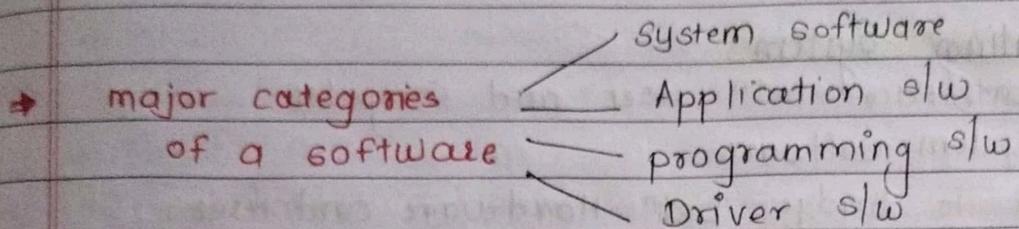


INTRODUCTION

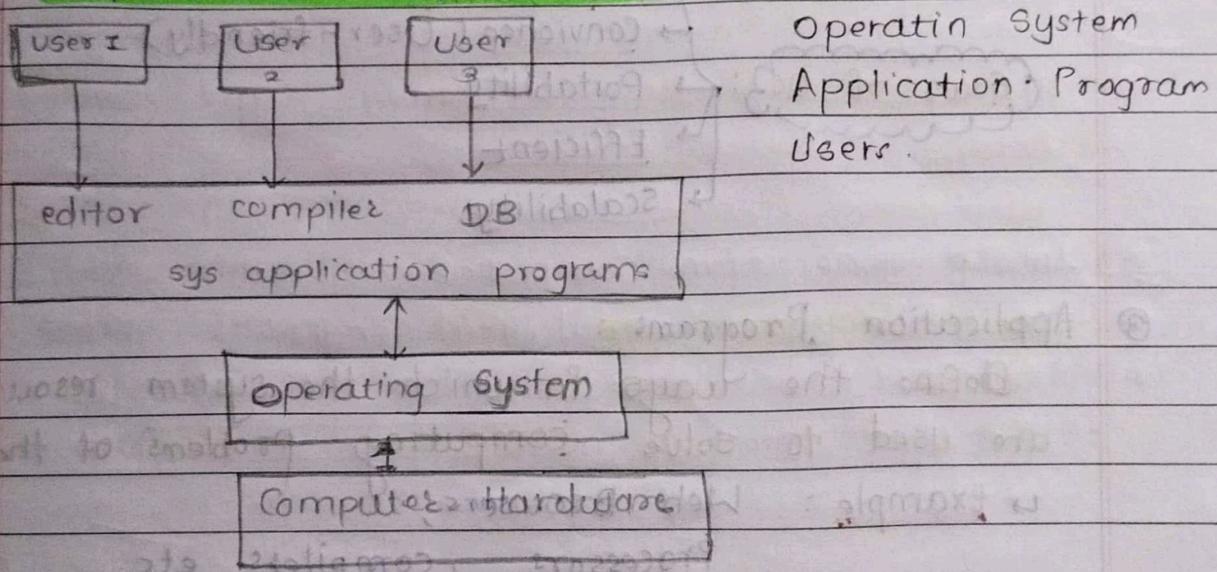
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INTRODUCTION TO OPERATING SYSTEM

components of computer system: Hardware



① Computer Hardware:

→ Physical Parts of machine provides basic computing resources.

classification

- ① I/p devices ② o/p devices ③ storage devices ④ Networking
- Keyboard, Mouse, Printer, Scanner CD, DVD, Router, switch
- Microphone, Web cam Monitor, Plotter, HVD, PD, bridge, mode
- Camera, Scanner Speakers HDD, Floppy, Hub, etc.
- ⑤ CPU
- ⑥ other devices Mother board, drives, Power supply

Software set of program use to perform certain task.

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① **Operating System:**

- Interface b/w user and computer.
- System Software.
- It is Bridge b/w Hardware and user.
- It works like mediator b/w Computer Hardware and User.
- Harmonization b/w Hardware & software is done by OS.

Goals of OS:

- Robustness
- Convenience (User-friendly)
- Portability
- Efficient
- Scalability

② **Application Programs:**

Define the ways in which the system resources are used to solve computing problems of the user.

↳ Example: Web Browsers,
Processors, compilers, etc.

④ **Users**

Humans are users

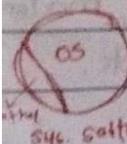
Machines are users

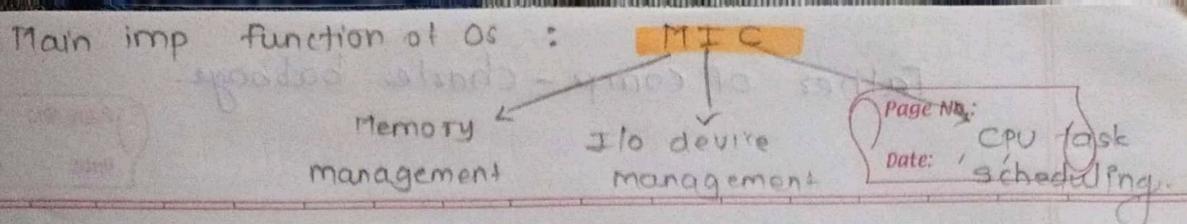
Other computers are also users

kernel: key program of OS called as heart of OS.

Deep:

- OS is major part of System Software
- other parts of System S/W are translators, interpreters and some utilities, etc.
- OS manages the computer resources and provides user with an interface used to access those resources.



