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Operating System

- O.S acts as an interface between user & hardware.
- O.S is a system software.

Software
↓
Tested Programs + Documentation
↓
user manual for using s/w.

Types of software:

Application s/w - Designed for some specific task. eg:- MS office, Windows media player etc.

System s/w - Operates the computer h/w. It provides platform for application software to run. Eg:- Linker, Loader, Debugger

User
↓
Application s/w
↕
System s/w
↓
H/w

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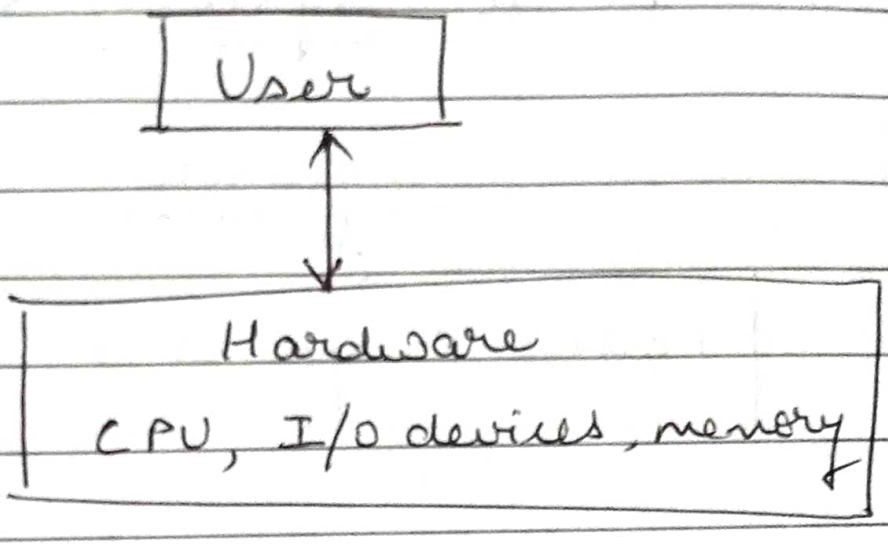
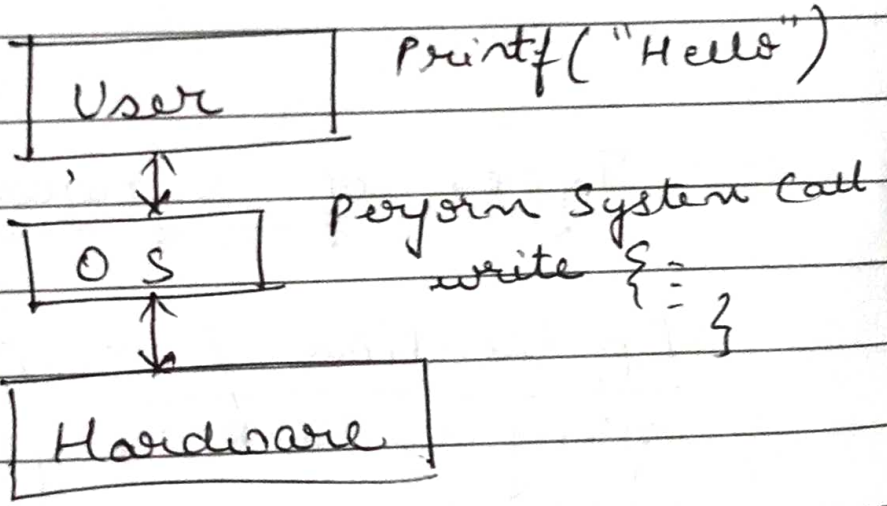
can User directly interact with hardware ?



Simple example :- Fan ← Switch



- O.S makes accessing of h/w easy for user.
- User need not to worry about background details/hardware details

or Goals.

★ Objective of Operating Systems.

Following are the 3 objectives of operating system:

1. Convenience
2. Efficiency
3. Ability to evolve

1. ~~Convence~~ : Convinience

Computer system can be conventy used due to operating system.

2. Efficiency:

An Operating system permits the computer system resources to be used in an efficient manner.

3. Ability to evolve:

The Operating system is built in such a manner that it allows the efficent development and introduction of new system function without interfering with the service

Functions of O.S

1) Resource Manager/allocator

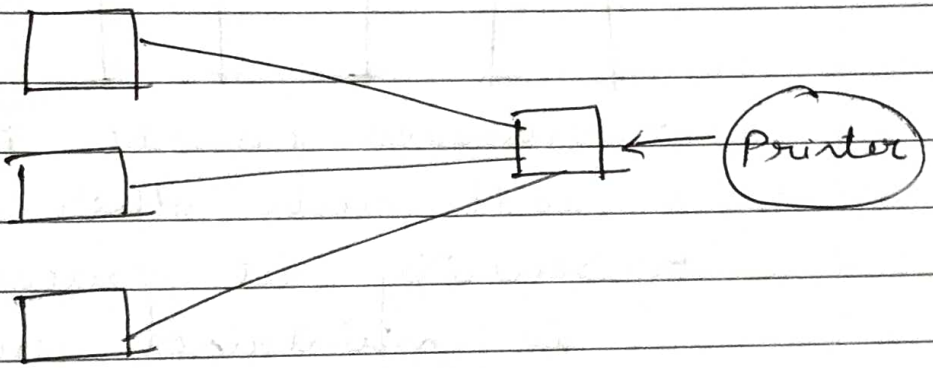
Two users want to access same resource, the O.S manages which user can access the resource.

