

# Operating System Overview

## \* Operating System :

An operating system acts as a interface between user and hardware to control the execution of application programs.

## \* Need of operating System :

- 1) to perform provided tasks.
- 2) to allocate processing units (CPU) to execute user programs.
- 3) to allocate the memory to user programs as per need.
- 4) to interact with other user programs through different devices.

## \* Components of Operating System :

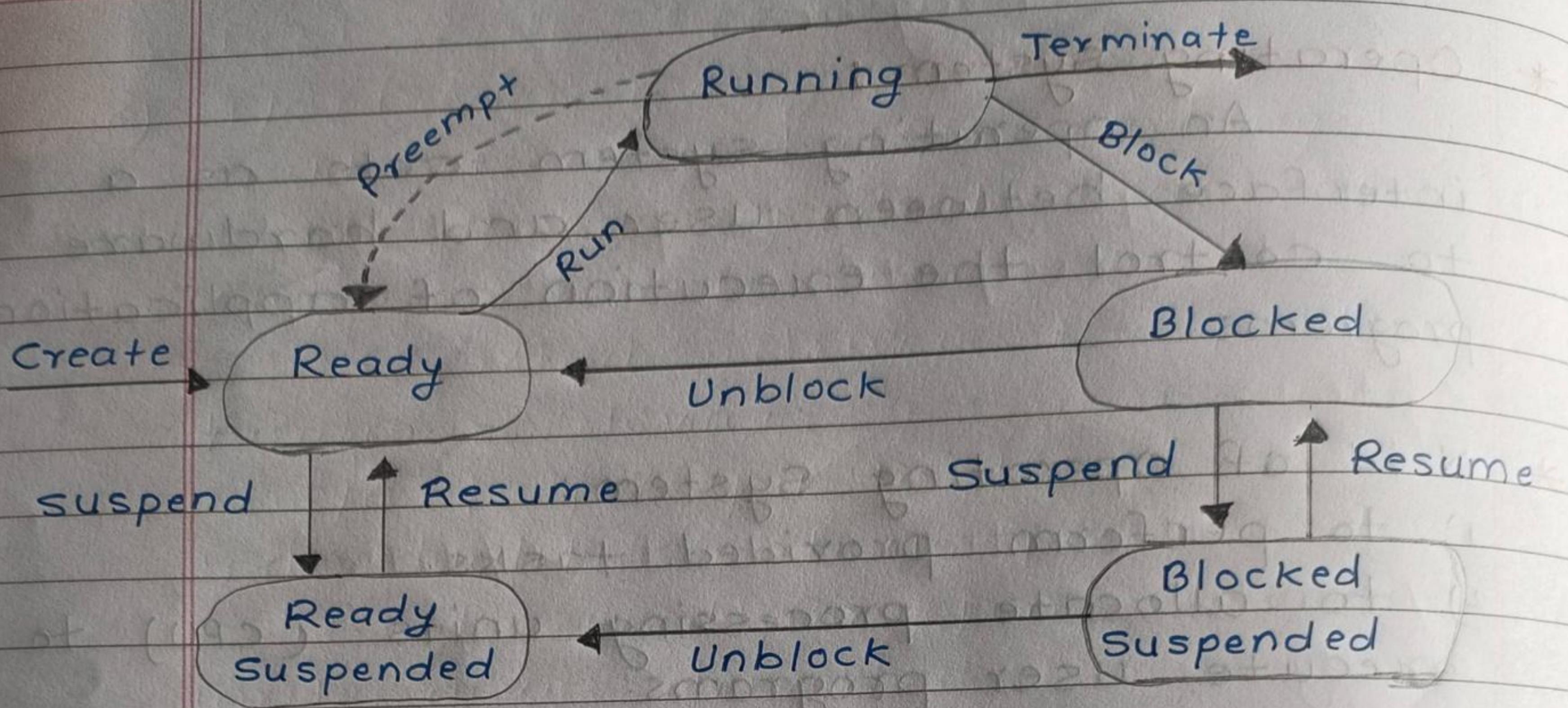
### 1) Process Management :

- It is a procedure for managing different processes running simultaneously on the operating system.
- Every application programs has one or more processes.
- For example, When we use a search engine like chrome, there are one or more process running for that browser program.
- It is also used for keeps processes running efficiently.
- It also uses the memory allocated to

OPPO Reno6 5G shutting down them when

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functions:

- 1) Creation & deletion of process
- 2) Suspension & resumption of process
- 3) Synchronization of process
- 4) communication of process.

2) Memory Management (main) :

- It helps you to <sup>keep</sup> track of primary memory.
- It allocates the memory to the different processes.
- After completion of process it free the memory allocated by the process
- Reallocation of memory to a program after used block becomes free.
- keep track of memory usage by the process.

### 3) File management :

- Creation and deletion of Files and directories.
- It is also used for manipulating files and directories.
- It is used for mapping files onto secondary storage.
- It is used to Backup files on stable storage media.

### 4) Network Management :

- Distributed systems help you to various computing resources in size and function.
- They may involve minicomputers, micro-processors, and many general-purpose computer systems.
- A distributed system also offers the user access to the various resources the network shares.
- It helps to access shared resources that help computation to speed up or offers data availability and reliability.

### 5) Secondary- storage management :

- It is used for storage allocation.
- It is used for Free space management.
- It is also used for Disk scheduling.
- It is also used for backup the main memory.
- to store programs and files.

### 6) I/O Device management :

- It offers a buffer caching system.
- It provides general device driver code.
- It provides drivers for particular hardware devices.
- I/O helps you to know the individualities of a specific device.
- It also used for open, close and write device drivers.
- communicate with device drivers to control and monitor them.

### 7) Security Management :

- The various processes in an operating system need to be secure from other activities.
- Therefore, various mechanisms can ensure those processes that want to operate files, memory CPU and other hardware resources should have proper authorization from the operating system.
- Security can improve reliability by detecting errors.
- Early detection of errors can prevent the foulness of a healthy system by a malfunctioning system.
- An unprotected resource cannot be misused by an unauthorized user.