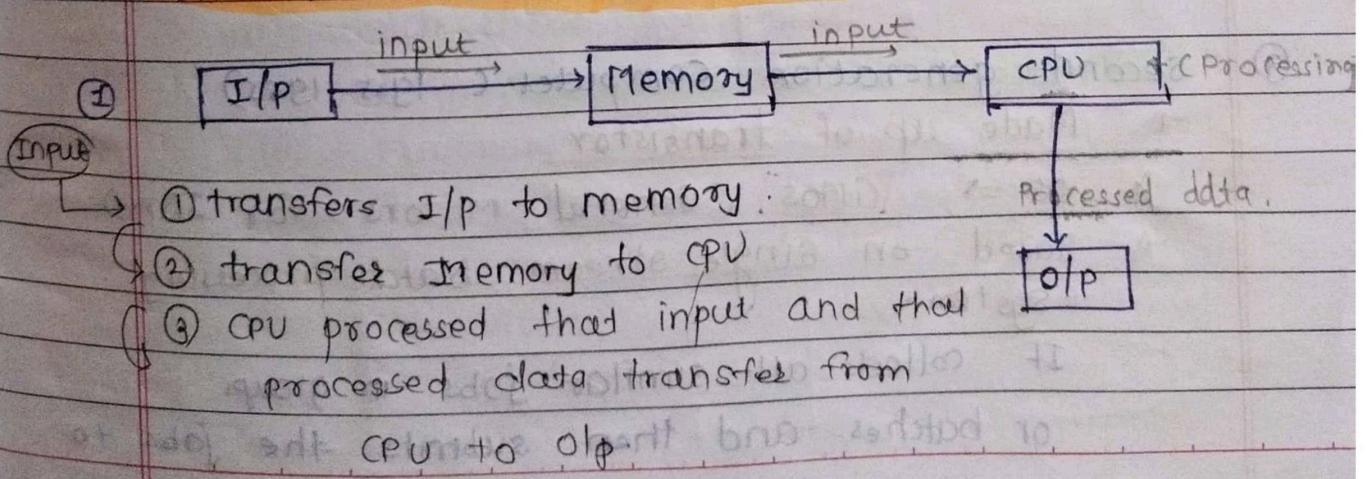


- Establishes communication channel b/w Computer User and Hardware devices.
- Basic functioning :
 - Control & allocate Memory
 - Prioritize requests.
 - Control I/O devices.
 - facilitating comp. networking & manage files.
- How OS gets load into main memory / Process of loading OS.

① When computer starts or boots, the program stored in **Firmware** i.e., ROM memory get executed. It checks status of **Hardware devices**. (It just allow data reading, erasing data like ROM is difficult from ROM).

② After Booting, OS starts executing and it gets loads into RAM i.e. main memory.

→ **FUNCTIONS OF OPERATING SYSTEM :**



- ① transfers I/P to memory.
- ② transfer memory to CPU
- ③ CPU processes that input and that processed data transferred from CPU to O/P.

Father of comp - Charles Babbage.

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- ④ Control I/P & O/P devices
- ⑤ loads application program from storage device to main program
- ⑥ handles copy one storage device data into other
- ⑦ Display error msg according to current status
- ⑧ Execution of program & user instructions
- ⑨ Provides security
- ⑩ Maintains files with details

- History of operating system
- Computer generation.

① zeroth generation computer

- made up of analytical engine
- Basic calculations
- slow speed
- No operating system

② first generation computer (1940 to 1950)

- made up of vacuum tubes
- Heating problem, size and space problem
- faster than zeroth generation
- No operating system

③ second generation computer (1955-1965)

- Made up of transistor
- OS → GMOS (General Motors for IBM)
- Based on single stream batch processing system.

It collects all similar jobs in groups or batches and then submits the jobs to

OS using a punch card to complete all jobs in a machine.

- Current leakage problem.

(4) Third generation (1965 - 1980)

- Made up of Silicon chip / IC's
- Improvement in performance.
- OS - **Multiprogramming**
- Capable for performing multiple tasks in a single computer.

Multiprogramming helps to keep CPU busy every time by performing different tasks at same time

(5) Fourth generation (1980 - till now)

- Personal Computer development
- Birth of OS like Windows, Mac-Dos, etc.

most popular

Technique used in 4th generation is Large Scale Integration.

Apple → OS (Mac OS or Macintosh) ⇒ Steve Jobs

* TYPES OF OS

① Batch processing System

② Multiprogramming

③ Multitasking

④ Multi processor

⑤ Real time

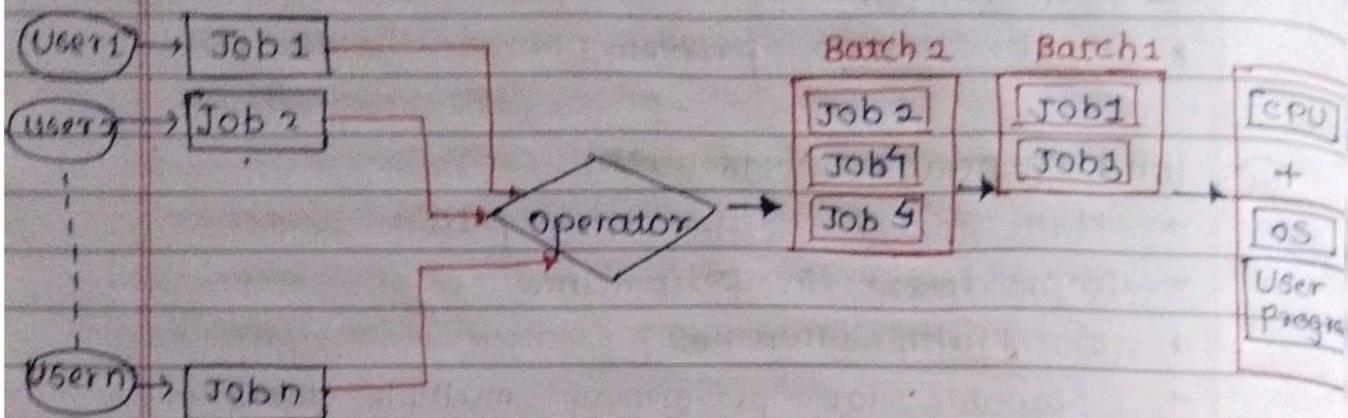
⑥ Time shared

⑦ Distributed

⑧ Clustered

Punch Cards : Small piece of paper stock
that can hold data in ^{Page No.} form
of small punched holes.

① BATCH PROCESSING SYSTEM



Batch Process OS

~~punch card~~

- Firstly, user prepares his job using **punch cards**.
- Then, He submits that job to computer **operator**
- Operator collects the jobs from different users and sorts the jobs into batches with similar need
- Then, operator submits the batches to the processor one by one.
- All the jobs of one batch are executed together.

→ Batch processing activities :

- 1) A job is a single unit consists of present sequence of **commands, data and programs**.
- 2) Processing takes place in first come, first served manner.
- 3) These jobs are stored in memory.
- 4) When job runs successfully, OS releases its memory.

Main task of Batch OS is done by **Batch Monitor**.

