ODHS TaskPhase-5

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This task is to help you understand what is an Operating system, and how it processes different tasks on the computer.

1. Types of operating systems
2. How operating systems and kernels work
3. Context switching
4. Scheduling & gaunt charts
5. First come first serve, Shortest job first and Round robin scheduling algorithms

Make a single report on these topics.

Submit your reports as pdf or word only to parikshit.odhs@gmail.com

Deadline: 24th November 2023, time: 23:59

Types of operating systems

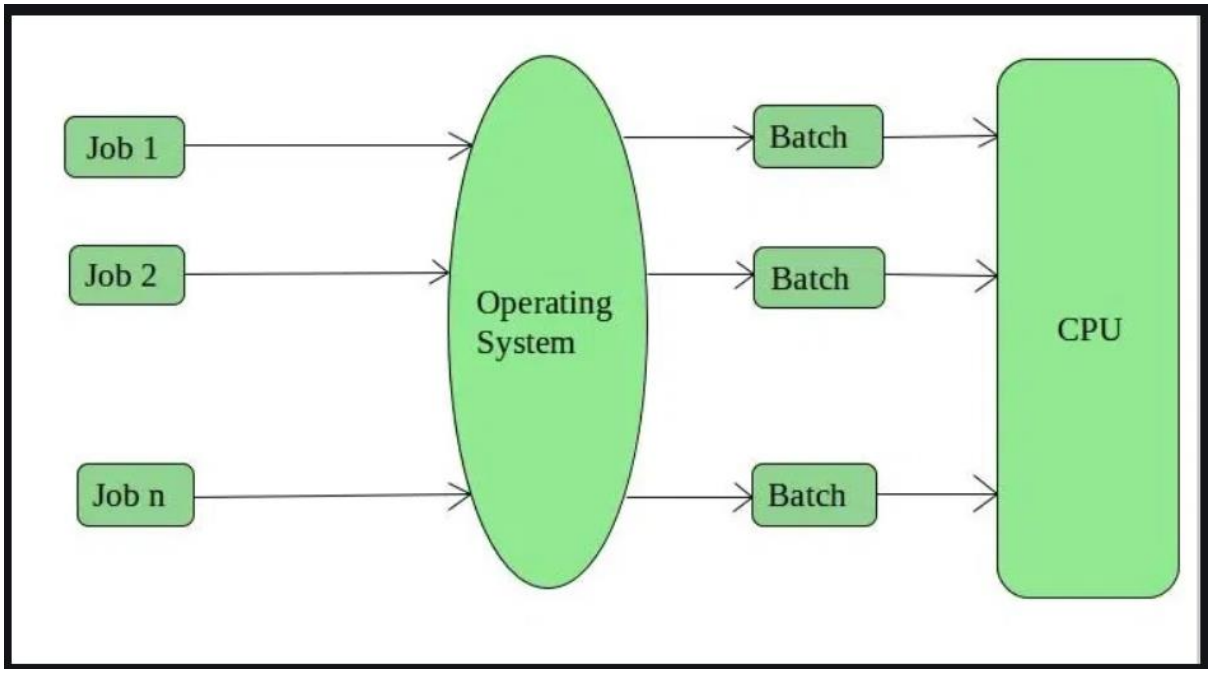
Batch Operating System

This type of operating system does not interact with the computer directly.

There is an operator who takes similar jobs having the same requirement and groups them into batches.

It is the responsibility of the operator to sort jobs with similar needs.

Eg:- payroll systems, bank statements etc.



Advantages:-

Multiple users can share

Very less idle time

Easy to manage large work repeatedly

Disadvantage:-

Computer operator should know how to operate

Hard to debug

Costly

Other jobs need to wait for unknown time if a job fails

Multi-Programming Operating System

This type of operating system allows more than one program to be present in the main memory, and any one of them can be kept in execution. This is basically used for better execution of resources.

Eg:- windows, linux.

Advantages

Increases throughput of the system

Reduces response time

Disadvantage

No user interaction with the system on hardware level.

Multi-Processing Operating System

This type of operating system uses more than one CPU for the execution of resources. It betters the throughput of the system.

Eg:- Unix, Linux

Advantages

Increases throughput

If one processor fails , work can be shifted onto the other processor

Disadvantages

Due to multiple processors, is very complex

A need for inter-processor communication

Sharing of memory.

