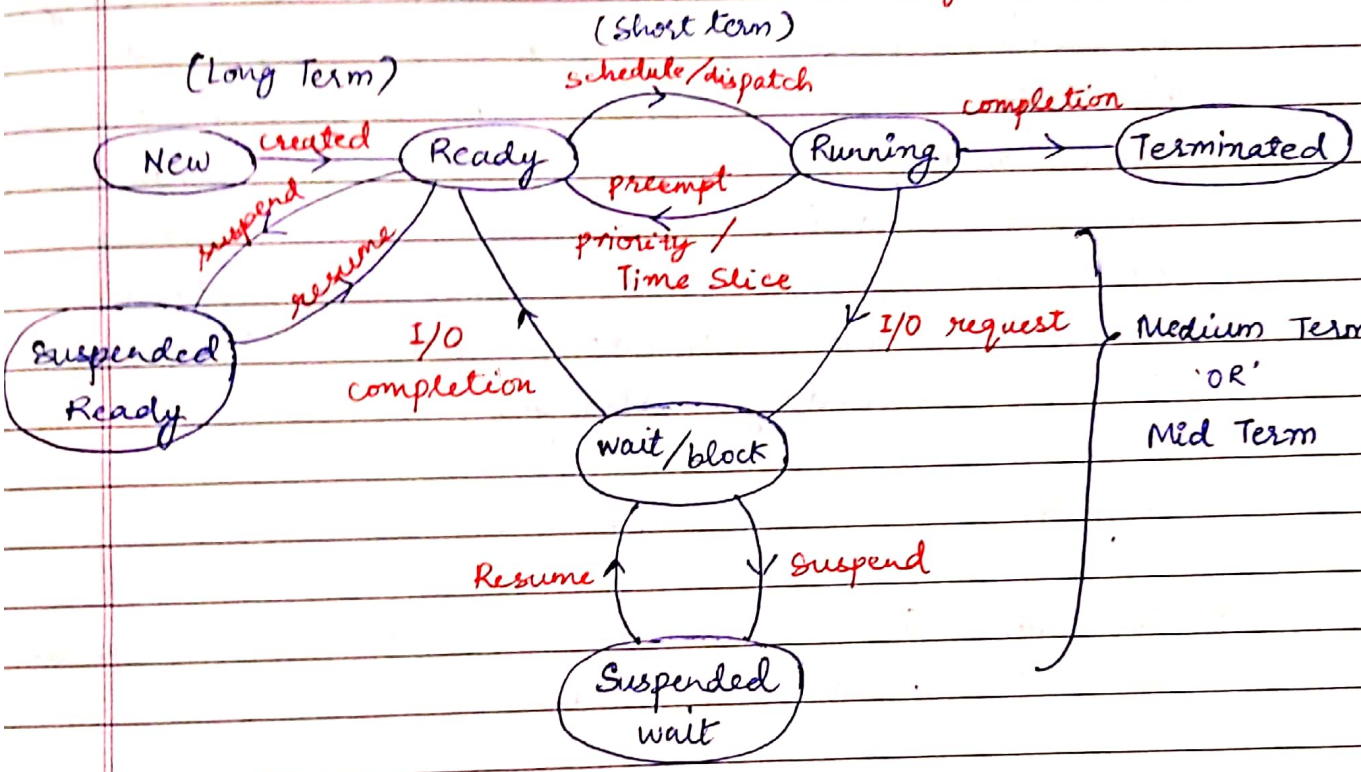
→ TYPES OF SCHEDULERS → Long Term
→ Short Term
→ Medium Term

– Process State Transition Diagram –



(I) Long Term / Job Scheduler : It determines which programs are submitted to the system for processing. It selects processes from the queue and loads them into memory for execution. Process loads into memory for CPU scheduling.

(II) Short Term / CPU Scheduler : Its main objective is to increase system performance. It is the change of ready state to running state of the process. CPU scheduler selects a process among the processes that are ready to execute and allocates CPU to one of them. It is also known as 'dispatcher', makes the decision of

which process to execute next. These are faster than long term schedulers.

(III) Medium / Mid Term: It is a part of swapping. It removes the processes from the memory. A running process may become suspended if it makes an IO request. A suspended process can't make any progress towards completion. In this condition, to remove the process from memory & make space for other processes, the suspended process is moved to the secondary storage.

⇒ DESCRIPTION OF THE STATES:

→ NEW STATE: This is the initial state when a process is first started or created.

→ READY STATE: Process may come into this state after start state or while running it by but interrupted by the scheduler to assign CPU to some other process.

→ RUNNING STATE: Once the process has been assigned to a processor by the OS scheduler.