Advantages :

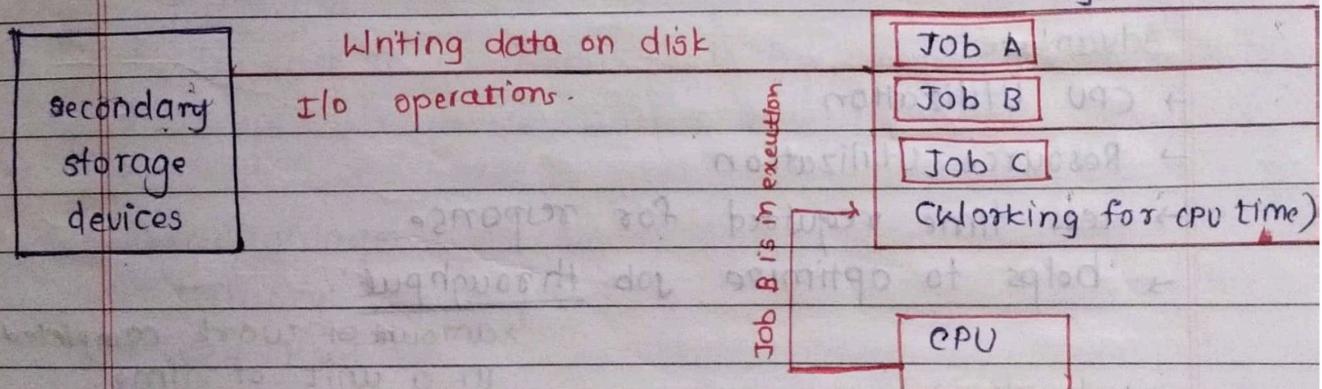
- ① saves time that was being wasted earlier for each individual process in context switching from one to another environment
- ② No manual intervention is needed

Disadvantages :

- 1) Priority cannot be set for jobs
- 2) CPU may remain idle for long time.
- 3) Lack of user interaction

② MULTIPROGRAMMING :

Main Memory



Multiprogramming :

→ **Multiprogramming** : Loading of one or multiple program into main memory for getting to execute.

WORKING :

In multiprogramming system, multiple users can perform their tasks concurrently, and it can be stored into main memory.

CPU has ability to deliver time to several programs while in idle mode.

↳ एकी वस्त्राला मगतो / रिकार्ड

Program = Process, Task, job
in execution process.

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All jobs are not executed in same time frame but multiple jobs present for processor and part of other processes are executed the segment of another and so on.

Working activities

- Multiprogramming os has ability to execute multiple programs with using one processor machine.
- Here If single program gets to wait state, then other program are always ready to CPU utilization. (thus multiple jobs can share time of its CPU)

Advantages:

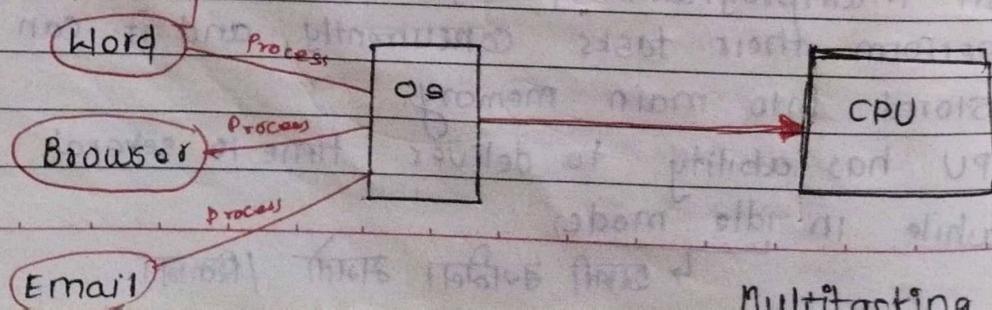
- CPU Utilization
- Resource Utilization
- Less time required for response.
- helps to optimize job throughput.

↳ amount of work completed in a unit of time.

Disadvantages:

- CPU scheduling requirement
- Memory Management
- User cannot interact with any program while that is in execution

b) Multitasking OS:



- Multitasking is logical extension of a multiprogramming system that enables the execution of multiple programs simultaneously.
- Multiple programs are resides in main memory.
- It allows user to perform more than one tasks (Processes) simultaneously.
- The CPU switches from one task to another for reading and processing. Thus idle time of peripherals get reduced.

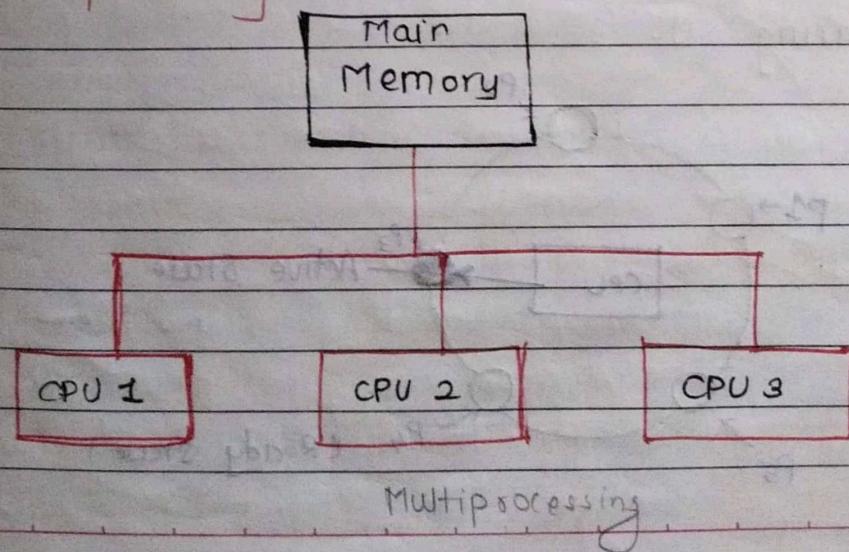
Advantages:

- Multiple tasks can processed simultaneously.
- Multiple applications are used in back and foreground.
- Increase in execution speed by resource management.
- Keeps I/o device and CPU busy.
-

Disadvantages:

- Memory boundation.
- CPU Head up

4) Multiprocessing OS (parallel system)



- To improve performance, more CPU's are used.
- More than one CPU / Processor can be placed in single cabinet, which share bus, resources, clock, etc.
- Multiple processors are used so that a job can be divided among them for faster execution.
- When job is finished results from all CPU's are collected and compiled to give final output.

UNIX OS is multiprocessor system

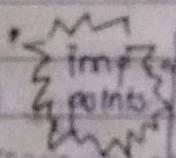
Symmetric → same copy of OS for both processors.