### 8) Command Interpreter System :

- It is the most important component of an operating system.
- The command interpreter is the primary interface between the user and the rest of the system.
- It reads commands and interprets them to execute a process.
- It deals with process management, I/O handling, secondary storage management, main memory management, etc.
- ex, SHELL in Unix, cmd in windows.

### \* Operations of operating system :

- An OS has its interrupt driven nature.
- If there are no processes to execute, no I/O devices to service or no users to whom to respond, then operating system sits idle waiting for an interrupt.

### 1) Dual mode operation :

- - For each type of interrupt, separate segment of code called as interrupt service routines are available that determines what action should be taken.



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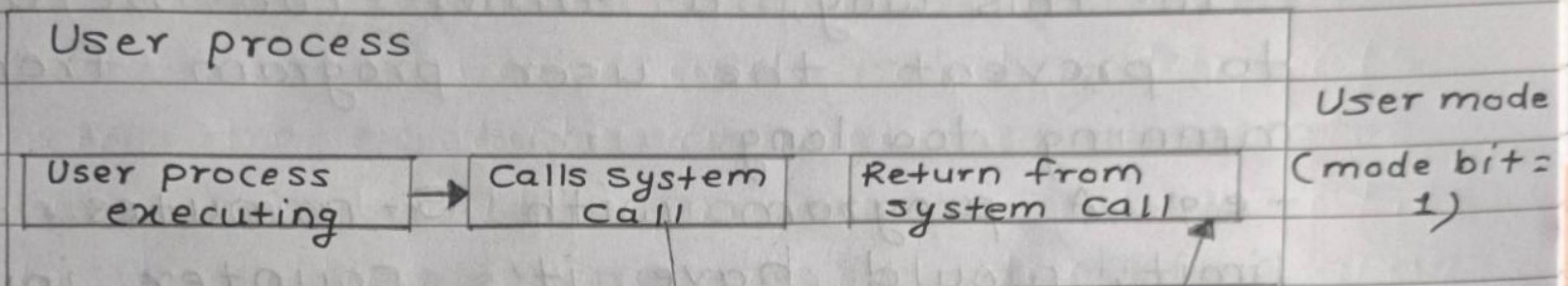
## 1) Dual mode Operation:

- There are two separate modes of operation in the system.
  - 1) User mode
  - 2) Kernel mode
- When the system is executing user instructions, the system is in user mode.
- However, when user executes any system call to get OS service, the system is transited from user to kernel mode.
- A mode bit is added to the hardware of computer to indicate the current mode
  - 1) User mode - 0
  - 2) Kernel mode - 1
- The kernel mode is also called as system mode.
- Once execution of system call is over, system returns back to user mode.
- The dual mode operation provides the protection of OS from unwanted users & also one user from another.
- This protection is achieved by special machine instruction called privileged instructions.
- Such instructions are allowed to be executed only in kernel mode.
- If an attempt of such instruction

it as a trap or an interrupt to the OS & execution mode changes from user mode to kernel mode.

- System calls are treated as privileged instructions.

### User process



### kernel

Trap  
mode bit = 0

Return  
mode bit = 1

kernel mode  
(mode bit = 0)

### Transition from user mode to kernel mode

#### 2) Timer :

- Operating system does not allow a user program to get stuck in an infinite loop or to fail to call system services.
- A timer can be used to interrupt the computer after specified time period.
- The time period can be fixed. (e.g. 1 millisecond) or variable (e.g. 1 to 1024 milliseconds).
- If the timer interrupts, control transfers

- automatically to the operating system.
- It is treated as either fatal error or may give the program more time.
  - The instructions to modify the timer are treated as privileged instructions.
  - In this way, a timer can be used to prevent the user program from running too long.
    - e.g. A program with 5-minutes time limit, would have it's counter initialized to 300.
    - After every second, timer interrupts & counter value is decremented by 1.
    - As long as counter is positive, the program is in execution.
    - When counter becomes negative, the OS terminates the program.

## \* Program Management:

- A program does nothing unless its instructions are executed by a CPU.
- A program in execution is called a process.
- In order to complete its task, process needs the computer resources.
- There may exist more than one process in the system which may require the same resource at the same time.

- Therefore, the operating system has to manage all the processes and the resources in a convenient and efficient way.
- Some resources may need to be executed by one process at a time to maintain the consistency.
- otherwise it becomes inconsistency.
- Functions :-
  - 1) Scheduling processes and threads on the CPU's.
  - 2) Creating and deleting both user and system processes.
  - 3) Suspending and resuming processes.
  - 4) Providing mechanisms for process synchronization.
  - 5) Provides mechanisms for process communication.

### \* Resource Management :

- The operating system is a program which is closely involved with the computer hardware.
- So, it is a resource Allocator.
- System consists of many resources such as, CPU, Memory (RAM), disks, storage, files and printers and so on.
- The operating system acts as resource manager + provide resource.

- It decides which resource should be given to which program.
- For how much time and after use it reclaims it from the program.
- Reallocate the reclaimed resource to another program whenever needed.
- Every program gets time and space with resource.
- Many users or applications can share resources because,
  - 1) The devices are expensive, so sharing saves the cost.
  - 2) The data needs to be shared as well as needs to be communicated.

### \* Security and Protection :

- Operating System manages both logical and physical resources to prevent interference with each other and unauthorized access from external sources.
- These methods are categorized as protection and security in operating system.
- Computing resources such as CPUs, disks and memory are secured and protected by this management.

- 1) Security : Security in operating system is the process of protecting user's data and programs.

interference, such as unauthorised users of other system.

## 2) Protection :

Protection is used to prevent other authorized users from interfering with a particular user's data and program.

Threats to Protection & security in operating system :

- 1) Virus
- 2) Worm
- 3) Trojan Horse
- 4) Trap Door
- 5) Ransomware

Methods to Ensure protection and security in OS :

- 1) keep a data backup.
- 2) Beware of suspicious emails and links.
- 3) Secure Authentication and Authorization.
- 4) Use secure Wi-Fi only.