2) Process Management (Scheduling) → P.T.O

3) Memory Management → P.T.O

4) File Management → P.T.O

5) I/O Device Management.



Only 1 user can access printer at one time. It is the responsibility of O.S.

6) Storage Management

→ To manage hard disk is responsibility of O.S.

7) Security & Protection

Password for Laptops.

↓

Authorized user can access the files in laptop.

↓

O.S manages the security by storing the p/w's & matching it with entered password.

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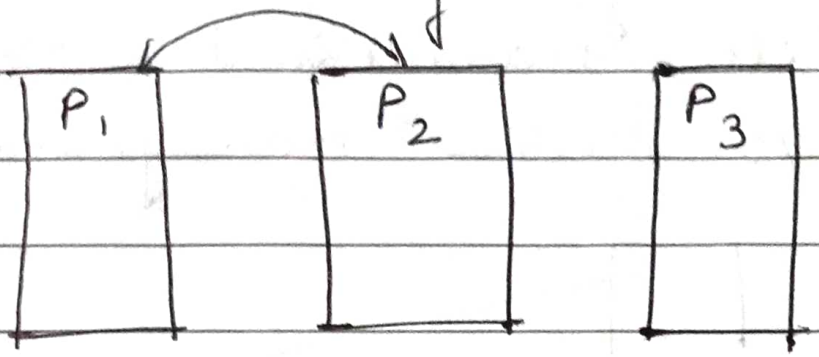
The resources of the system are protected by the O.S



- Processes cannot interfere with each other
- Security at process level is maintained by O.S.

(1) Process management.

1] A process can be thought of as a program in execution.

2] The process management activities handaled by OS are as follows:

a) Creation, execution and deletion of system processes.

b) Resume a process execution or cancel it.

c) Scheduling of a process.

d) Inter process communication and deadlock handling for processes.

(2) Memory Management.

1] The memory managment activities handled by OS are:

a) Keeping track of which part of memory is currently being used and by which program

b) Deciding which processes are to be loaded in the memory when memory space becomes available.

c) Allocation and realocation of the memory space as per the requirement.

(3) File Management.

1] File Management is one of the most important function or component of O.S

2] A File is a collection of records.

3] File represents programs and data

4] Data files may be numeric or alphabetic

5] Operating system looks after the following activities

a) Creation and deletion of Files

b) Creation and deletion of directries

c) Maintain file backup & file security.

* Evolution of O.S

1) First generation (1945 - 1955) -
   No O.S.

2) Second Generation (1955 - 1965)
   Batch Processing System.

3) Third Generation (1965 - 1980)
   Multiprogramming System
   Time Sharing System

