

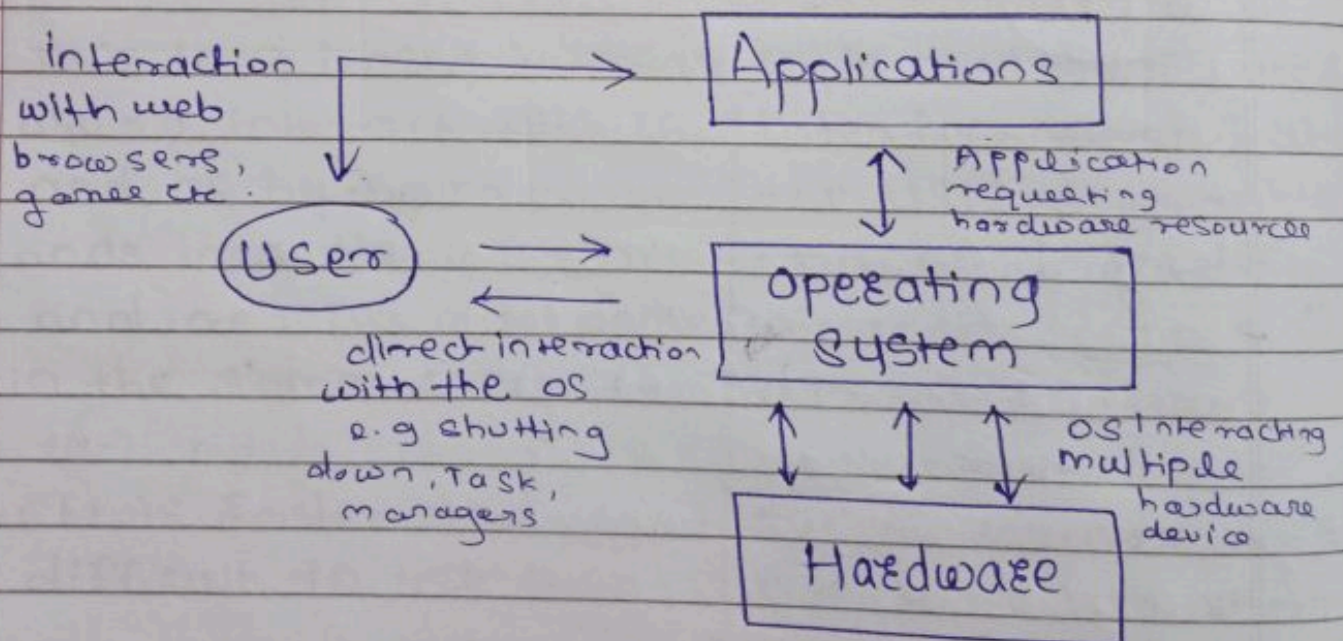
Overview of operating System

Defination :

An operating System (OS) is a software program that acts as an interface between a computer's hardware and its users.

It is a fundamental component of any computer system and manages the overall operations of a computer or a network of computers.

The main purpose of an operating system is to provide a convenient and efficient way for users to interact with the computer system.



Different types of operating system exist, including general-purpose operating system like windows, macos, & Linux as well as specialized operating system for specific devices or application (e.g. real time).

operating system for smartphones).

—: Dual Mode Operation :-

Dual mode operation, also known as dual privilege mode or privileged mode, is a feature of modern operating systems that enables a clear distinction between privileged and non-privileged operations.

In dual mode operation, the processor or CPU (Central Processing Unit) operates in two distinct modes.

1] User Mode : ① In this mode, the CPU executes instructions on behalf of user application or processes.

② The user mode provides a restricted environment where application can run, but they have limited access to system resources.

③ User mode application cannot directly access hardware devices or perform privileged operations.