## \* Views of OS :

### 1) User View :

- Single User:
- In single user system, user sits in front of desktop or Laptops.
- The goal of this system is to maximize the work that user is performing.
- The os is designed by giving more importance for convenience rather than performance.

### - Multi-User:

- In multiuser system, user sits at terminal connected to server.
- Users share resources & may exchange information with the help of network.
- The os is designed to maximize the resource utilization & to improve the performance.

### 2) System view :

- From the computer systems point of view, the os is a software that acts as a resource allocator.
- OS acts as a manager of various computing resources such as CPU time, memory space, storage space, I/O devices & so on.

allocation to application programs & users so that it can perform work more efficiently.

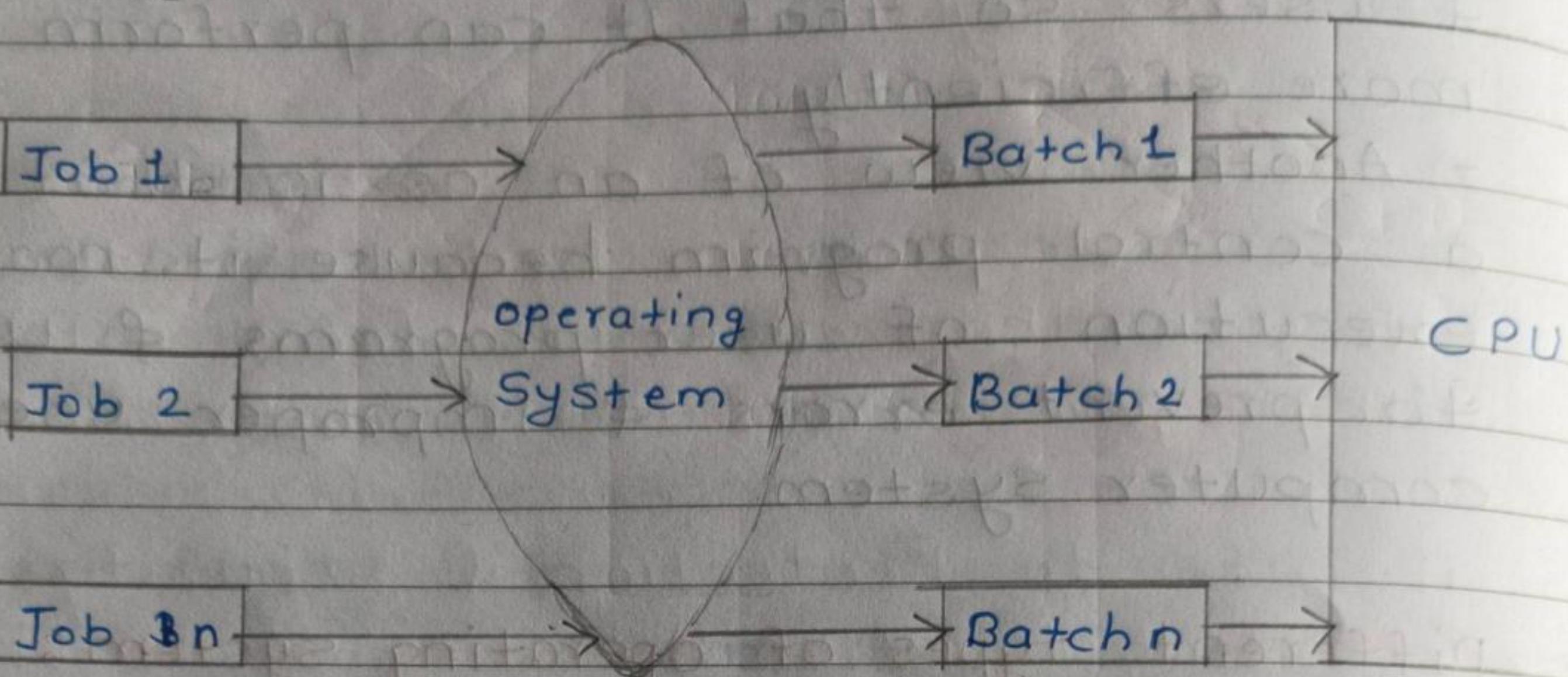
- Another view of an OS is that it is a control program because it manages execution of user programs & users to prevent errors & improper use of computer system.

### \* Different types of operating system :

#### i) Batch Operating System :

- The users who are using a batch operating system do not interact with the computer directly.
- Each user prepares its job on an offline device like punch cards and submits it to the computer operator.
- To speed up the processing, jobs with similar needs are batched together and run as a group.
- The programmers exit their programs with the operator and the operator then sorts the programs with similar requirements into batch.
- These batches are processed and run at same time.
- After execution of batches is done the work of programmers submitted to the related programmer.

- Diagram:



## Batch Operating System

- Action taken during process:

- 1) A job is a single unit made up of a pre-programmed set of data, commands and programs.
- 2) The orders are processed in the order in which these are received, meaning first come, first served.
- 3) These jobs are saved in memory and run without the need of any manual ~~output~~ input.
- 4) The OS releases memory after a job is completed successfully.

- Advantages:

- 1) It is very difficult to guess or know the time required for any job to complete, it is only known to processor.