Types

Asymmetric → different OS for other processors

Advantages

- ① More than 1 processor
- ② Provides reliability (failure management)
- ③ Throughput increased
- ④ Maximum work done

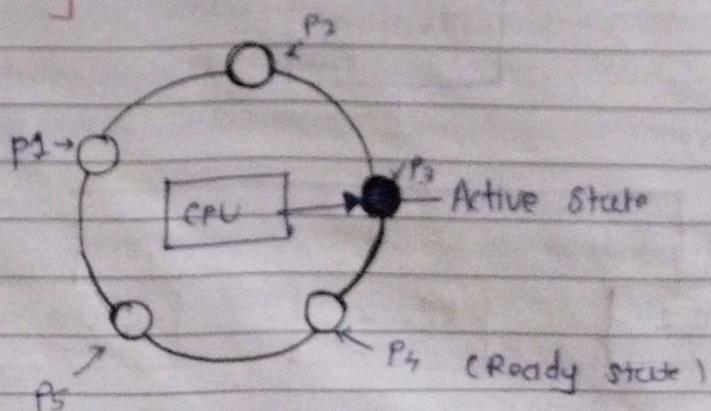


- More than 2 → High parallelism
- They share parallel memory & p. → ① a. Throughput → ② A.

Disadvantages :

- ① Expensive
- ② Large memory requirement

3) Time sharing OS :



- It allows to user to perform more than one task at a time, each task getting the same amount of time to execute.
- switching betⁿ task is very fast due to which the user feels all tasks are running at same time .

Working :

time sharing is performed through CPU scheduling & multiprogramming .

→ A short duration of time is chosen for each process ie time slot , quantum , time slice

→ P₁, P₂, P₃, etc are processes , if quantum is set as 3ns then each processes execute for 3ns .

Advantages :-

- Reduces Response time
- Reduce idle time .
- Equal time slot .

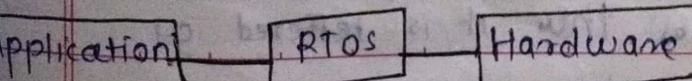
Disadvantages :-

- Much system resources
- Reliability problem

6) Real time OS (RTOS)

→ It provides good response time

→ Used in real time application



Real Time Application is a application which requires timely response . From

- In real time OS, a job has to be completed within fixed deadline.
- If job is not completed within given time, then system may extend time for doing the operation.

Types

Hard Real Time → Where time constraints are very strict, shortest possible delay may lead to failure.

Soft Real Time → small delay may be accepted.

Advantages:

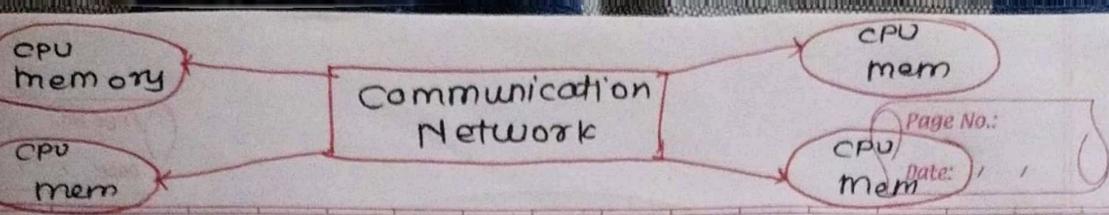
- Maximum utilization of devices & system
- Less time shifting.
- Focus on current Application
- Memory management

Disadvantages:

- Limited tasks
- Complex Algo.

① Distributed OS :

- A distributed system is one in which single communication channel is used to connect multiple computer systems.
- These systems have their individual systems with processors and memory. They communicate through high-speed buses or telephone lines. Thus it is referred as loosely coupled systems.



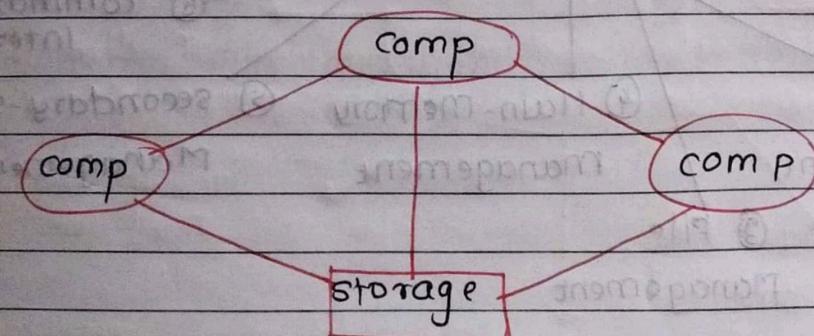
Advantages :

- sharing resources.
- Increases the data exchange speed
- Reduce data processing time.
- Failure doesn't leads to complete system failure
- Reliability

Disadvantages:

- Maintenance cost is high
- Failure in main network will stop entire communication
- Expensive

③ Clustered OS :



- Two or more computers are interconnected
- combination of H/w and s/w cluster.

this cluster responsible for

sharing high-performance disks provide best environments for

- Each node contains cluster, s/w. This clusters are monitor by s/w and it makes sure it is working as required.

→ If any ~~cluster~~^{node} is failed, then remaining nodes take control of its storage.

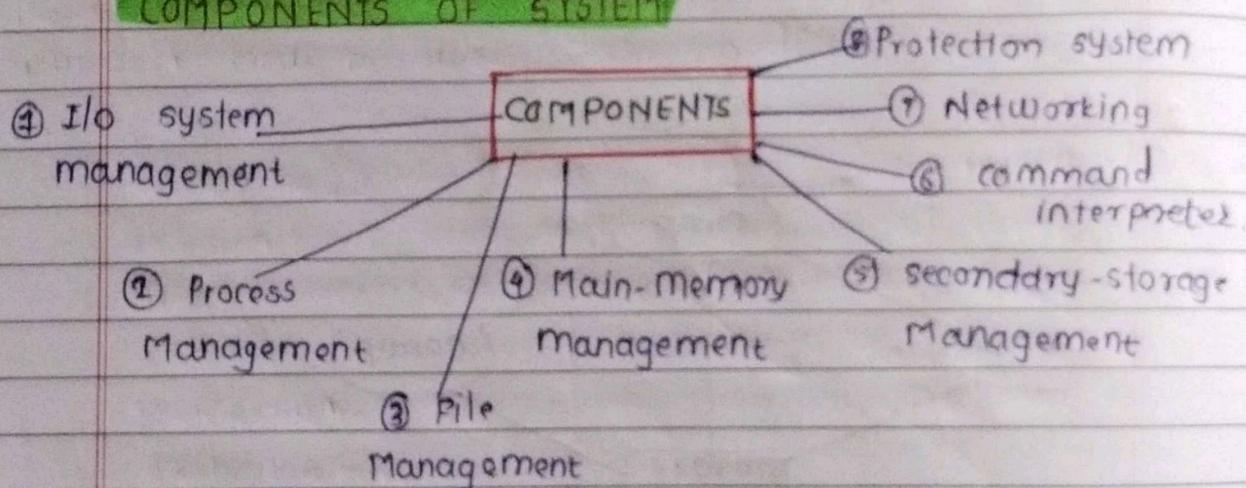
Advantages:

- ① High Availability
- ② Cost Efficiency
- ③ Additional Scalability
- ④ Fault tolerance
- ⑤ Processing at high speed.