4) Fourth Generation (After 1980)
   Personal Computer

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* Types of O.S

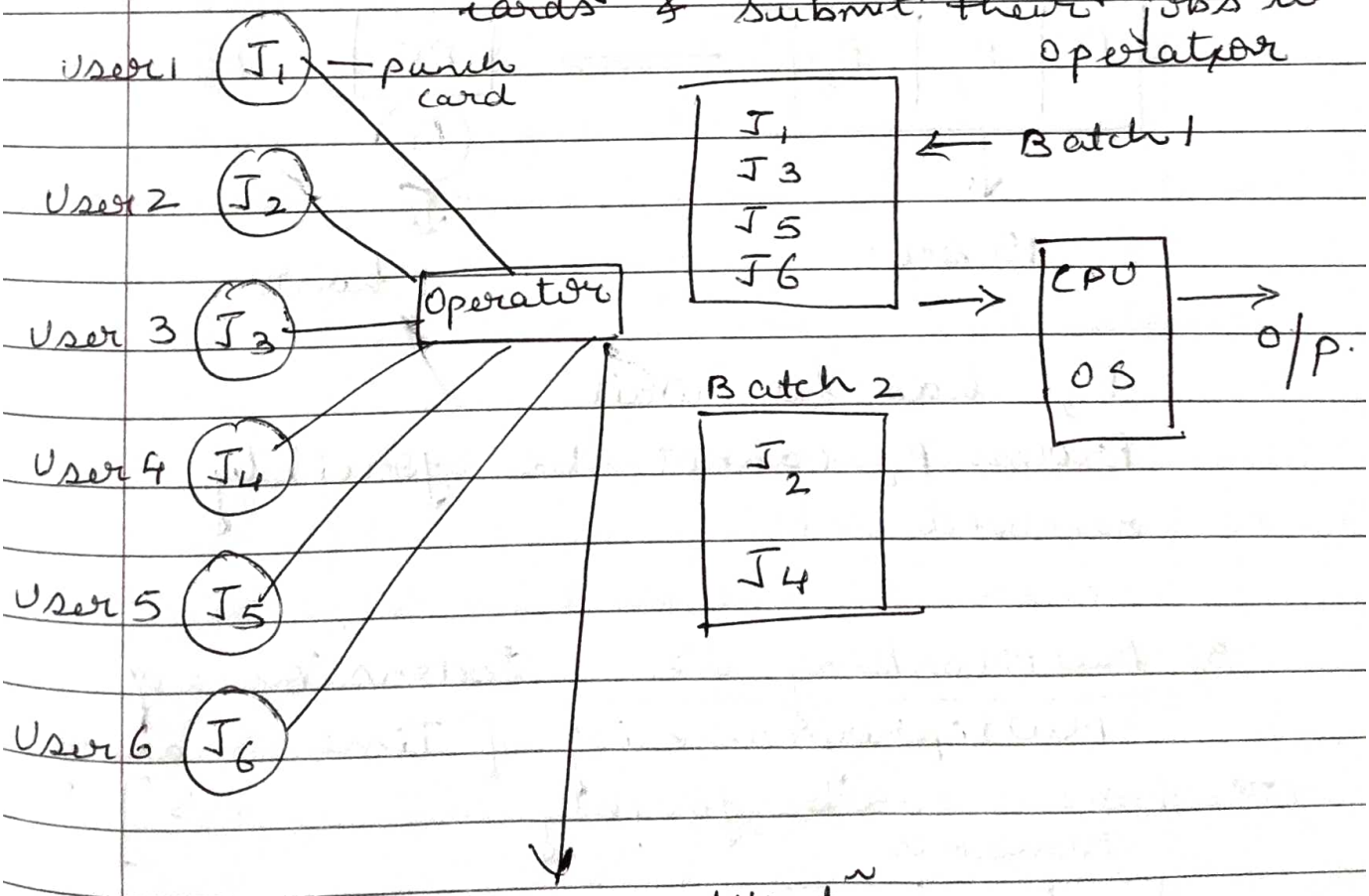
1) Batch O.S → Batch has many jobs.

User cannot interact.
Batch O.S is non-interactive

Job.

Program
I/p Data
Control Instructions

User prepare their jobs in the form of punch cards & submit their jobs to operator

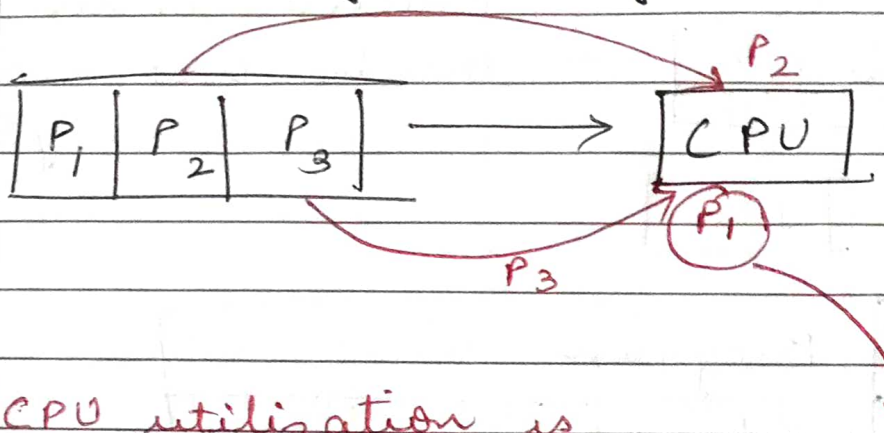


Person utilisat~~ion~~ is low. (Loading jobs & unloading jobs)

Drawback - CPU ~~is idle~~.

Time Consuming.

2) Multiprogramming OS

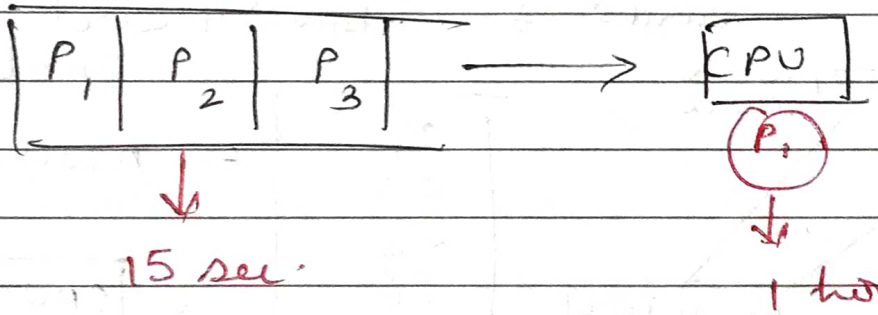


CPU utilization is increased.