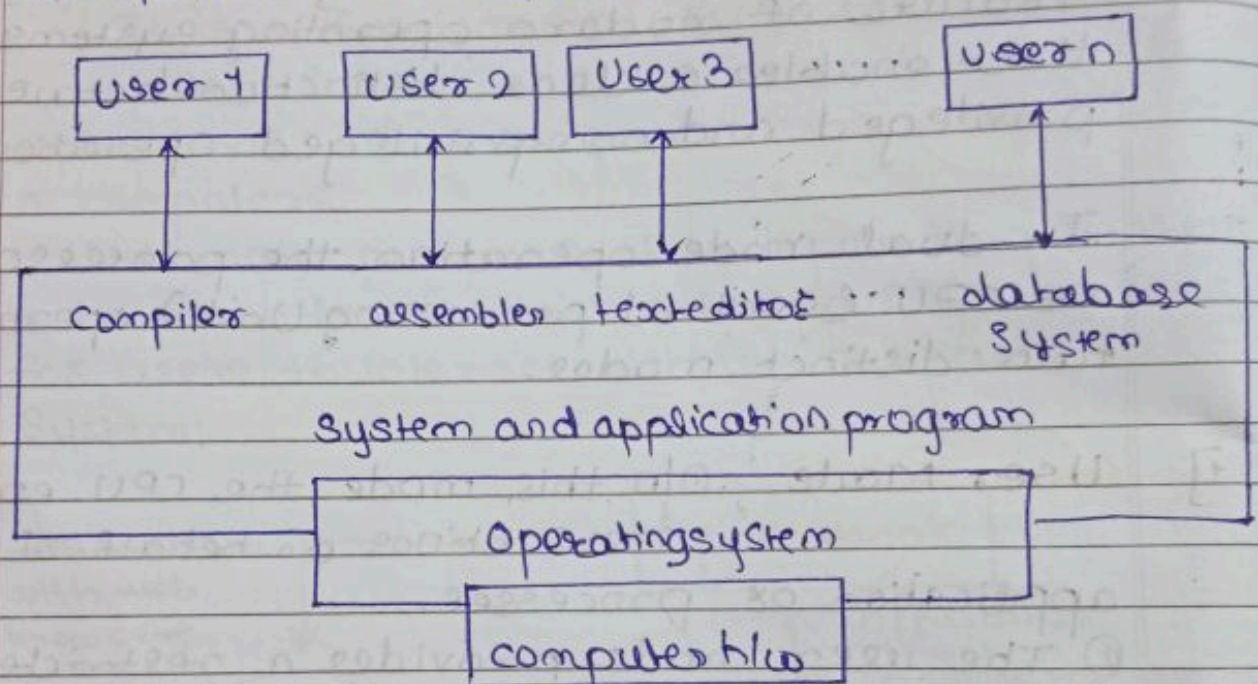
2] Kernel mode (also known as Supervisor mode, system mode or privileged mode):

① The kernel mode is the higher-privileged mode of operation.

② In this mode, the CPU executes instructions

on behalf of the operating system kernel.
② The kernel has full access to system resources, including hardware devices, memory, and privileged instructions.

components of computer system:

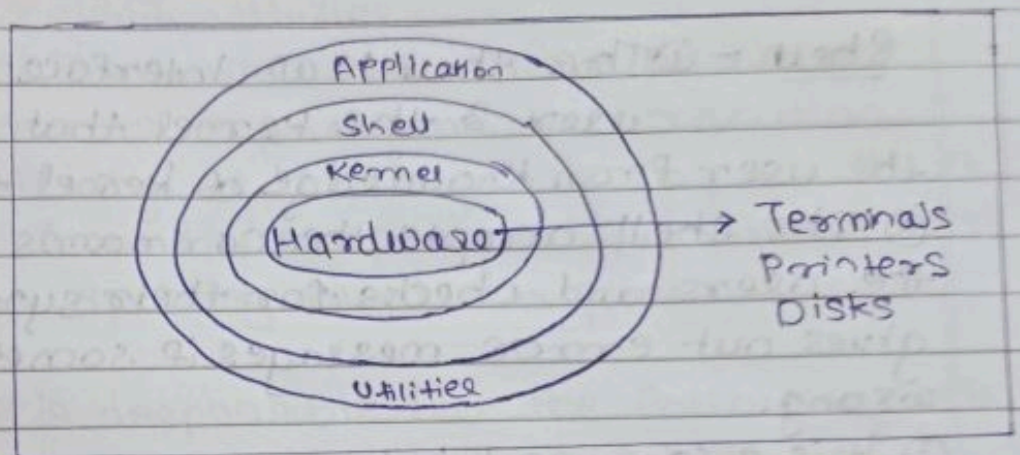


- Hardware - provides basic computing resources (CPU, memory, i/o devices).
- Operating system - controls and coordinates the use of the hardware among the various application programs for the various users.
- Application programs - define the ways in which the system

resources are used to solve the computing problems of the users. (compilers, database systems, video games, business programs).

- Users : (people, machines, other computers)

Structure of OS :



- Hardware : ① The H/w is centre of Structure that provides the OS with basic services.

② The h/w consists of all pt peripherals like memory (RAM, HDD, FDD etc) processor, mouse and other i/p devices, terminals printers etc.

- The Kernel : ① The kernel is the heart of the System - a collection of programs mostly written in 'C' which communicate with the h/w directly.

② Kernel is an interface betwⁿ h/w and of the System and shell.