Multi-Tasking Operating System

This type of operating system allows more than one task to be executed simultaneously.

Needs proper memory management.

Eg:- windows, linux etc

Two types :-

Preemptive

In this the OS decides how long a tasks should run and interrupts it and gives control to other task

Cooperative

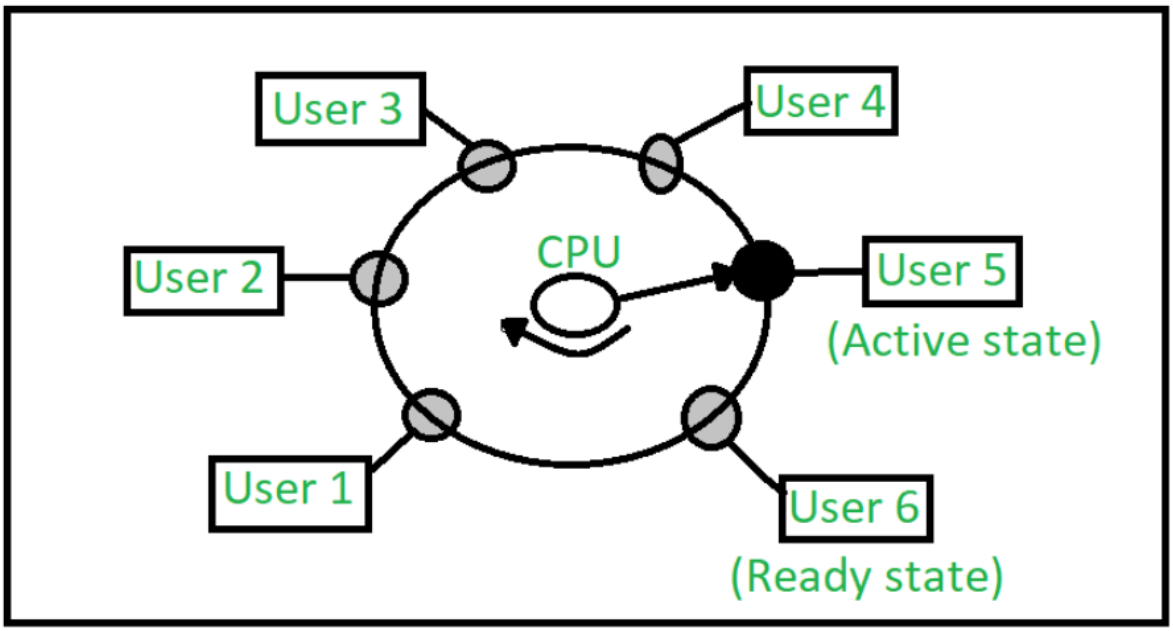
OS never initiates context switching , occurs only when the task itself gives back control.

Eg:- macintosh OS 8.0.

Time-Sharing Operating System

This type of operating system allows multiple users to use the same computer simultaneously.

Eg:- windows terminal services, Time Sharing Option (IBM)



Advantages

CPU idle time can be reduced.

Resource sharing, cpu memory and peripherals reducing costs

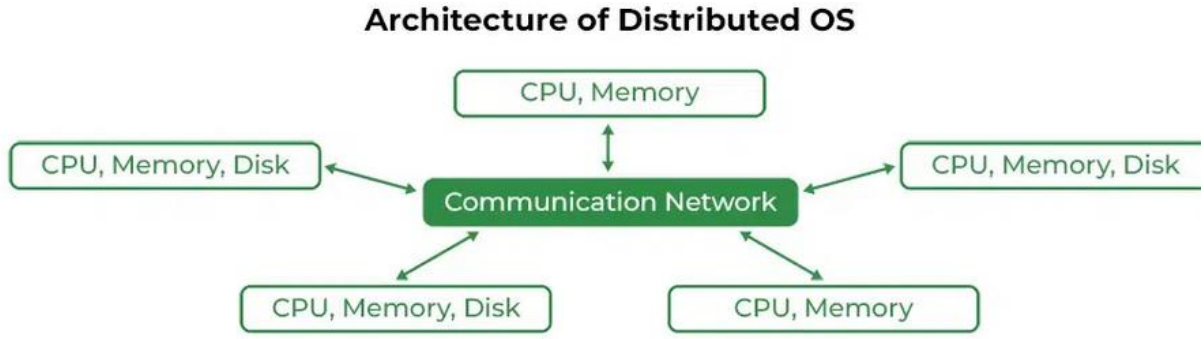
Disadvantages

Reliability problem

Security Risks: With multiple users sharing resources, the risk of security breaches increases. Time-sharing systems require careful management of user access, authentication, and authorization to ensure the security of data and software