→ WAITING STATE: Process moves into waiting state if it needs to wait for a resource such as waiting for user input, waiting for a file to become available.

→ TERMINATED STATE : Once the process finishes its execution.

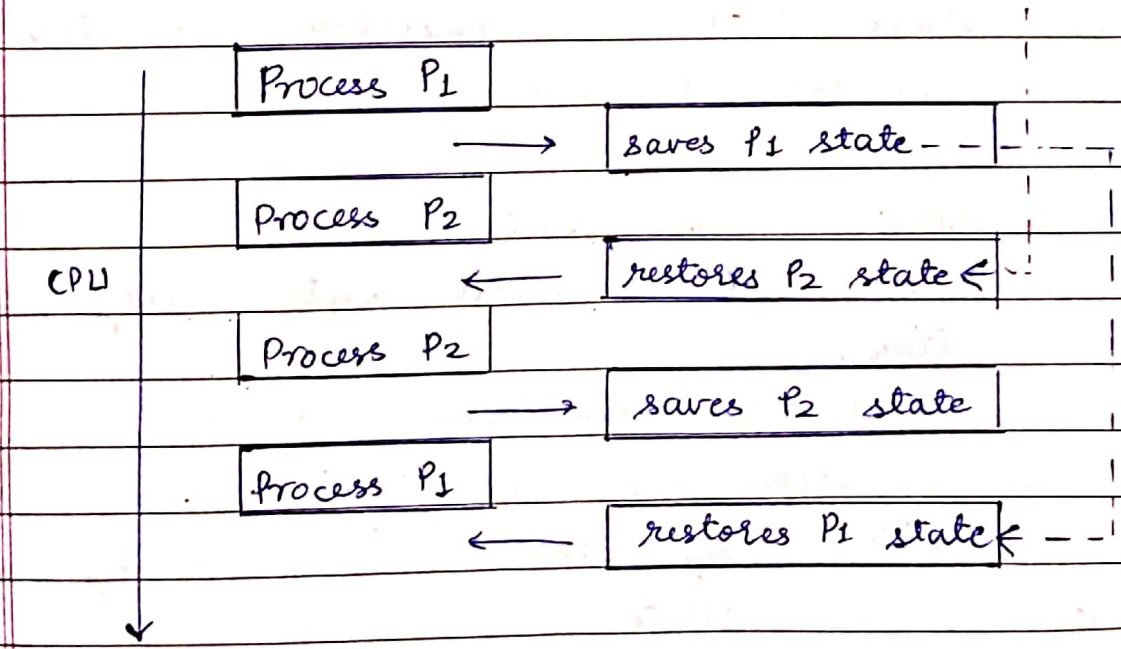
→ SUSPEND READY : Process that was initially in the ready state but was swapped out of main memory & placed onto external storage by scheduler.

→ SUSPEND WAIT / BLOCK : It is similar to suspend ready but uses the process which was performing I/O operation and lack of main memory.

NOTE: CPU & I/O bound processes :

If the process is intensive in terms of CPU operations then it is called CPU bound process.
If the process is intensive in terms of I/O operations then it is called I/O bound process.

⇒ CONTEXT SWITCHING



It is the mechanism to store & restore the state or context of CPU in process controlled block so that a process execution can be

resumed from the same point at a later time.

→ CPU SCHEDULING

Whenever the CPU becomes idle, the OS must select one of the processes in the ready queue to be executed. The selection of process is carried out by the short term scheduler. The scheduler selects a process from the processes in memory that are ready to execute and allocates the CPU to that process.

(1.) PRE-EMPTIVE SCHEDULING:

Process is forcefully removed from the CPU.

- when a process switches from running to waiting state (invocation of wait).
- When a process switches from running to ready state (when an interrupt occurs).
- when a process switches from waiting to ready state (at the completion of I/O).
- When a process terminates.

(2.) NON-PREEMPTIVE SCHEDULING:

Processes are not removed until they comp the execution.

Once the CPU has been allocated to a process the process keeps the CPU until it releases the CPU either by termination or by switch to the waiting state.

⇒ DISPATCHER

It is the module that gives control of the CPU to the process selected by the short term scheduler. It involves switching context.

⇒ DISPATCH LATENCY

The time it takes for the dispatcher to stop one process & start another running process is known as dispatch latency.

⇒ SCHEDULING CRITERIA

1. **CPU Utilization :** We want to keep CPU as busy as possible upto 90%.

2. **Throughput :** No. of processes that are completed per unit time are called throughput.

⇒ DEGREE OF MULTIPROGRAMMING

The no. of processes that can reside in the ready state at maximum decides the degree of multiprogramming. For example, if degree of multiprogramming is 100 then it means 100 processes can reside in the ready state at maximum.