Disadvantages:

- ① Maintenance
- ② Required Resources
- ③ Cost Effective

COMPONENTS OF SYSTEM



① **PROCESS Management:** It is executed by CPU & managed by OS.

Process → Task
executed by CPU is called process.

program execution Internal system task

computer OS manages various activities from user programs upto system programs, called as Process

Examples: printer spooling
file/Name server

Part of process

during execution resources (I/O devices, data, program etc) are required thus they are part of process.

Requirements of process

Execution components (code, data, PC, registers, etc) are required.

Process is unit that measures work done by system.

creation & deletion of user/sys process

5 major activities related to process Management

* scheduling

suspension & resumption
(stopping process temporarily & resume as required)

Handling deadlock situation when processes waits for a resource to become free

Process synchronization

(There must be co-ordination in both processes)

Process Communication

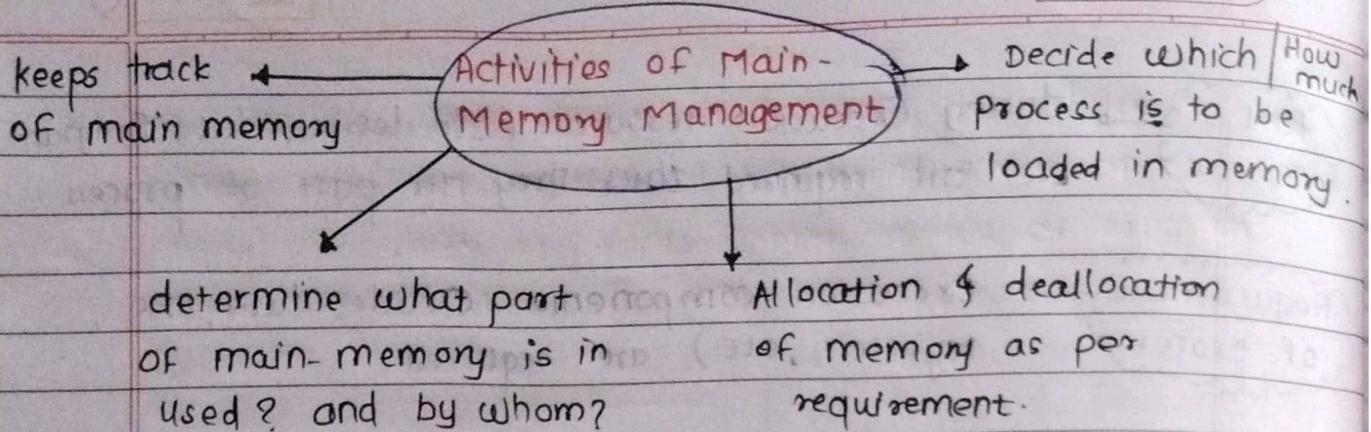
(for smooth running Processes may need to communicate with each other)

① Main-Memory management :

Memory :- Primary memory (RAM, ROM, PROM, EPROM, etc)

Secondary memory (HDD, Floppy disk, CD, DVD, etc)

RAM → Major part of main memory or primary memory. It is large array of words which has an unique address. CPU uses main memory to execute instructions, as program is stored in main memory. When a program is loaded.



③ File Management :

File → collection of related info or data

- 1) Program File - collection of executable files.
- 2) data File - stores data define by creator.

File is stored on disk (secondary storage). OS decides where & how to store data on disk

storage device stores data on locations called tracks, sectors, clusters

creation & deletion of directories

Creation & deletion of directories

Files

Manipulating files and directories

Backup the files (on secondary devices)

Mapping files on secondary storage

④ Input/Output system management :

→ Hiding variations of specific H/w devices from user
is major function of OS

Activities of I/O sys.

Hide com-

plexity of I/O devices

From user.

I/O operation

Management

Memory management for I/O devices.

Keeps I/O

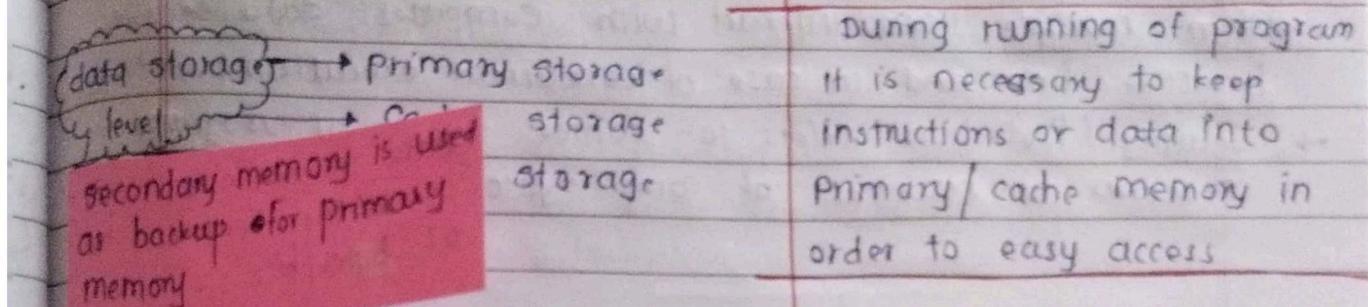
devices continuously busy

- set of all addresses that are available to a program is called address space

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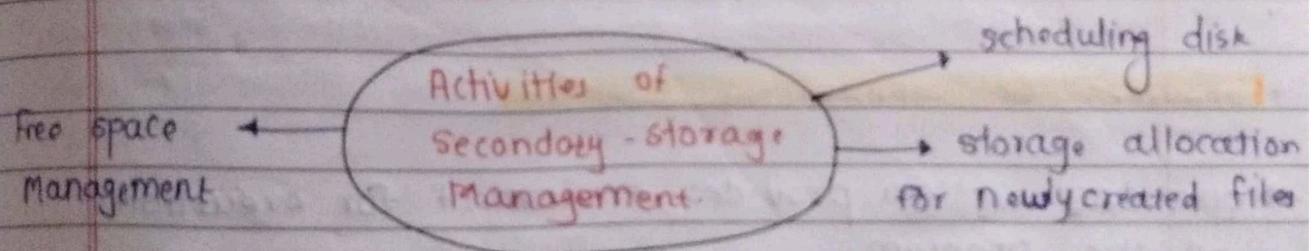
⑤ Secondary - storage device Management :



during running of program it is necessary to keep instructions or data into Primary / cache memory in order to easy access

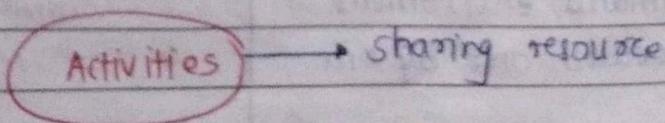
→ But as the main / Primary memory's size is small to store program or data permanently on primary memory thus as a permanent storage we use secondary memory

→ Each location in secondary memory has its unique address where data may be or may not be present



⑥ Networking :

- * Allow multiple computers to connect with each other
- * Distributed sys is collection of processors that never share their memory & clock
- * Network = communication that takes place among processors via telephone / communication lines .