Distributed Operating System

This type of operating system manages a group of independent computers and makes them appear to be a single computer. Eg:- LOCUS



Advantages

Failure of one will not affect the other network communication, as all systems are independent of each other

Load on host computer reduces.

These systems are easily scalable as many systems can be easily added to the network

Disadvantages

Failure of the main network will stop the entire communication.

To establish distributed systems the language is used not well-defined yet.

Network Operating System

This type of operating system is designed to run on a server and allows multiple computers to communicate with each other. Eg:- Windows server, centOS,

Real-Time Operating System

This type of operating system is designed to process data as it comes in, typically without buffering delays

Used in missile systems, robots, air traffic control etc

These types of systems are error-free

Less task shifting

Maximum utilization of devices and systems

Only limited tasks

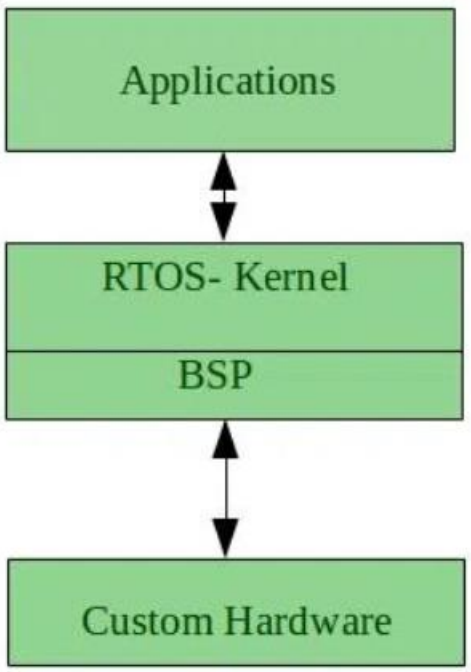
Types

Hard Real-Time Systems:

Hard Real-Time OSs are meant for applications where time constraints are very strict and even the shortest possible delay is not acceptable. These systems are built for saving life like automatic parachutes or airbags which are required to be readily available in case of an accident. Virtual memory is rarely found in these systems.

Soft Real-Time Systems:

These OSs are for applications where time-constraint is less strict.



Resource:-

https://www.geeksforgeeks.org/types-of-operating-systems/

Operating system and kernel

The kernel is the central component of an operating system. It provides low-level functionalities to enable communication between hardware and software.

It directly interacts with the hardware and manages its resources, including memory, CPU, input/output devices, etc. It provides essential services like process management, memory management, device management, file system management etc.

The kernel enforces security measures to protect the system from unauthorized access, viruses, and other threats. It controls access to resources and ensures that processes cannot interfere with each other's memory space.

The kernel manages file systems, handling file creation, deletion, reading, and writing. It provides an interface for applications to access and manipulate files stored on storage devices

allocates and deallocates memory as needed, performs virtual memory management (including swapping data between RAM and disk storage), and ensures memory protection to prevent one process from accessing another's memory.

includes schedulers that determine how processes and threads are allocated CPU time. Different scheduling algorithms manage priorities, fairness, and optimization of resource utilization.

The kernel manages interrupts triggered by hardware devices. When a device needs attention (such as a keystroke on the keyboard or data arriving from a network), an interrupt is generated. The kernel handles these interrupts, ensuring that the appropriate device driver or system process responds accordingly.

3 main Types:-

Monolithic-all services in the same address space. Uses faster system call protocol. If any service fails , entire system shuts down. Requires less source code so less bugs. Not as flexible thus for a new service requires extensive work.

Microkernel- creates different addresses for different services. So even if one service fails, it doesn't affect other services. Uses message passing. (?)