③ It is loaded into the memory when the system

is booted.

- (4) User programs that need to communicate with the kernel use the services of the kernel, which performs the job on the user's behalf.
- (5) It manages the system's memory, schedules processes, decides their priorities and performs other tasks.

- Shell - (1) The shell is an interface between the user & the kernel that isolates the user from knowledge of kernel functions.
 (2) The shell accepts the commands keyed by the users and checks for their syntax and gives out error messages if something goes wrong.
 (3) It is a command interpreter of user requests.

- Application programs - (1) The various compilers for languages like C, C++, Pascal, Fortran and other application programs written by programmers which are used by users for their operations fall in this layer.
 (2) Only those persons who maintain an "account" with the computer system can use the UNIX system.

- User can directly access application programs through which they can interact with the system.

Operations of OS :

1] Program Management :

- ① The CPU executes a large number of programs.
- ② While its main concern is the execution of user programs, the CPU is also needed for other system activities.
- ③ These activities are called processes.
- ④ A process is program in execution.
- ⑤ Typically, a batch job is a process, A time shared user program, a system task such as spooling is also a process.

The OS is responsible for the following activities-

- ① The creation and deletion of both user and system process.
- ② The suspension and resumption of processes.
- ③ The provision of mechanisms for process synchronization.
- ④ The provision of mechanisms for deadlock handling.

2] Resource Management :

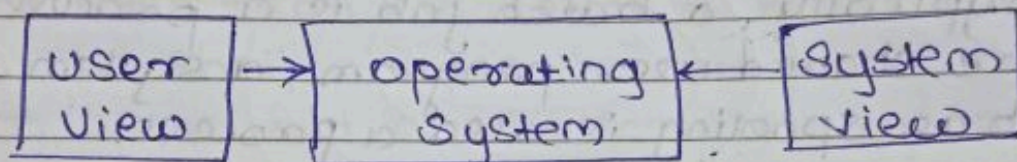
- ① When there are multiple users or multiple jobs running at the same time.
- ② Resources must be allocated to each of them.
- ③ Many different types of resource are managed by the OS.

④

3] Protection and Security:

Security defends a system from external and internal attacks viruses, worms, denial of service attacks, identify theft, protection controls the access of processes or users to the resources of the computer system.

View of OS:



User view:

- User view of the computer varies according to the interface.
- operating makes this view more easy by providing ease of use (easy handling).
- The different types of user view experiences can be experienced explained as follows:

- a) User is using personal computer
- b) user is using a system connected to a mainframe.
- c) User is using a workstation connected to other workstations in a network
- d) User is using a mobile, PDA or a palmtop.

System View :

- From the computer's point of view, the OS is involved with the hardware.
- It is known as resource allocator.
- OS controls many I/O devices.
- It is a control program that manages that the execution of user program to prevent errors & improper use of computer.

* Evolution of Operating System.

Generations of OS

1. First Generation (1945-1955)
2. Second Generation (1955-1965)
3. Third Generation (1965-1980)
4. Fourth Generation (1980-Present)

1] The First Generation (1945-1955):

Vacuum Tubes and Plugboards

The earliest electronic digital computers had no operating systems. Machines of the time were so primitive that programs were often entered one bit at a time on rows of mechanical switches (plug boards). Programming languages were unknown (not even assembly languages).

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2] The Second Generation (1955-1965):

Transistors and Batch System

① Second generation 1955-1965 - transistors, batch systems.

② By the early 1950's, the routine had improved somewhat with the introduction of punch cards.

③ The General Motors Research Laboratories implemented the first OS in the early 1950's for their IBM 701.

④ The system of the 50's generally ran one job at a time.

⑤ These were called single-stream batch processing system because programs and data were submitted in group or batches.

3] The Third Generation (1965-1980):

Integrated Circuits & Multiprogramming.

TG 1965-1980 - ICs & multiprogramming.

② The systems of the 1960's were also batch processing systems, but they were able to take better advantage of the computer's resources by running several jobs at once.

② So operating system designers developed the concept of multiprogramming in which several jobs are in main memory at once; a processor is switched from

job to job as needed to keep several job advancing while keeping the peripheral devices in use.

4] The Fourth Generation (1980-present): Personal Computers.

4th Gen 1980: present personal computers with the development of LSI (Large Scale Integration) circuits, chips, Operating S. entered in the system entered in the pc and the workstation age.