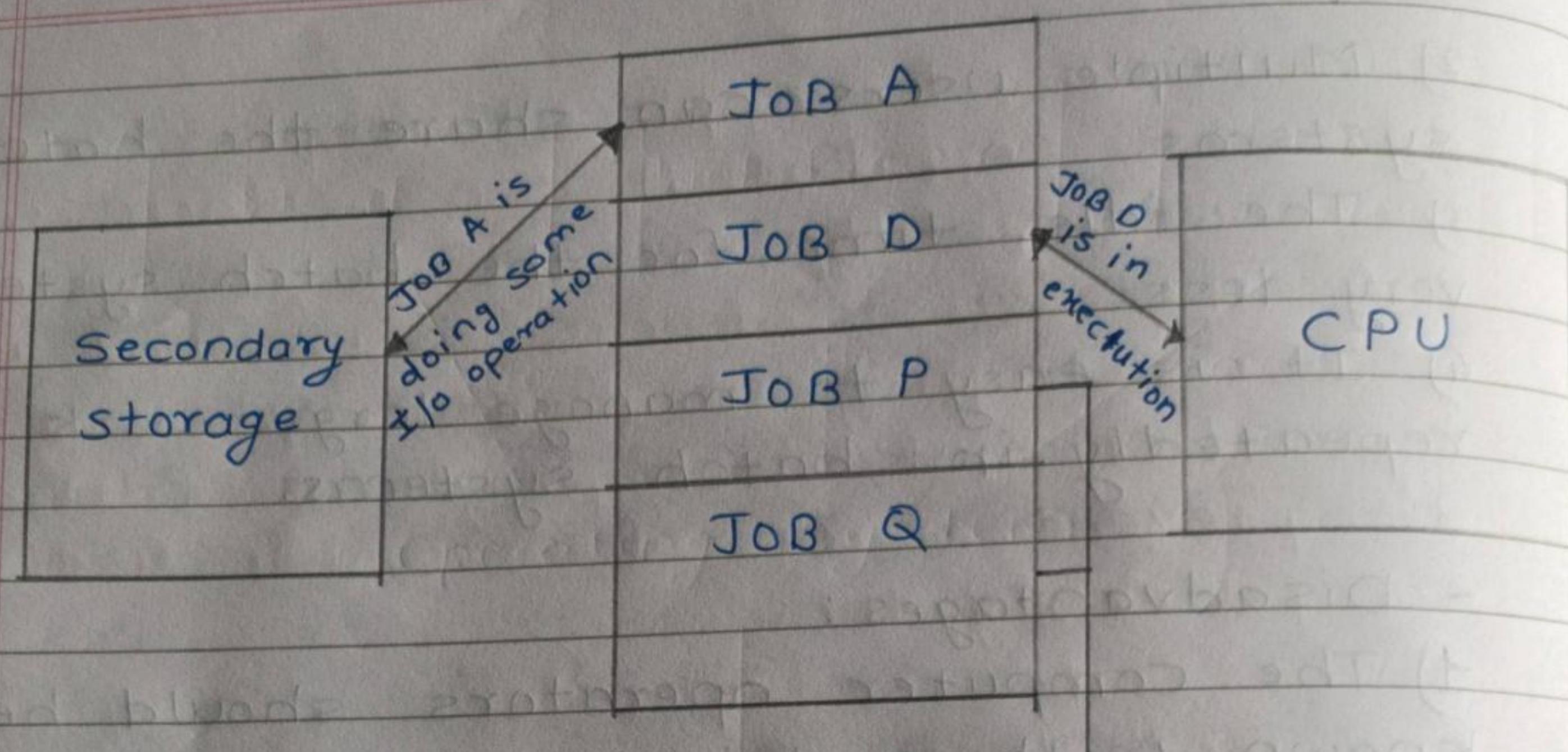
- 2) Multiple users can share the batch systems.
- 3) The idle time for the batch system is very less.
- 4) It is easy to manage large work repeatedly in batch systems.

- Disadvantages :

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

2) Multi-programmed Operating System :

- A multiprogramming operating may run many programs on a single processor machine.
- More than one programs should present in main memory at the same time.
- This type of operating systems organizes jobs in a such way that CPU always get one job to execute to improve the CPU utilization.
- If any job required I/O operation while processing then CPU does not remain idle it takes another job for processing till I/O operation completes.
- CPU and Memory utilization is better in this types of operating system.
- OPPO Reno 6 5G always on CPU utilization.



JOB P & Q are waiting for CPU time.

## Multiprogramming operating system

- Advantages:
- CPU utilization is high.
- Memory utilization is efficient.
- It helps to run various jobs simultaneously.
- Short-time jobs are done quickly than long-time jobs.
  
- Disadvantages:
- It requires CPU scheduling.
- It is highly complicated.
- Memory management is required.
- User is not able to interact with jobs when it is executing.

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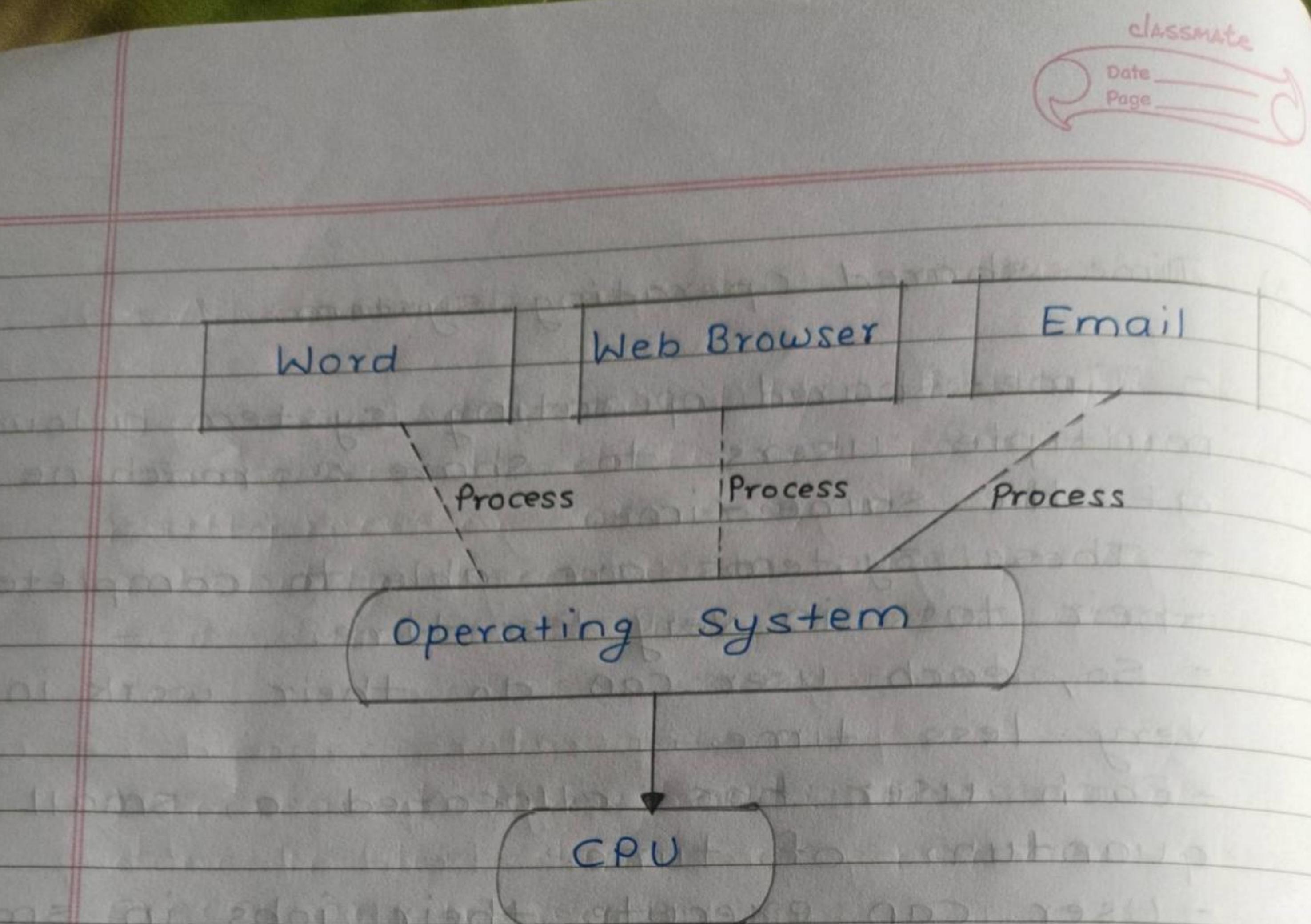
### 3) Time-shared Operating System:

- Time-shared operating system allows multiple users to share a machine at the same time.
- These systems are able to complete their task in very less time.
- So, each user can do their work in very less time.
- Each user has allocated a small quantum of time.
- User can execute their jobs in small time allocated to them.
- After expiration of slot, CPU allocates to another user and again time is allocated to execute the jobs. and so on.
- Due to this mechanism, each user feels like CPU is allocated to him only.
- because, the time quantum allocated to each user is very small and switching from one user to another takes place in very small time.
- It is also known as multitasking operating system.
- State of working:

1) Active state

2) Ready state

3) Waitting state

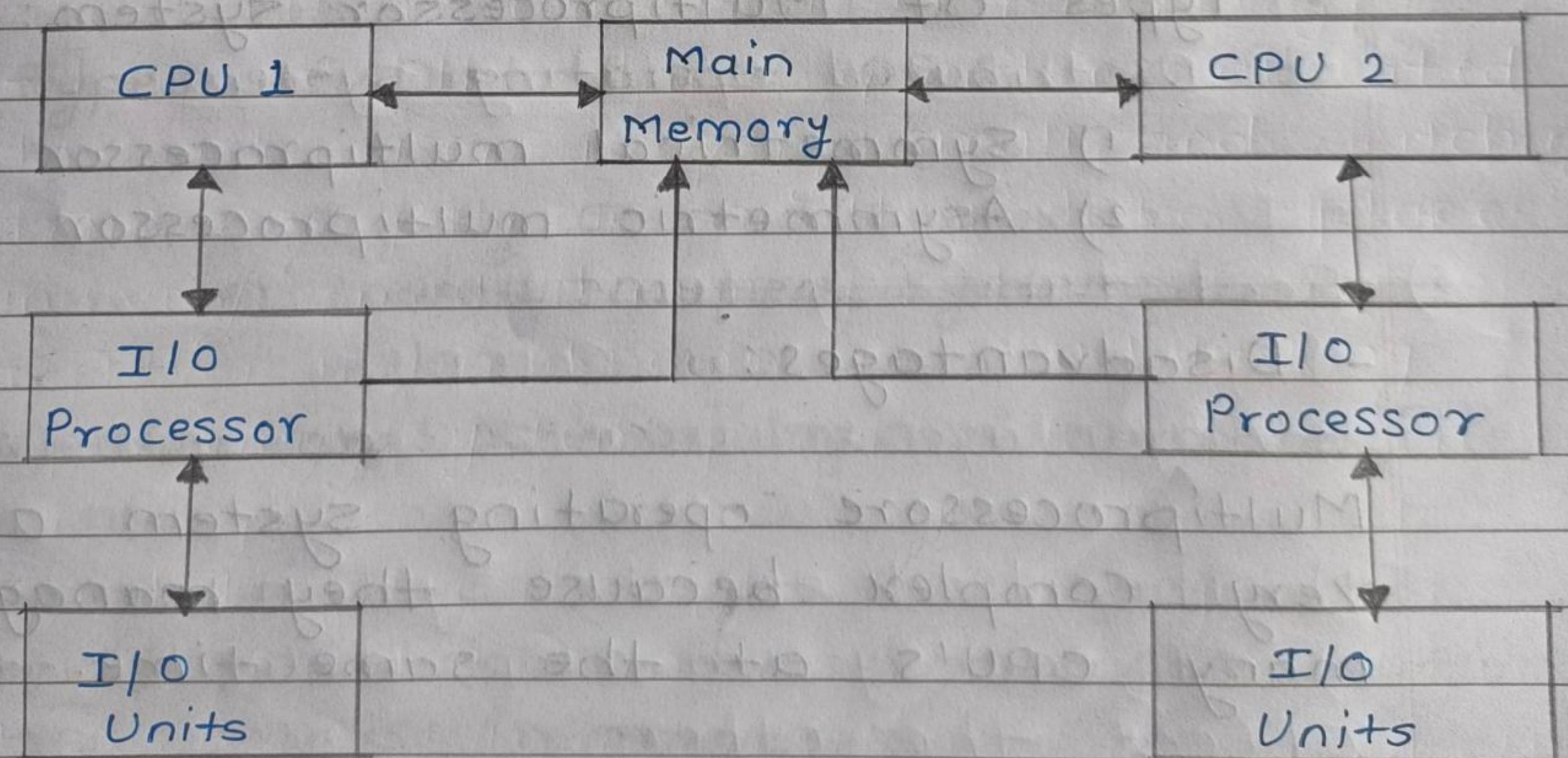


### Time sharing operating System

- Advantages :
  - Response time of CPU reduces.
  - Idle time of CPU reduces.
  - Each task/ process gets an equal time slot to execute.
- Disadvantages :
  - The data of each program should be secure so that they don't mix.
  - Communication is very important. Lack of communication can affect the whole working.