Hybrid kernel- it is a combination of the monolithic kernel and microkernel, it has increased modularity, and parts of the OS gain memory protection

Eg:-

Linux- monolithic

Windows- NT kernel hybrid

Apple's OS/devices- XNU kernel hybrid

Exokernel???—gives direct access to hardware resources

Resource:-

https://www.techtarget.com/searchdatacenter/definition/kernel

https://www.youtube.com/watch?v=IvGdY6luTtU

Context switching

Fundamental operation where kernel switches the cpu from executing one program/thread to another.

When a process is running, other processes with the highest priority queue up to use the CPU to complete their job. Switching the CPU to another process requires performing a state save of the current process and a state restore of a different process. This task is known as a context switch.

When a context switch occurs, the kernel saves the context of the old process in its Process Control Block (PCB) and loads the saved context of the new process scheduled to run.

Context-switch time is pure overhead, because the system does no useful work while switching .

Switching speed varies from machine to machine, depending on the memory speed, the number of registers that must be copied, and the existence of special instructions (such as a single instruction to load or store all registers).(A typical speed is a few milliseconds.)

Context-switch times are highly dependent on hardware support.

For instance, some processors provide multiple sets of registers. A context switch here simply requires changing the pointer to the current register set.

Scheduling

Scheduling in operating systems involves managing the allocation of resources (like CPU time, memory, and peripheral devices) to different tasks or processes efficiently.

There are various scheduling algorithms used by the operating system, such as First-Come, First-Served (FCFS), Shortest Job Next (SJN), Round Robin, etc.

These algorithms determine the order and duration of process execution, aiming to optimize resource utilization, minimize waiting times, and enhance system performance.

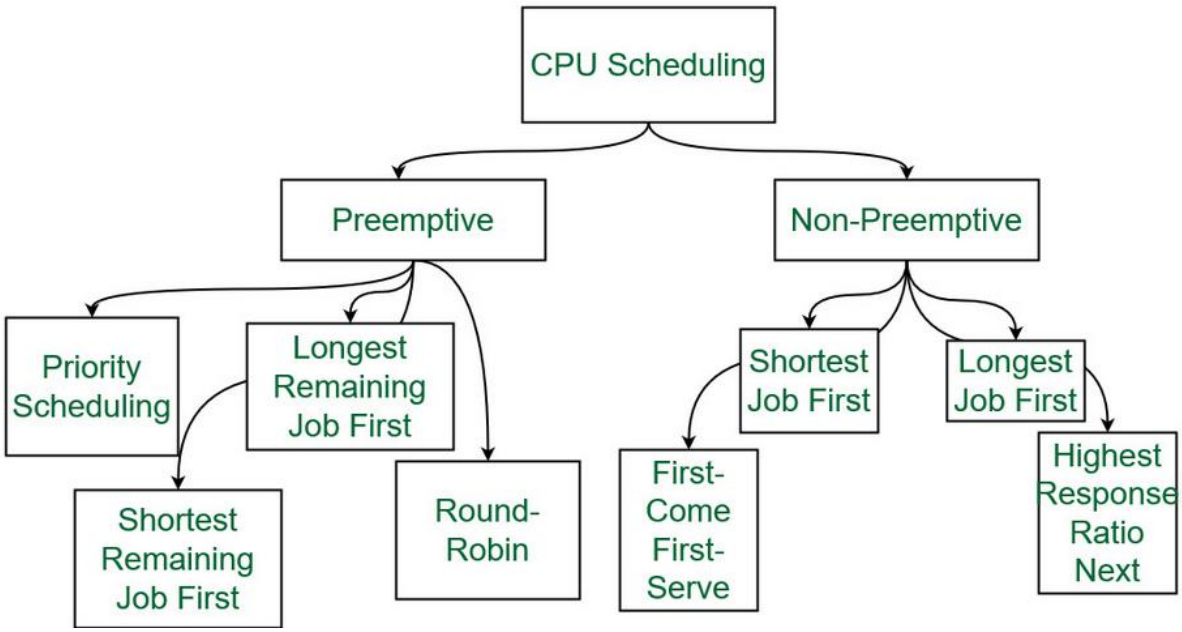
Types of scheduling

Preemptive scheduling:-

used when a process switches from running state to ready state or from the waiting state to the ready state

non-preemptive scheduling

used when a process terminates , or when a process switches from running state to waiting state.