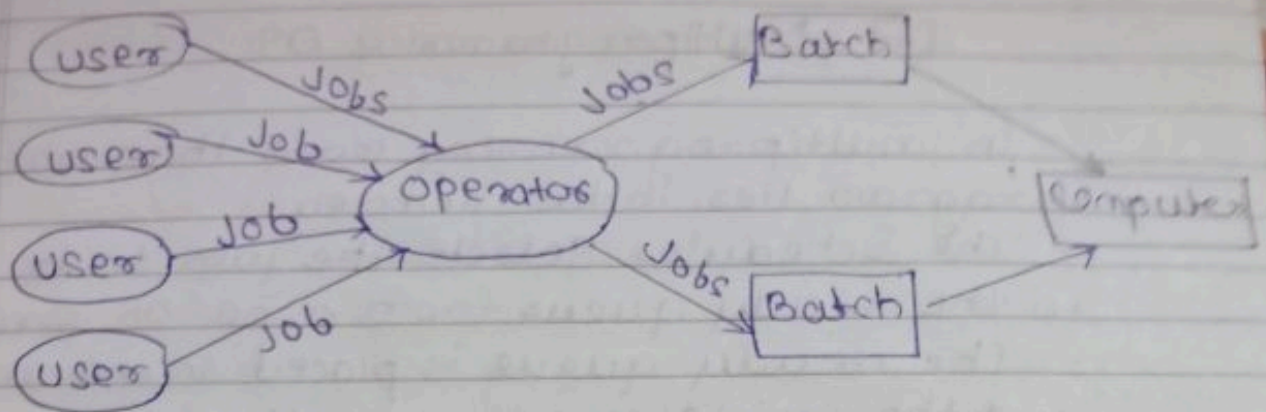
Microprocessor technology evolved to the point that it became possible to build desktop computers as powerful as the mainframes of the 1970s.

* Types of operating System.

- 1] Batch OS.
- 2] Multiprogramming
- 3] Multi-tasking / Time-sharing System
- 4] Multiprocessor System
- 5] Distributed System
- 6] Real Time System.

[1] Batch operating System

- This type of OS does not interact with the computer directly.
- The user has to submit a job (written on cards or tape) to a computer operator.
- There is an operator which takes similar jobs having the same requirements and groups them into batches.
- It is the responsibility of the operator to sort the jobs with similar needs.
- The computer operator places a batch of several jobs on an i/p device.
- Jobs are batched together by type of languages and requirements.
- The monitor is always in the main memory and available for execution.



Advantages

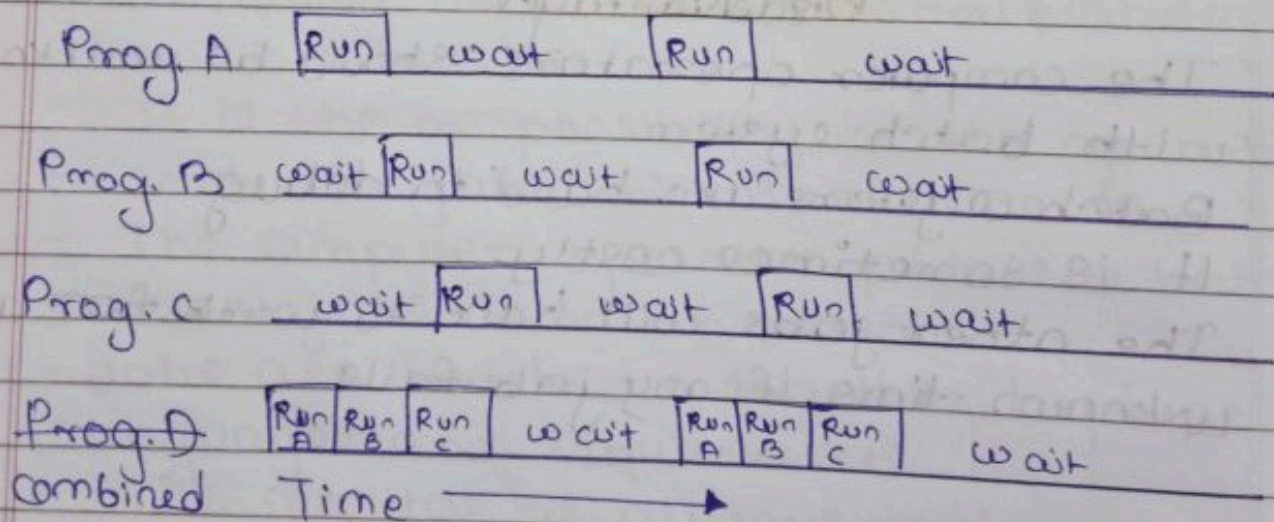
- The idle time for the batch system is less.
- It is easy to manage large work repeatedly in batch systems.
- Easier to handle large jobs.
- Good for repetitive task.