I/O operation

Drawback:

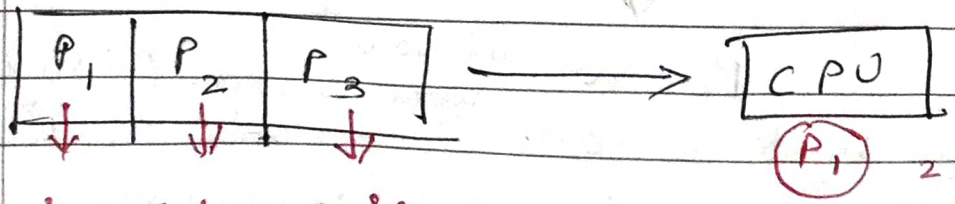
→



P_2 has to wait.
Process P_1 cannot be forcibly removed.

3) Multitasking OS — Extension of Multiprogramming [Time Sharing OS]

→ Process can be forcibly removed



Time Quantum = 2s

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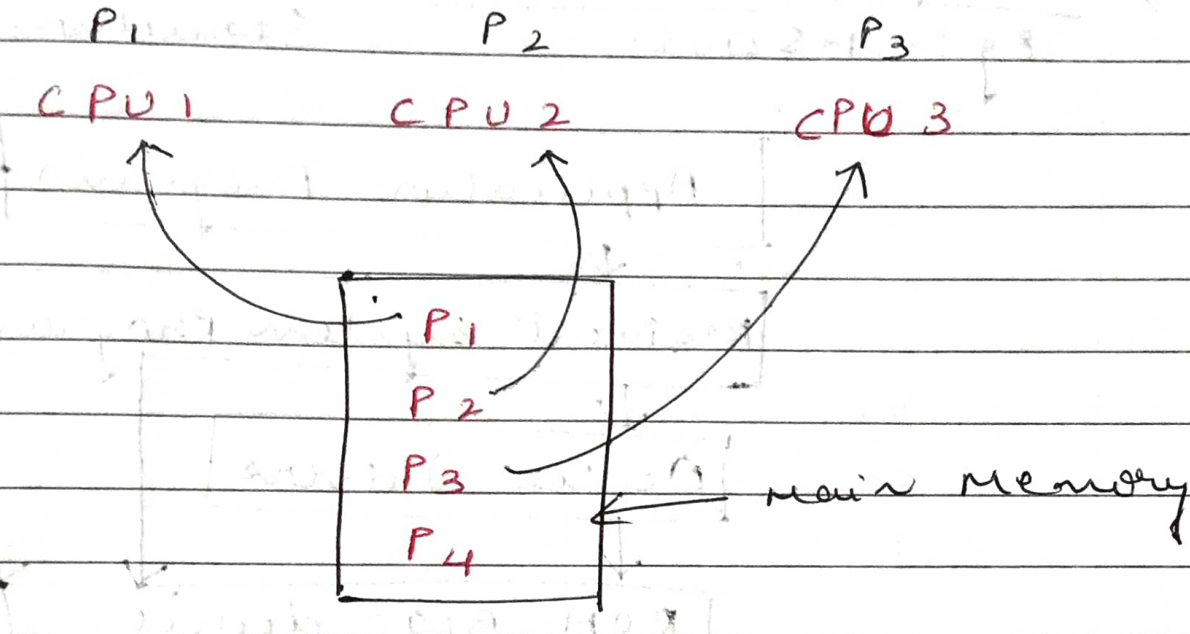
4) **Multi Processing O.S**

Multiple CPU's.



At the same time multiple processes are running.

5) **Real time O.S**

Used in real time applications.

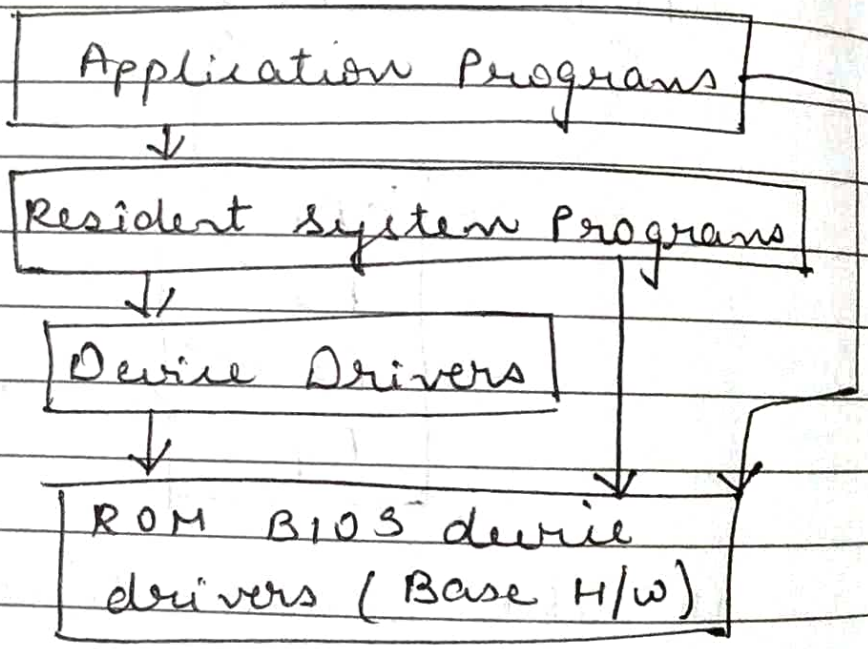
Soft Real time O.S → Process should be completed within the time bound.
Hard Real time O.S → Process should be completed at exact time.

eg :- Time Bomb, Missile Launching.