## Multiprocessor Operating systems :

- To improve the performance of more than one CPU can be used within one computer system.
- Multiple CPU's are interconnected so that job can be divided among them for faster execution.
- When a job finishes, results from all CPU's are collected and compiled to give the final output.
- Jobs needed to share main memory and they may also share other system resources among themselves.
- Multiple CPU's can also be used to run multiple jobs simultaneously.
- Diagram :



Multiprocessor Operating System

### - Advantages:

- 1) Increased reliability: Multiple tasks are given to different processors in multiprocessor os. So, it shows reliability because if one processor fails, the tasks is passed to another one.
- 2) Increased throughout: More work is done in less time as number of processor increases.
- 3) The economy of scale: Multiprocessor system are less expensive than uni-processor because they share resources in between them.

### - Types of Multiprocessor system:

- 1) Symmetrical multiprocessor
- 2) Asymmetric multiprocessor

### - Disadvantages:

Multiprocessor operating system are very complex because they manages many CPU's at the same time.

## 5) Distributed Operating System:

- It is an important operating system.
- A distributed operating system is one in which several computer systems connected through a single communication channel.
- Moreover, these systems have their individual processors and memory.
- These processors communicate through high-speed buses or telephone lines.
- These individual systems that connect through a single channel are considered as a single unit.
- We can also call them as loosely coupled systems.
- These individual systems of the network are nodes.

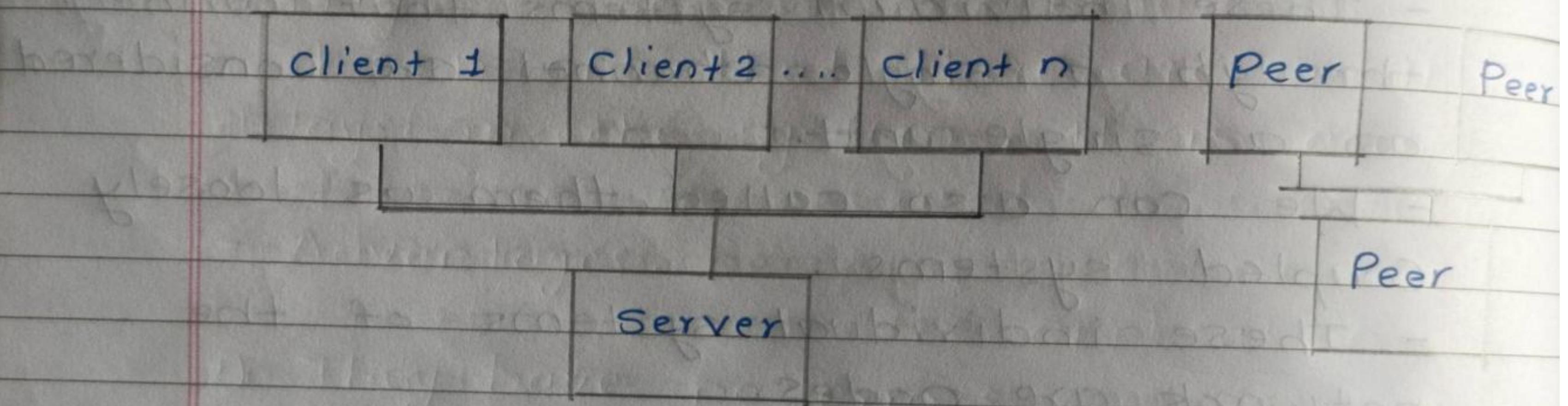
### Types of Distributed OS :

- 1) Tightly coupled systems
- 2) Loosely coupled systems.

a) Network OS for login & remote file manager

b) Distributed OS for Data, computation and process migration.

- Network OS provides features like file sharing including information, communication & the system with network OS act autonomously even if it is aware of network.
- A distributed OS is less autonomous i.e. different OS communicate closely to provide the illusion that only a single OS system controls the network.  
Ex. Windows 2008.



### Distributed operating system

#### 6) Real-time Systems:

- Advantages:
  - 1) The load on the system decreases
  - 2) If one system stops it will not affect the other.
  - 3) The system shares a workload that makes calculations easy.

4) The size of the system can be set to according requirements.

- Disadvantages:

- 1) The cost for set up is more.
- 2) Failure of the main system will affect the whole system.
- 3) Programming is complex.

5) Real-time operating Systems:

- The real-time operating systems are used in real-time systems where the time constraints are fixed and followed strictly.

- This means that the time for processing and responding are small.

- The system should perform the given task in a fixed time otherwise, it results in a system failure.

Types of real-time OS:

1) Hard Real-time Systems:

- In this, the time constraints is very short and strict.

- Even seconds of delay is not acceptable

- Therefore, it is compulsory to complete the task within the given time only.

- Ex, time bomb.

## 2) Firm Real-time Systems:

- In these system, the deadline is given but missing it does not result in great loss.

- There can be some unwanted side effects in the system if the deadline is not followed.

## 3) Soft Real-Time Systems:

- the system handles the deadlines softly.

- This means that there are small delays in the system , it is acceptable.

### - Advantages :

1) They have no errors.

2) Due to their small size, they can be easily added to other systems.

### - Disadvantages :

1) Algorithms are complex.

2) System resources are expensive.