Disadvantages

- The computer operators should be well known with batch system.
- Batch systems are hard to debug.
- It is sometimes costly.
- The other jobs will have to wait for an unknown time if any job fails.

[2] Multiprogramming OS

- In multiprogramming more than one program lies in the memory.
- The Scheduler selects the jobs to be placed in the ready queue from a no. of programs.
- The ready queue is placed in memory and the existence of more than one program in main memory is known as multiprogramming.
- Since there is only one processor, multiple programs cannot be executed at a time.
- Instead the OS executes part of one program then the part of another and so on.
e.g. user can open word, excel, access & other applications in a system.

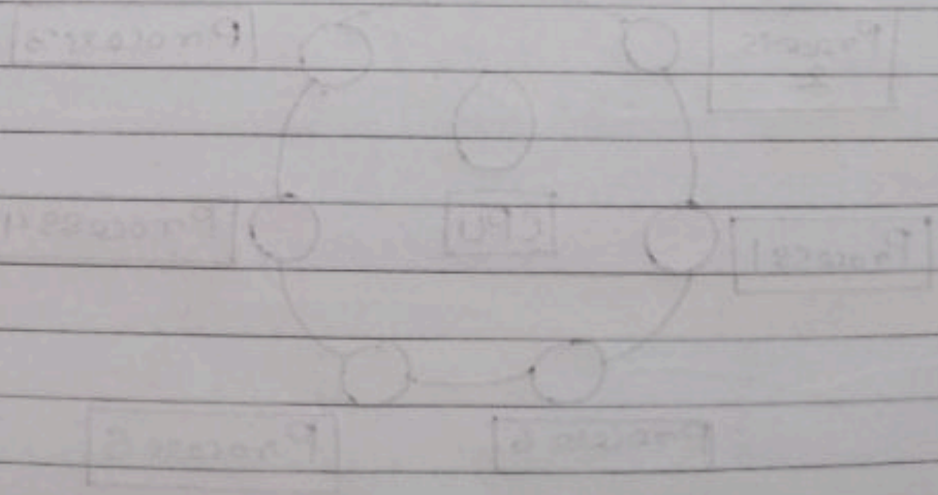


Advantages

- Provides less response time.
- It may help to run various jobs in a single application simultaneously.
- It helps to optimizing the total job throughput of the computer.
- Various users may use the multiprogramming system at once.

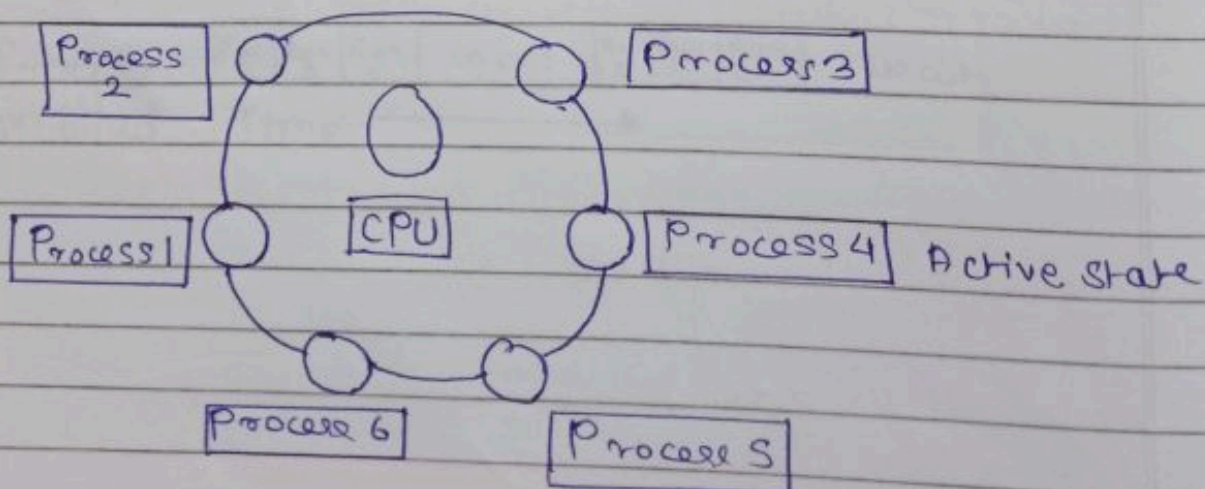
Disadvantages

- It is highly complicated and sophisticated.
- The CPU scheduling is required.
- Memory management is needed in the OS because all types of tasks are stored in the main memory.
- The harder task is to handle all processes and tasks.
- Due to large no. of jobs, the long-term jobs will require a long wait.



