

Classification of OS

Resident Monitor

- Early (oldest) OS resides in memory and monitor execution of the programs. If it fails, error is reported.
- OS provides hardware interfacing that can be reused by all the programs.

Batch Systems

- The batch/group of similar programs is loaded in the computer, from which OS loads one program in the memory and execute it. The programs are executed one after another.
- In this case, if any process is performing IO, CPU will wait for that process and hence not utilized efficiently.

Multi-Programming

- In multi-programming systems, multiple program can be loaded in the memory.
- The number of program that can be loaded in the memory at the same time, is called as "degree of multi-programming".
- In these systems, if one of the process is performing IO, CPU can continue execution of another program. This will increase CPU utilization.
- Each process will spend some time for CPU computation (CPU burst) and some time for IO (IO burst).
 - If CPU burst > IO burst, then process is called as "CPU bound".
 - If IO burst > CPU burst, then process is called as "IO bound".
- To efficiently utilize CPU, a good mix of CPU bound and IO bound processes should be loaded into memory. This task is performed by an unit of OS called as "Job scheduler" OR "Long term scheduler".
- If multiple programs are loaded into the RAM by job scheduler, then one of process need to be executed (dispatched) on the CPU. This selection is done by another unit of OS called as "CPU scheduler" OR "Short term scheduler".

Multi-tasking OR time-sharing

- CPU time is shared among multiple processes in the main memory is called as "multi-tasking".
- In such system, a small amount of CPU time is given to each process repeatedly, so that response time for any process < 1 sec.
- With this mechanism, multiple tasks (ready for execution) can execute concurrently.
- There are two types of multi-tasking:
 - Process based multitasking: Multiple independent processes are executing concurrently. Processes running on multiple processors called as "multi-processing".
 - Thread based multi-tasking OR multi-threading: Multiple parts/functions in a process are executing concurrently.

Multiprocessor systems

- The systems in which multiple processors are connected in a close circuit is called as "multiprocessor computer".
- The programs/OS take advantage of multiple processors in the computer are called as "Multiprocessing" programs/OS.

- Windows Vista: First Windows OS designed for multi-processing.
- Linux 2.5+: Linux started supporting multi-processing.
- Modern PC architectures are multi-core arch i.e. multiple CPUs on single chip.
- Since multiple tasks can be executed on these processors simultaneously, such systems are also called as "parallel systems".
- Parallel systems have more throughput (Number of tasks done in unit time).
- There are two types of multiprocessor systems:
 - Asymmetric Multi-processing
 - Symmetric Multi-processing

Asymmetric Multi-processing

- OS treats one of the processor as master processor and schedule task for it. The task is in turn divided into smaller tasks and get them done from other processors.

Symmetric Multi-processing

- OS considers all processors at same level and schedule tasks on each processor individually.
- All modern desktop systems are SMP.

Multi-user

- Multiple users can execute multiple tasks concurrently on the same systems. e.g. IBM 360, UNIX, Windows Servers, etc.
- Each user can access system via different terminal.
- There are many UNIX commands to track users and terminals.
 - tty, who, who am i, whoami, w