① Protection System :-

- When multiple users interact with computer, data security becomes imp. and in case of concurrent execution protection^{imp.}
- Security / Protection refers to control access of programs, processes or resources of comp. system.

② Command Interpreter System :-

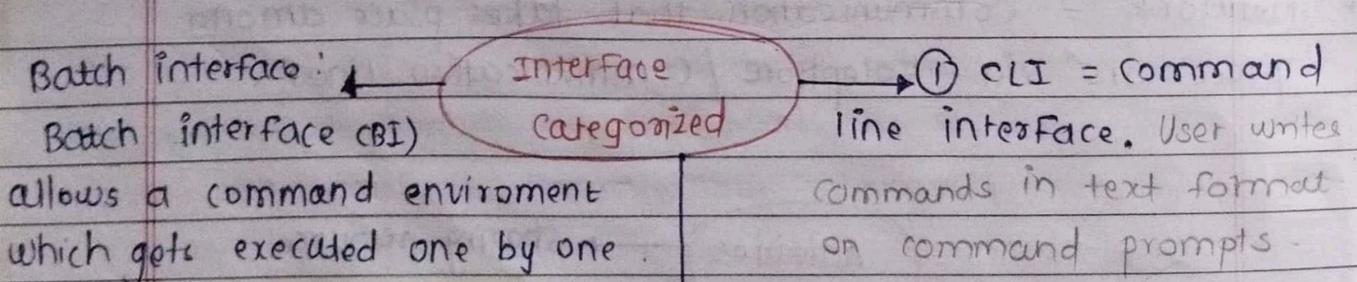
- Interface b/w user and os.
- Main function is get the command & execute it.

→ SERVICES OF OPERATING SYSTEM :-

- operating system provides environment for execution of the program.
- It provides certain services to programs & users of program.

① User interface :-

- It is the medium through which user interacts with the computer via os.



In Batch interface: User creates a batch file

which contains multiple TUI :- Graphical User interface.

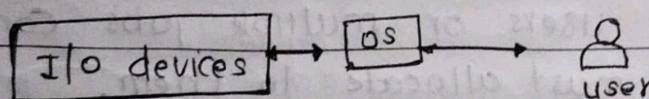
It is a window system with tools like pointing devices to point I/O, choose from menu.

Program Execution :

- Important service
- OS assigns work to CPU for program execution.
- User's program cannot run independently, it needs a platform of OS.
- So,
 - i) OS loads / allocates main memory to program
 - ii) Program gets executed
 - iii) OS frees / deallocates the memory.

Input / Output Operation :

- Program may require I/O devices for execution which involves file or other I/O devices.
- For better efficiency and protection, User cannot directly interact with I/O device.
- So Here OS provides means to interact with I/O devices and make them available for users.



OS hides
H/W details
of I/O devices

File System Manipulation :

- i) Output of a program may be needed for another program as an input in that case output must be written into new files.
- ii) There are many files & directories in your sys. OS manipulates them.
- iii) You may have to create file, delete file, Modify file or search file all this controlled by OS. Also it provides different permissions like read / Write / execute etc. according to file owner access permission.

⑤ Communication :

- Here communication refers to communication b/w different processes
- Process on same computer or on different computer system can communicate with each other using os support of message passing or shared Memory

⑥ Error Detection :

- Error leads to Malfunctioning of system
- To avoid this os monitors system constantly for error detection
- Os take adequate action for ensuring correct and consistent computing

⑦ Resource Allocation :

- When multiple users or multiple jobs concurrently then, resources must allocate to them.
- Resources → CPU, main memory & file storage, etc.
- Os allocates required resources by process.

⑧ Accounting :

- keeping track which resource is used by users and How much time
- Helps to find usage statistics
- Helps researchers to find out usage & and requirement to reconfigure system

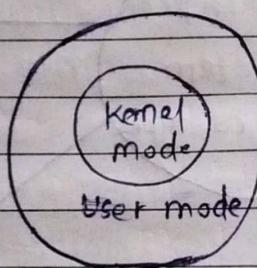
⑨ Protection & Security :

protection : all access to sys resources is controlled
security : use user authentication to secure system from unwanted users.

Protect Your System & keep it secured.

SYSTEM CALL

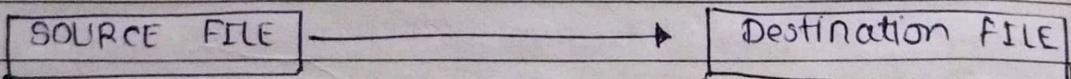
- System Call is the interface communication made by an OS system with the processes.
- It provides interface b/w process and the operating system.
- It is programmatic way in which comp. program request a service from kernel of the OS.
- These services are offered via API (Application Programming Interface).



EXAMPLE

System call for

Copy data from one to another file.