[3] Multitasking OS

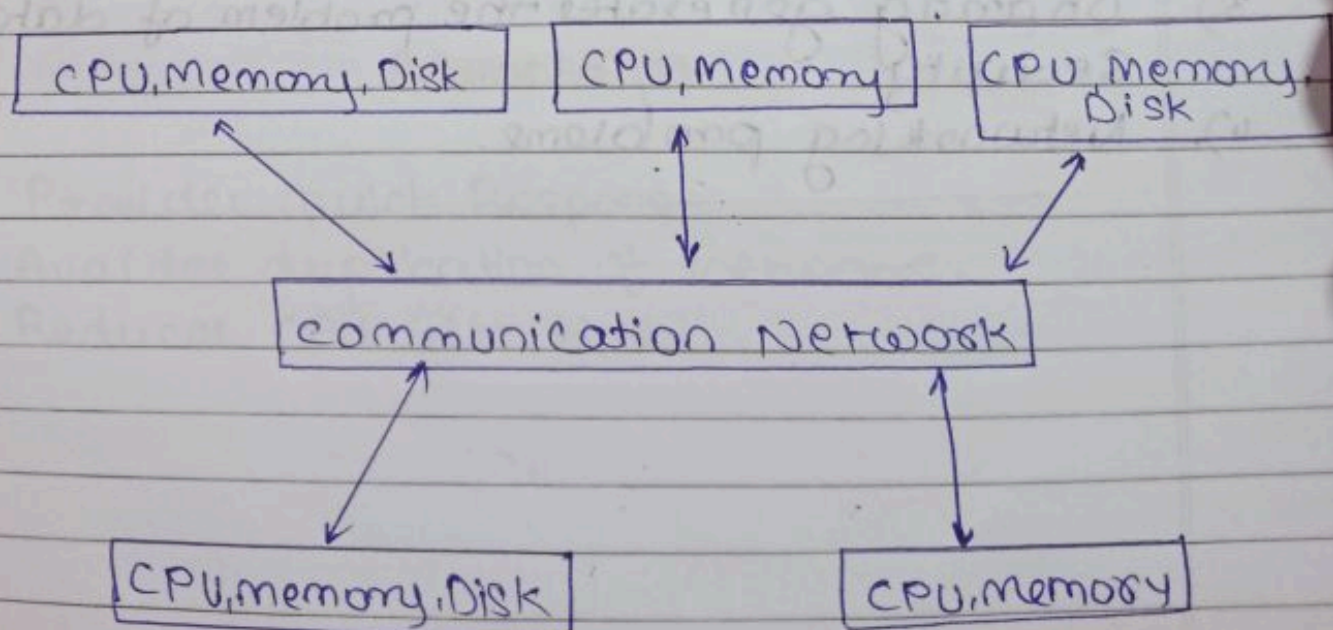
- A multitasking OS is the type of system that is capable of running more than one task at a time.
- It also maintains the synchronization between I/O devices and processes so that users can use different applications in the background and current applications in the foreground.
- In multitasking the resources are made continuously working.
- The CPU switches from one task to another for reading and processing.
- Thus idle time of peripheral gets reduced.
- In the multitasking operating system the code as well as data of several processes is stored into main memory.
- e.g.: when you are printing a document of 100 pages, you can do other jobs like typing a new document.
- So, more than one task is performed.



[4] Distributed Operating System

- Distributed systems use multiple central processors to serve multiple real-time applications and multiple users.
- Many machines in the same organization can be connected together through LAN and information can be transferred between machines in very small amount of time.
- Data processing jobs are distributed among the processors accordingly.
- The processors communicate with one another through various communication lines (such as high-speed buses or telephone lines).
- These are referred as loosely coupled systems or distributed systems.
- Processors in a distributed system may vary in size and function.

Architecture of Distributed OS



Advantages

- 1) With resource sharing facilities, a user at one site may be able to use the resources available at another.
- 2) It speeds up the exchange of data with one another via electronic mail.
If one site fails in a distributed system, the remaining sites can potentially continue operating.
- 3) Provides better service to the customers.
- 4) Reduction of the load on the host computer.

Disadvantages

- 1) Difficult to maintain.
- 2) Complicated to setup.
- 3) Sharing generates the problem of data security.
- 4) Networking problems.

[5] Time sharing operating System.

- Timesharing or multitasking is a logical extension of multiprogramming.

Processor's time which is shared among multiple users simultaneously is termed as time-sharing.