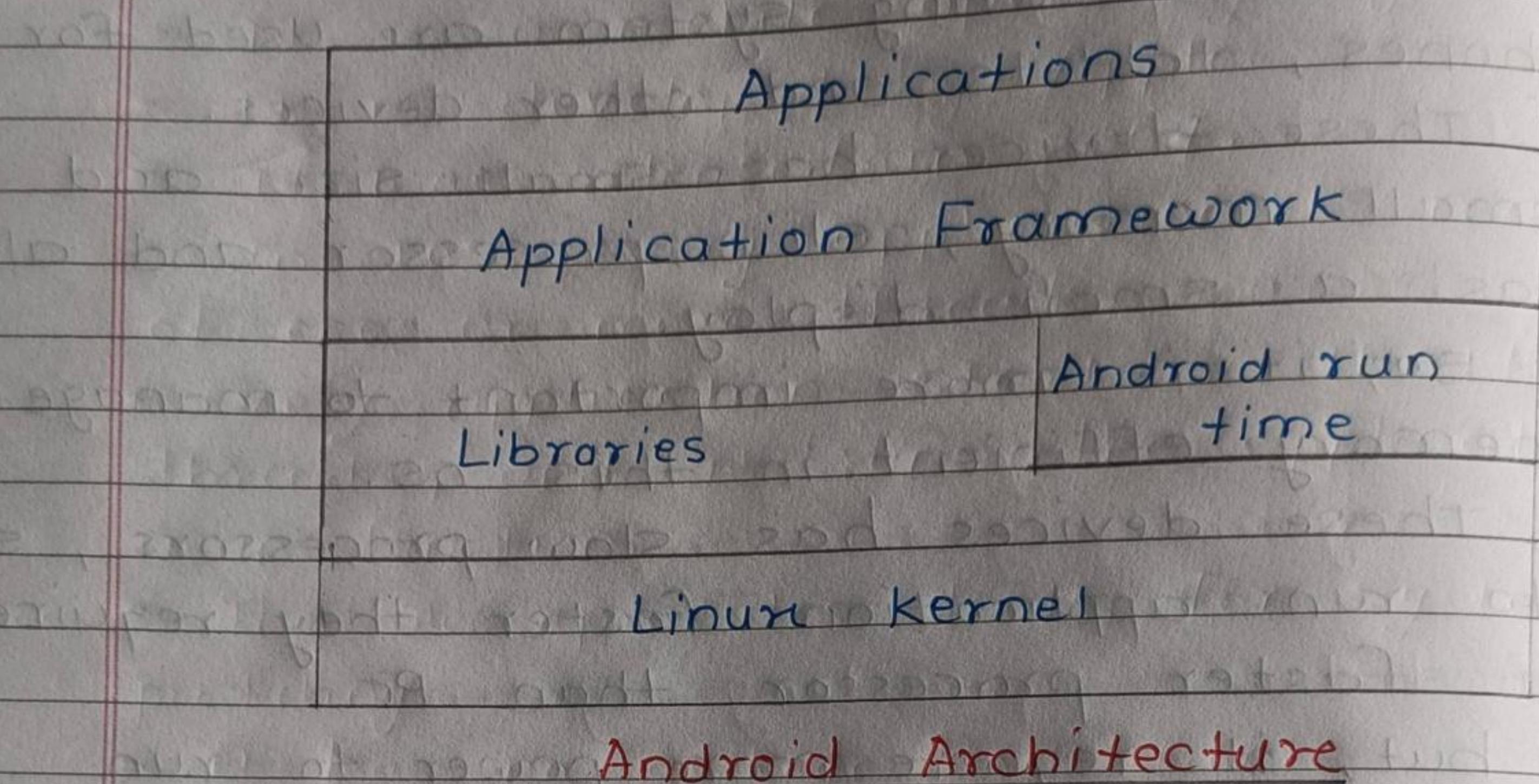
### Mobile OS :

- Mobile operating system are used for phones, tablets and other devices.
- These devices has small size and small memory, slow processor and also has a small display.
- so, it is more important to manage memory efficient in this OS.
- These devices has slow processors, so to run application faster they required a faster processor than PC.
- but, it require more power to run which will occupy more space for battery.
- Therefore, the operating system and applications are designed in such a way that they do not put load on processor.

### Android OS :

- Android OS is more popular nowadays.
- It is a open source OS.
- The main goal of android is to support a rich third party applications environment.
- It is from Google.
- This OS is more stable and robust.
- It is easy to interact with user.
- Android OS provides facility of using third party applications and it has its own collection of apps stored in Google Play Store.

## - Android Architecture:



### 1) Applications:

- Java language is used to create applications.
- It contains all the applications run on android.
- Ex. Media Player, clocks, Email and so on.

### 2) Application Framework:

- Android is open-source programming language.
- The Framework API used by core application, can be accessed fully by developers of application.
- Components:

- 1) Activity manager
- 2) Window manager
- 3) View manager
- 4) Content manager
- 5) Notification manager
- 6) ~~File~~ Package manager, etc.

### 3) Libraries :

- It is the third layer of architecture.
- The communication to this layer is through Application Framework Layer.
- It has total 9 components.
  - 1) Surface Manager.
  - 2) Open GLIES
  - 3) SQLite
  - 4) Media Framework
  - 5) Scalable Graphics Libraries
  - 6) Webkit
  - 7) Libc
  - 8) Secured Socket Layer.
  - 9) FreeType.

### Android Run Time:

- In this layer, there are two components to work.
  - 1) Dalvik Virtual Machine (DVM)
  - 2) Core Libraries.

### 4) Linux Kernel :

- The complete Android OS is constructed on the top of Linux 2.6 kernel.
- It contains driver managers.
- It has total 10 components.
- They all are drivers.

## 2) IOS :

- It is a mobile operating system.
- It is developed by Apple.
- It was released in 2007.
- In IOS, every application is made up of one or more threads.
- Every application starts with its main thread , and it runs the applications main function.
- The IOS provides tools for system profiling.
- It has no garbage collection.
- ios do not have the power management like macos.
- It has more security and does not support third - party applications.