Get input file name

Write prompt on screen

Accept input

Get output file name

Write prompt on screen

Accept input

Open input file

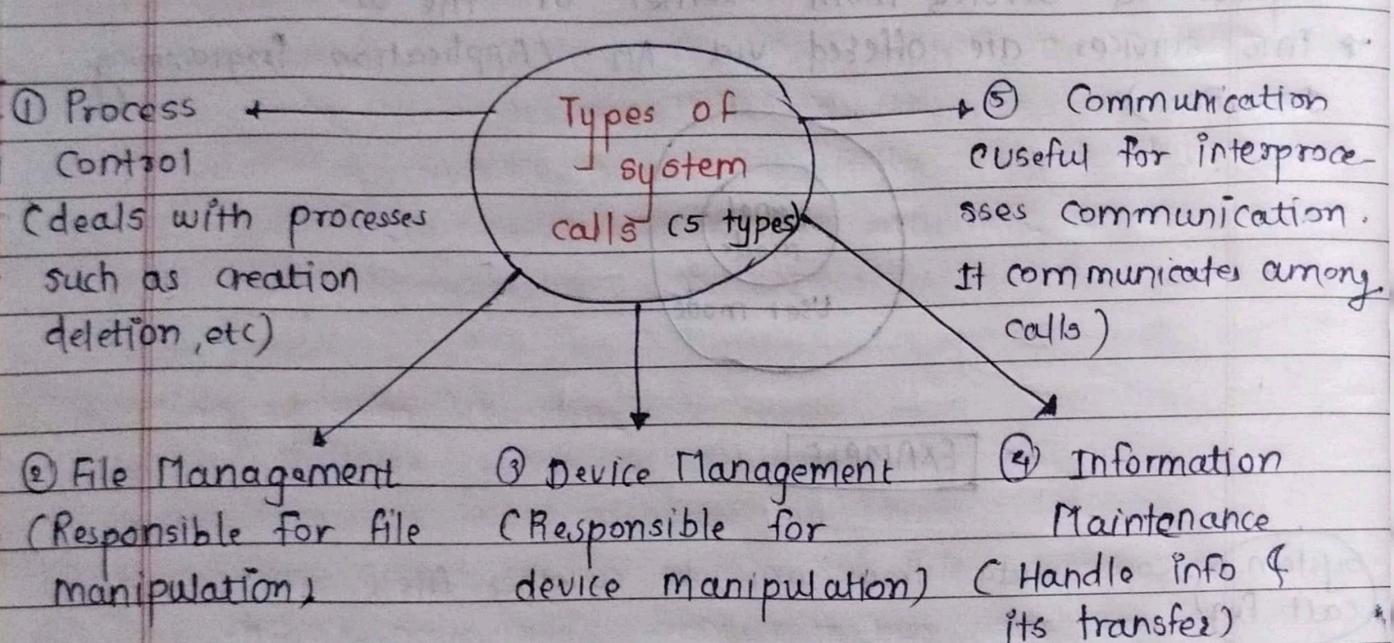
If not exist, abort operation

Create file (output)

If file exists, abort operation

```

    Loop      Read from I/p file
              Write to O/p file
    till read fails
    close O/p file
    Write completion msg to screen
    stop.
  
```



① Process Control

- end, abort
- load, execute
- Create, terminate
- get/set process attribute
- Wait for time
- Wait event, signal event
- Allocate & free memory

② File Management

- Create File, delete file
- Open, close
- read, write, reposition
- get file attributes
- set file attributes

③ Device Management :

- Request device, release device
- Read, write, reposition
- get / set device attributes
- Logically attach or detach device.

④ Information maintenance :

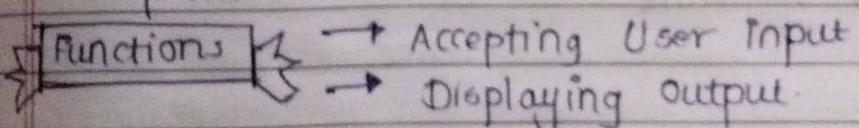
- get / set time or date
- get / set system data
- get / set file, process or device attributes

⑤ Communication :

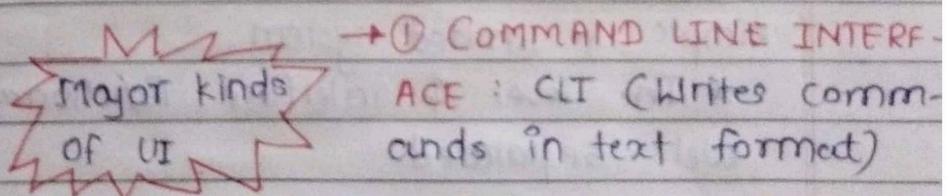
- Create, delete communication connection
- Send, receive messages
- Transfer status info.
- Attach / Detach remote devices

User-Operating System Interface :

→ First impression of software system from user point of view.



→ UI has its syntax (look and feel) & semantics (usability)



② → GRAPHICAL USER INTERFACE : (GUI)

Also known as WIMP :

W → Windows - rectangular area on screen to run app

I → Icon - symbol of H/w or application

M → Menu - list of options

P → Pointer - used for pointing.

→ It is comp resource that uses s/w

Virtual Machines : instead of a physical comp to run apps.

→ VM provides an environment that is logically separated from the underlying H/w.

→ Host machine - machine on which VM is created

Guest machine - VM is referred as Guest Machine

Hypervisor - Software/Firmware manages the VM

Types

① Process VM - It allows to run single process as an application on Host-machine.

② System VM - It is fully virtualized VM design, substitute for a physical machine.

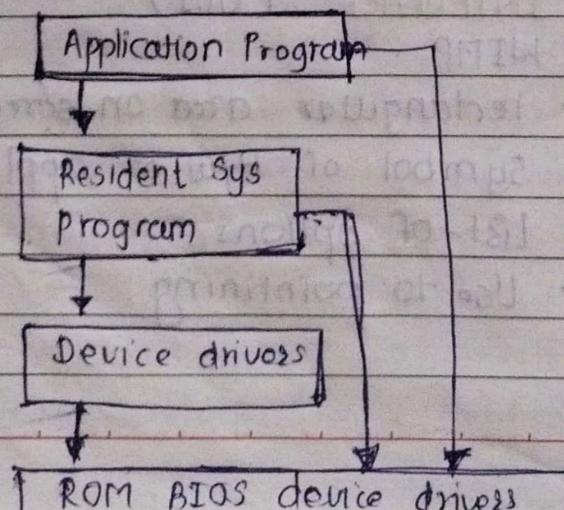
Operating system structure

1) Simple Structured OS

→ don't have well define structure and are small, simple & limited system.

→ The level & interface functionality are not well separated.

→ Example MS-DOS



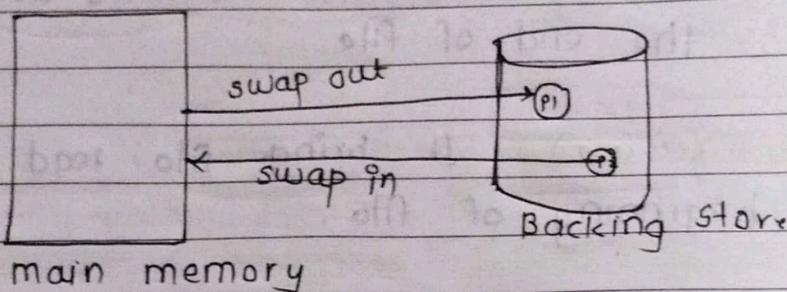
swapping :

- memory management tech
- Any process must be in the

memory for its execution, but can be swapped temporarily out of memory to backing store and then again come back in memory for execution is called swapping.