Resource:-

https://www.geeksforgeeks.org/cpu-scheduling-in-operating-systems/

Gantt Charts

Gantt charts are visual tools used in project management to illustrate the scheduling and progress of tasks over time. They display tasks as horizontal bars along a timeline, showing when each task starts, its duration, and when it finishes.

They are effective for planning, monitoring, and communicating project timelines and task allocation.

Resource:-

http://www.gchamirpur.org/wp-content/uploads/2023/07/Unit-II-Lecture-9-Scheduling-Part-II.pdf

scheduling algorithms

first come first serve (FCFS)

simplest scheduling algorithm

the process that requests CPU firsts is allocated first.

Uses FIFO Queue.

supports non-preemptive and preemptive CPU scheduling algorithms

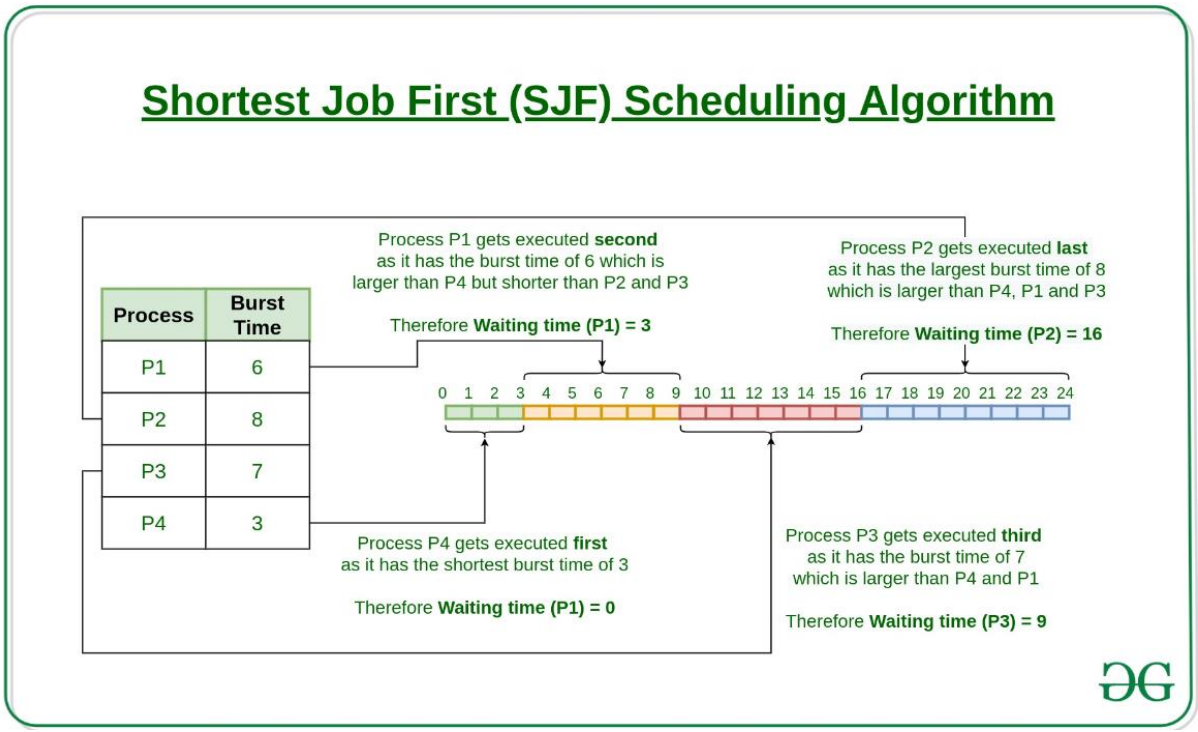
is easy to implement

not efficient as high wait times

suffers from convoy effect(?)

Shortest job first

Selects the waiting process that has the smallest execution time to execute first.



minimum average waiting time among all other scheduling algorithms

may cause starvation if shorter processes keep coming. Can be solved using the concept of ageing.

Many times it becomes complicated to predict the length of the upcoming CPU request

Round robin scheduling

Each process is cyclically given a fixed time slot i.e.time sharing technique.

Preemptive version of first come first serve

Starvation free as all processes get balanced cpu allocation

Widely used

Is considered preemptive as cpu is given for a limited time.

resource:-

https://www.geeksforgeeks.org/cpu-scheduling-in-operating-systems-using-priority-queue-with-gantt-chart/