- The only main difference between multiprogrammed Batch Systems and Time Sharing system is that in case of MBS, the objective is to maximize processor use, whereas in time sharing system, the objective is to minimize response time.

- Multiple jobs are executed by the CPU by switching betwⁿ them.

- Thus, the user can receive an immediate response.

Advantages

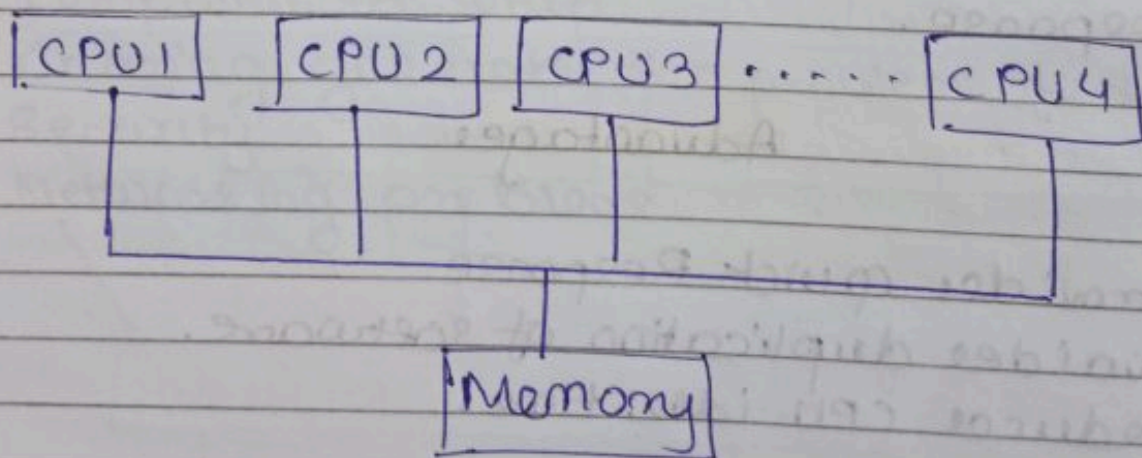
- 1) Provide quick Response
- 2) Avoids duplication of software.
- 3) Reduces CPU idle time.

Disadvantages

- 1) Problem of reliability
- 2) Question of security and integrity of users programs and data.
- 3) Problem of data communication.

Multiprocessor System [6]

- Most computer system are single processor system i.e. they only have one processor.
- However, in multiprocessor system or parallel system are increasing in importance nowadays.
- These systems have multiple processors working in parallel that share the computer clock, memory, bus, peripheral devices etc.



Type of multiprocessors Systems.

- Symmetric multiprocessor
- Asymmetric multiprocessor

1. Symmetric Multiprocessor:

① In these types of systems, each processor contains a similar copy of the OS and they all communicate with each other.

② All the processors are in a peer to peer relationship i.e. no master-slave relationship exists between them.

③ An example: Encore version of Unix for the multimax computer.

2. Asymmetric Multiprocessors:

① In asymmetric systems, each processor is given a predefined task.

② There is a master processor that gives instruction to all the other processors.

③ Asymmetric multiprocessor system contains a master-slave relationship.

④ Asymmetric multiprocessor was the only type of multiprocessor available before symmetric multiprocessors were created.

Advantages

1. **Improved performance**: Multiprocessor system can execute tasks faster than single-processor systems, as the workload can be distributed across multiple processors.
2. **Better Scalability**: It can be scaled more easily than single-processor systems.
3. **Increased reliability**: It can continue to operate even if one processor fails, as the remaining processors can continue to execute tasks.

Disadvantage

1. **Increased complexity**: Multiprocessor computer systems are more complex than single-computer systems, and they require additional hardware, software & management resources.
2. **Higher power consumption**: Multicomputer systems require more power to operate than

Single-computer systems, which can increase the cost of operating and maintaining the system.

3. **Difficult programming**: Developing S/W that can effectively utilize multiple computers can be challenging and it requires specialized programming skills.

[7] Real Time OS

- Real-time Operating System has well defined fixed time constraints.
- Processing should be done within the defined constraints - Hard & Soft real time system.
- A primary objective of real-time systems is to provide quick event response time and thus meet the scheduling deadline.

Types:

- i) **Hard real-time**: When an event occurs, it should be serviced within the predictable time all times in a given hard real-time system.

- 2) **Soft real-time** : It means that only the precedence & sequence for the task operations are defined, interrupt latencies are small. There can be few deviations between expected latencies of the tasks & observed time constraints and a few deadline misses are accepted.

Advantages

- 1) Max^m utilization of devices and systems. Thus more o/p from all the resources.
- 2) Focus on running applications & less importance to applications that are in the queue.
- 3) Error free.
- 4) Memory Allocation.