* Structures of O.S

1) Simple structure (~~Monolithic Structure~~)

Eg:- MS DOS.



→ Simple structure was the structure that was followed for most of the operating systems that were designed long ago.

→ They do not have very well defined structure.

→ Application programs can access Resident system programs & base h/w

→ Resident system programs can access Device ~~or~~ drivers & base h/w

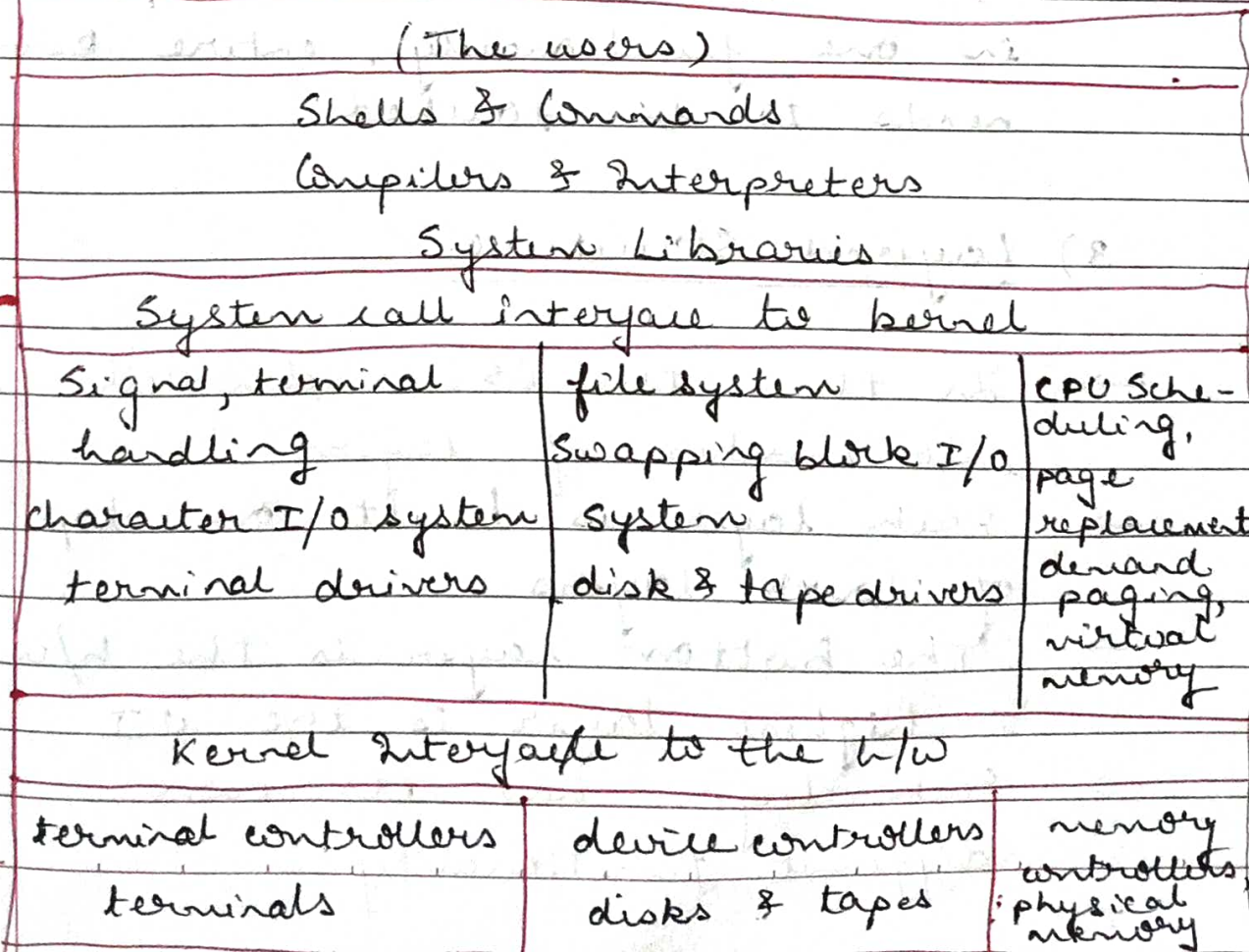
→ Base h/w can be accessed by all the layers above it.

→ Application programs can directly access base h/w without going

through all layers.
- Such freedom leads the MS DOS to vulnerable to malicious programs, causing the entire system to crash when the user program fails.

Disadvantages.
→ If user program fails, entire system will crash as it has direct access to base h/w.
→ Not well protected
- Not well structured.