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Round Robin

Scheduling

- Time slice is given to processes.
- When time slice expires memory manager swap out those processes.
- An swap in another process for execution.

Priority-Based

scheduling

- If higher priority process enters in ready queue memory manager swap out current process
- swap in high priority process
- swap out - roll out
swap in - roll in

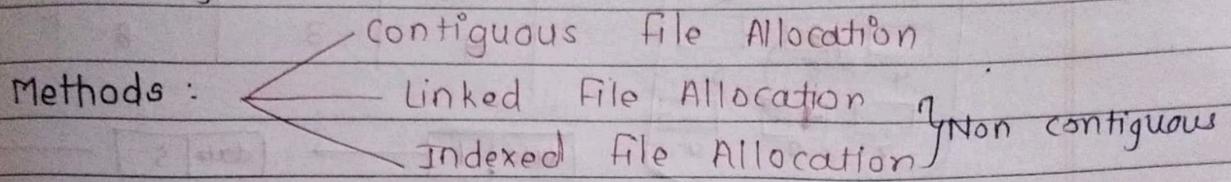
Swap in - process remove from secondary memory & placed in main memory

Swap out - Removing process from main memory (and placed in backing store / secondary memory).

done by
Memory
manager

File Allocation Methods :

There are many files that are present on same disk, problem is how to utilize these files so that disk space will be utilized effectively.

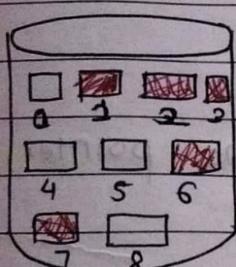


Contiguous File Allocation -

→ Each file occupies contiguous set blocks on disk.

→ Head movement is done from one track to another.

- directory entry of file contains
- ① Address of starting file
 - ② length of file



directory

File	start	length
A	1	3
B	6	2

Advantages : → Faster data access

→ support direct and sequential Access

Disadvantages : → External fragmentation (space available but not contiguous)

→ File grow is not possible / difficult.

Linked list Allocation :

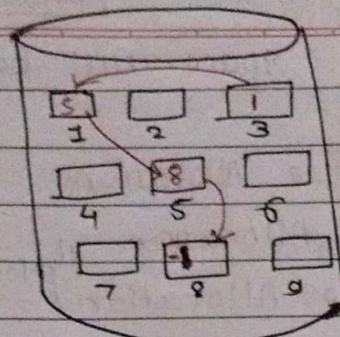
→ Non-contiguous allocation.

→ disk blocks of file are chained together with linked-list.

→ Directory contains pointer to first and last block file

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File	Start	end
A	3	8

data | 1 | → data | 5 | → data | 8 |
3 1 5
 ↓ ↓
 data | -1 | ← data | 8 |
 5

Advantages: → solve external fragmentation

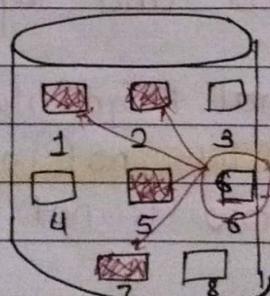
- File can grow
- Start and end of file is easy to find.

Disadvantages: → pointer overhead

- Not useful for direct access
(Searching done from beginning)
- Time consuming

3) Indexed Allocation :

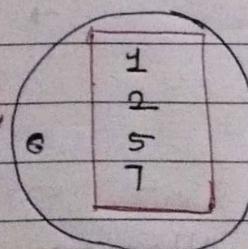
- Here, special index block contains pointer to all blocks occupied by a file
- Each file has own index block
- Directory contains address of index block



File	Index block
A	6

Disadvantages:

- Space wastage
- pointer overhead
- Not efficient to use index box in case of small file.



Advantages: → Faster

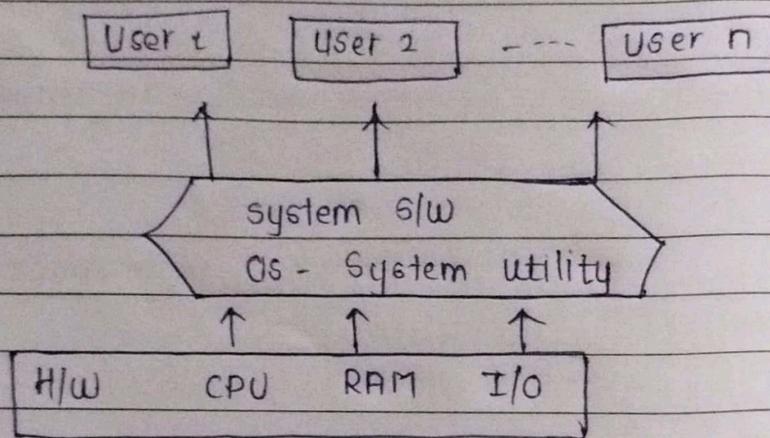
- Set of pointers are at one location
- No fragmentation
- Easy Access

UNIT - 01 Introduction

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QOS basic Concepts :

OS is system sw which is interface betn user and computer.



Basic OS structure

① Diff. functions of Os :

① Memory management :

② Processor - H :

allocation of CPU to diffnt processes.

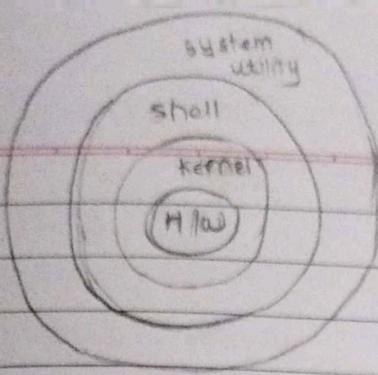
③ File management :

→ Intro
 → Types
 → Adv/Disadv
 → Why we study Linux
 → OC

② GNU project

→ History :-

③ Open source s/w movement & linux os :



Linux structure.

DIFF'NT UNIX and LINUX.

• Types of OS :

① Batch OS :-

The users of batch os do not interact with the comp. directly. Each user prepares his job offline & sends to operator.
for. ex. punch cards

② Time sharing OS :-

It is the technique which enables many people located at various terminal to use a particular sys at ~~various~~^{same} times, processor time which shared among multiple user simultaneously

Adv : provide quick response

Avoid duplication of S/w.

Reduce CPU time

dis : Security of data

Integrity →