## \* Imp Questions (?) :

- 1) Difference between Time - sharing system and Real time system.
- 2) Difference between Multiprogramming and multitasking .

## Command Line based OS:

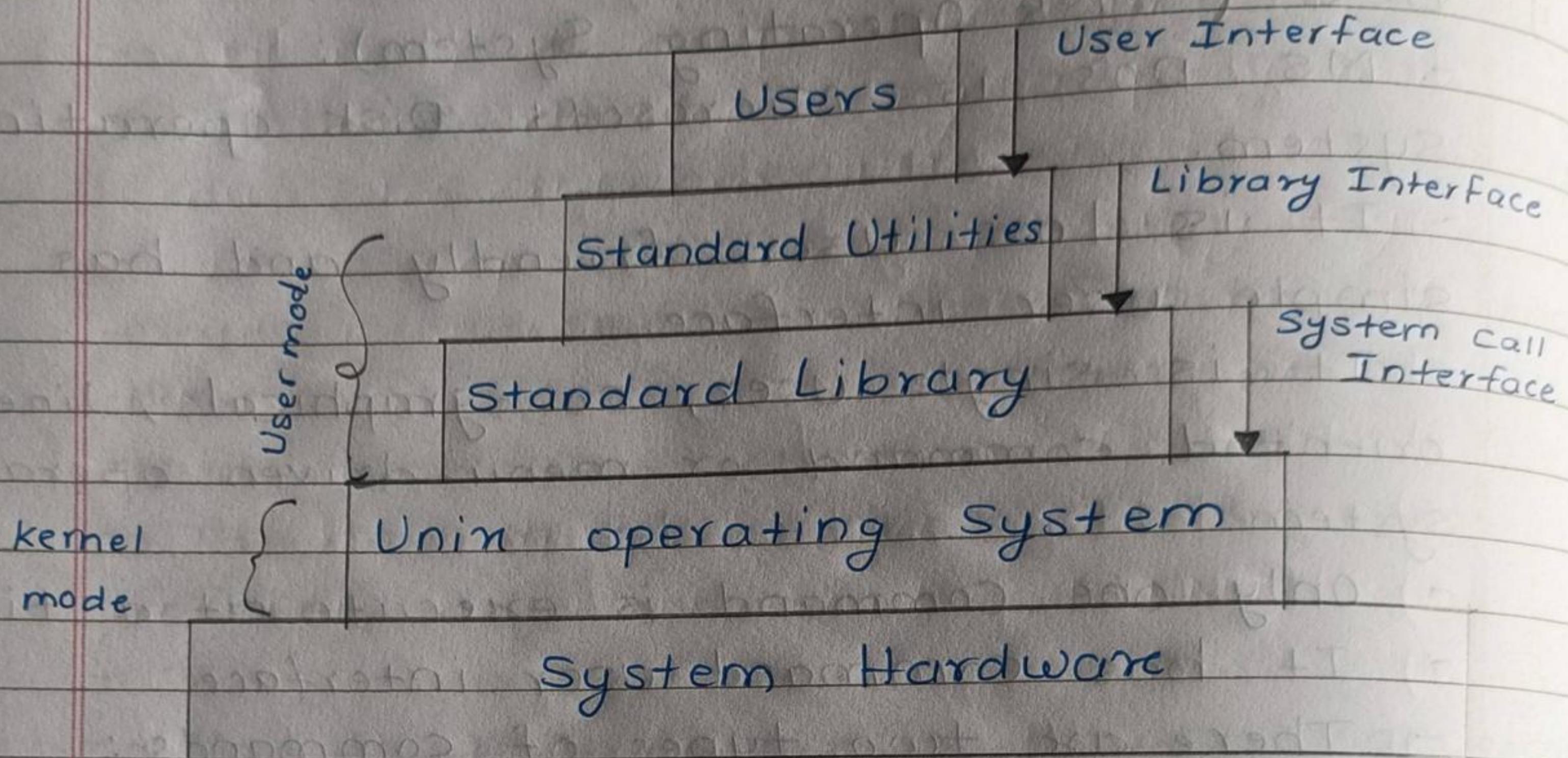
DOS (Disk Operating System):

- MS DOS is Microsoft Disk operating system.
- It is less user friendly and has simple user interface.
- It is single user, non-graphical, line-oriented command or menu-driven operating system.
- Only one command is execute at a time.
- It has command user interface.
- There are two types of commands:
  - 1) internal
  - 2) External
- It supports three executable files EXE files, COM files and BAT files.
- It supports hierarchical directories.
- It is completely written in 8086 assembly language.
- It supports I/O operations.

## 2) UNIX :

- UNIX is a command line based operating system.
- It was developed in 1970 at Bell Laboratory, USA.
- UNIX runs on wider range of computers.
- It allows users to work together and share information.
- It is simple, graceful and consistent.

## Interfaces to Unix:



## Layers in UNIX System.

### 1) User:

All the users interacting with system.

### 2) Standard Utilities:

These programs are invoked by users while working on terminal.

### 3) Standard Library:

Program issues a trap instruction to switch from User mode to kernel mode.

### 4) UNIX operating system.

It is used to control the hardware and perform all the operations from hardware.

### 5) System Hardware:

- It includes CPU, Memory, disks and other devices.

### The UNIX Shell:

- The UNIX command line interface is called shell.
- This shell is just a simple user program having ability to read from and write to the terminal.
- Also, it has power to run other programs.

### \* GUI based OS:

#### 1) Windows:

- Microsoft Windows is one of the most common graphical OS.
- It is developed and marketed by Microsoft.
- The first version of windows was released in 1985.
- It has different editions like Windows Home and Windows Professional (Windows Pro).
- It is an improved version of Disk operating system (MS-DOS).
- It has Graphical User Interface.
- It is user friendly and easy to use.

2) Linux:

- Linux is a popular operating system.
- It is not a part of any organization.
- It was developed by a programmer Linus Torvalds in 1991.
- It is open-source operating system.
- It contains all the features of UNIX OS.
- It has also its own features.
- It has different versions like UBUNTU, DEBIAN, SOLAS, MINT, etc.