2) Monolithic Structure (UNIX OS)



→ It is also a limited structure.
→ It was used by earlier Unix systems
→ All functionalities are ~~packaged~~ packed in one level i.e. kernel.

Disadvantages

→ Too many functions are packed in kernel level & this makes its implementation & maintainance difficult.
→ If you want to add a function to kernel level then you have to change or modify the entire kernel.
→ In order to solve issue present in one functionality, entire kernel needs to be touched.

3) Layered Structure

→ In this the OS is divided into number of layers.
→ Each layer is built on top of lower layers
→ The bottom layer is the h/w & highest layer is the UI
→ Each layer has its own different functionality.

→ If error is found in one layer, only that layer needs to be debugged.

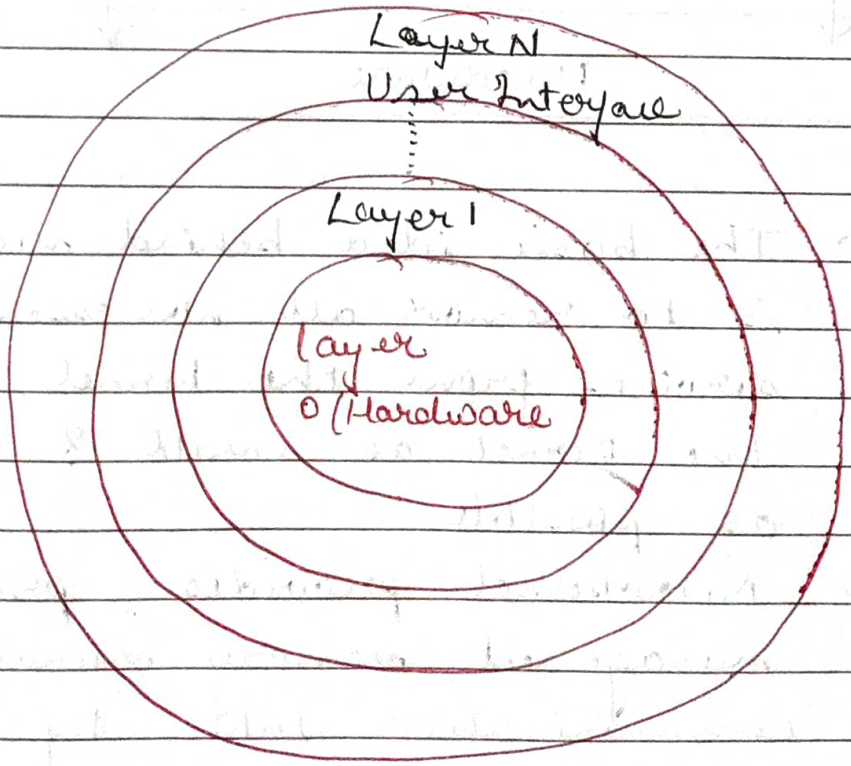
Advantages

→ Easy to implement

→ Easy to maintain

Disadvantages

→ It requires careful planning of the proper placement of layers



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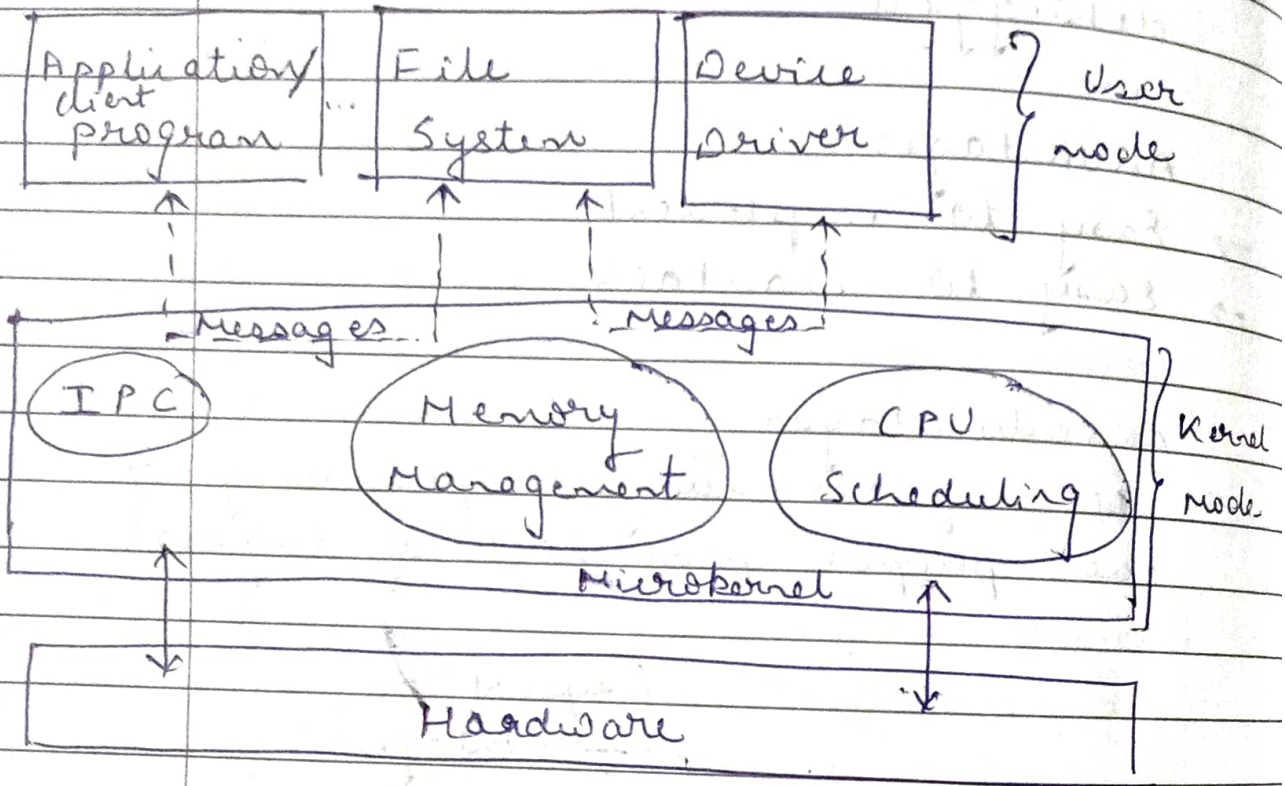
4) Microkernel Structure