Disadvantages

- 1) Limited Tasks :
- 2) Use Heavy System Resources : sometimes the system resources are not so good & are expensive as well.
- 3) Complex Algorithms :

Applications : Flight Control System Simulation.

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* Difference between Real Time System & Time Sharing System.

Real Time OS	Time Sharing OS
① In RTOS a job has to be completed within fixed deadline.	In TSOS fixed time is given to each process and all processes are arranged in a queue.
② A RTS has well-defined, fixed time constraints.	It requires more complicated CPU scheduling algorithms.
③ Response time is important.	Response time is not important.
④ Process deals with single application at a time.	Process deals with more than one application simultaneously.
⑤ Computer resources are not shared betw ⁿ the user.	Computer resources are shared between the user.
⑥ No modification is possible.	The programs can be modified and written by the users.
⑦ Switching is not present.	Take place among the processes.

* Difference between multitasking and multiprogramming operating system.

Multitasking	Multiprogramming
① In multitasking, task shares the common resource i.e. CPU.	A computer running more than one program at a time is called as multiprogramming.
② Multitasking is the ability of a computer to handle a number of task or jobs simultaneously.	Multiprogramming is the capacity to run or handle several programs at the same time.
③ It is possible CPU to running more than one task (job) at the same time.	It is impossible for a CPU to running more than one program at the same time.
④ e.g. let us say we are printing a doc. of 100 pages.	e.g. let us say there are two programs waiting in the pool to be executed.
⑤ Objective is to minimize the response time.	Improvement in CPU utilization.
Simple complexity	Complexity is high

Mobile OS

- ① A mobile OS is an operating system that is specially designed to run on mobile devices such as mobile phones, smartphones, PDAs, tablet computers and other handheld devices.
- ② The mobile OS is the s/w platform on top of which other programs, called application programs, can run on mobile devices.
- ③ An operating system for smartphones, tablets and other mobile devices is called mobile OS.

Some of the most popular OS for mobile devices includes -

Android OS :

- ① An android OS is an open source operating system primarily used in mobile devices.
- ② Written primarily in Java and based on the Linux OS, it was initially developed by Android Inc. and was eventually purchased by Google in 2005.

IOS :

- ① ios is the operating system created by Apple Inc. for mobile devices.
- ② The ios is used in many of the mobile devices for apple such as iPhone, iPad, iPad etc.
- ③ ios is used a lot and only lags behind Android in terms of popularity.

Command based OS

④ DISK OPERATING SYSTEM (DOS)

- ① It is MSDOS microsoft disk operating system.
- ② It is a single user, non-graphical line oriented command or menu-driven OS.
- ③ It has a simple interface but the interface is less user friendly.
- ④ e.g. dir, mkdir etc.

UNIX OS :

- ① Developed in 1970 by Ken Thompson at Bell Laboratory.
- ② UNIX runs on a wider range of system than any other OS.
- ③ It allows people to work together & share information in controlled way.
- ④ UNIX provides power & flexibility.

GUI Based OS :

WINDOWS

- ① windows is developed by Microsoft.
- ② It is a forerunner to the Apple, macintosh
- ③ Microsoft provided ms-dos a graphical user interface called windows.

1] WINDOWS system components.

- ① **Hardware Abstraction layer (HAL)** - HAL provides portability across platforms.
- ② **KERNEL** - It is responsible for handling all kind of programs & process.
- ③ **EXECUTIVE** - It is written in C and includes 10 components.

2] **LINUX** : ① It is a free and open source OS.

- ② It supports GUI.
- ③ It supports multiple languages
- ④ It supports multiple users, multithreading, multitasking & networking as well.
- ⑤ It is portable and can be installed on any machine.

Components of LINUX:

KERNEL:

- ① It is responsible for handling all kinds of programs and processes.
- ② System Libraries - Provides interaction with the kernel.
- ③ System Utilities - These are the programs that carry out individual, specialized management task.

Questions asked.

1. Define real time OS. List any four applications of it.
2. Enlist types of OS. Explain multiprogramming OS in detail.
3. List components of OS. Explain process management in detail.
4. Diff: multiprogrammed and multitasking OS any (2 points)
5. Explain Time sharing OS.
6. Describe any 2 components of O.S.
7. State & describe any two advantages of multiprocessor system.
8. Describe working of Time sharing system with neat diagram.
9. State any two features of Linux.
10. Difference between Time Sharing & Real Time system.
11. Explain real time OS. Explain with any two applications of it.
12. Describe multiprocessor OS. Write its advantages.
- 13.