→ The basic idea behind microkernel is to remove all non essential services from the kernel, making the kernel as small & efficient as possible.

→ Microkernel provides process management, memory management & communication tasks by message passing between user modules.

Advantages:

1) Easier to extend microkernel
2) More secure
3) More Reliable

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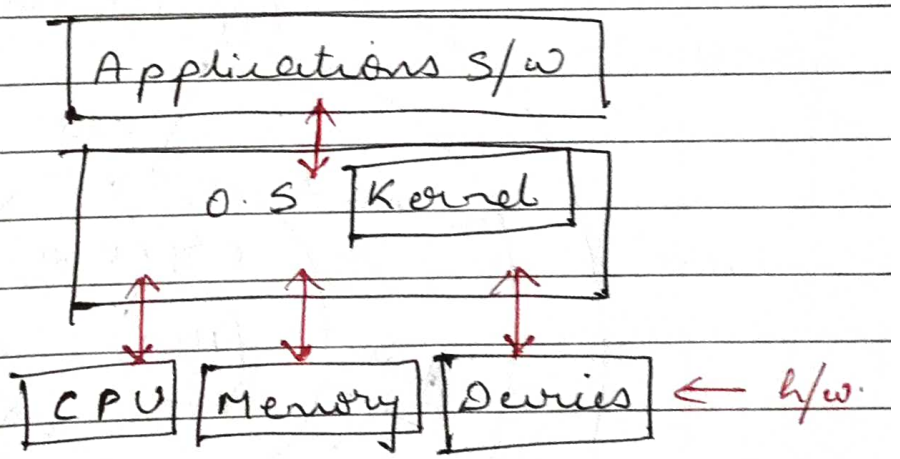
Disadvantages:

Performance ~~overhead of msg~~ Decreased performance due to message passing.

* Kernel

-> The Kernel is the core component of O.S.

-> It is the central part of an O.S that manages resource access, & operations of the computer & hardware.



Kernel controls application S/W & hardware.

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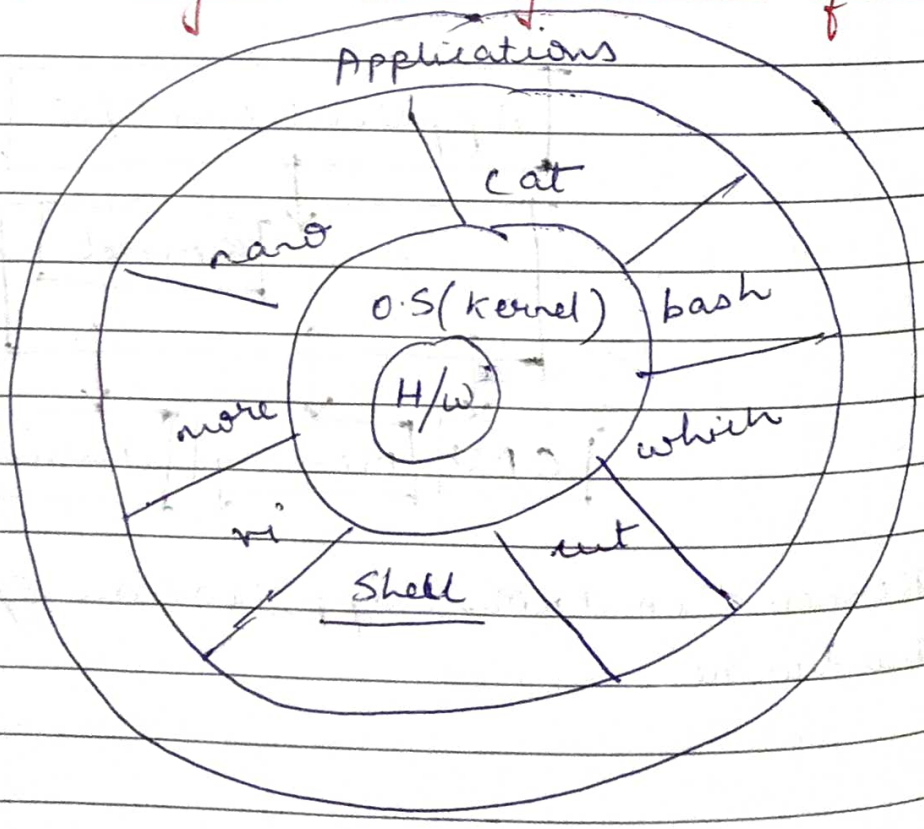
* Shell

→ Users communicate with O.S (kernel) through a program known as the shell.

→ It is a command line interpreter

→ Translates commands provided by the user & converts it into a language that is understood by the O.S (kernel.)

Kernel interacts with the hardware. Memory mgmt, process scheduling & file mgmt are functions of kernel.



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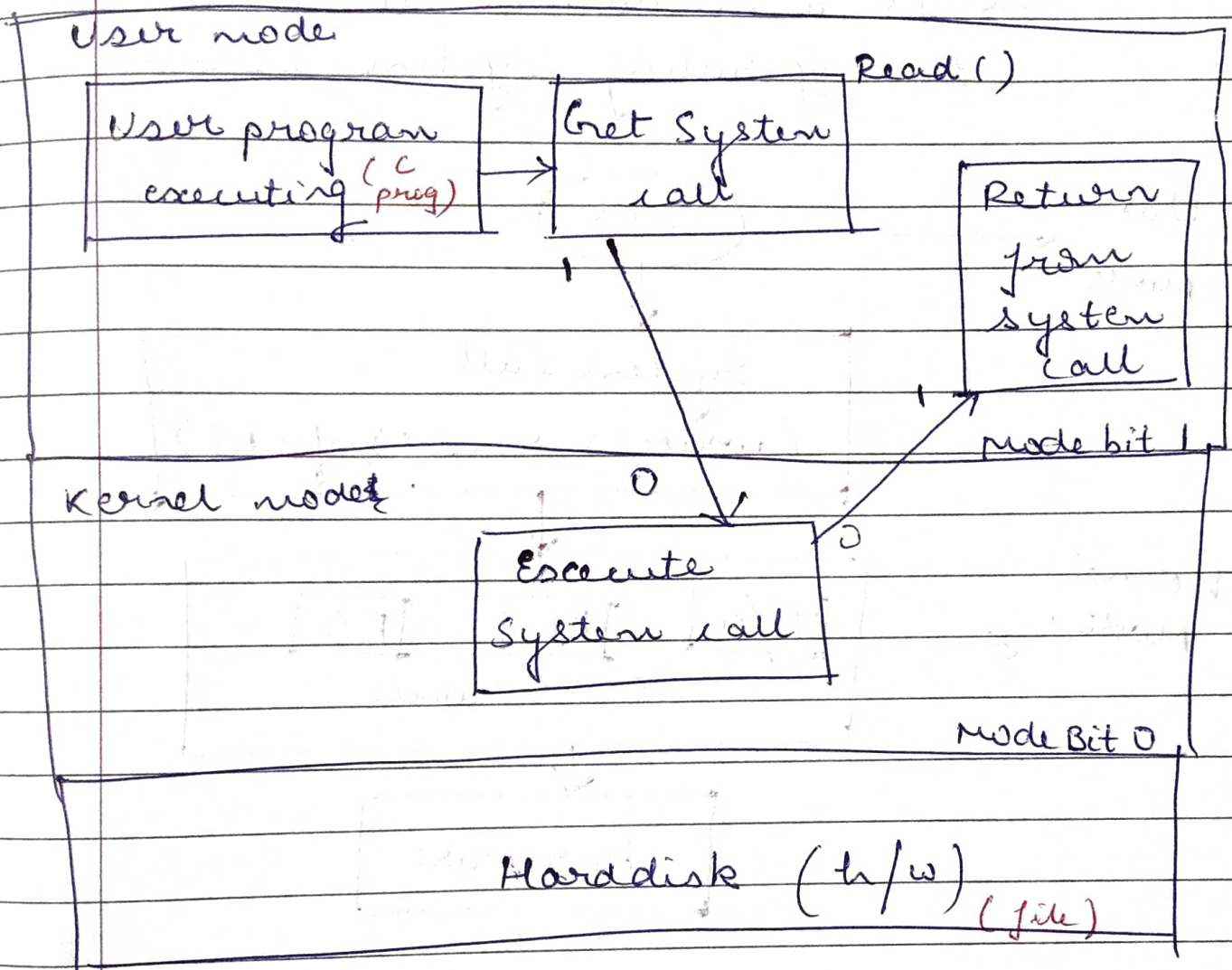
* User mode & kernel mode



Read file from HD & write data i.e update data into file.

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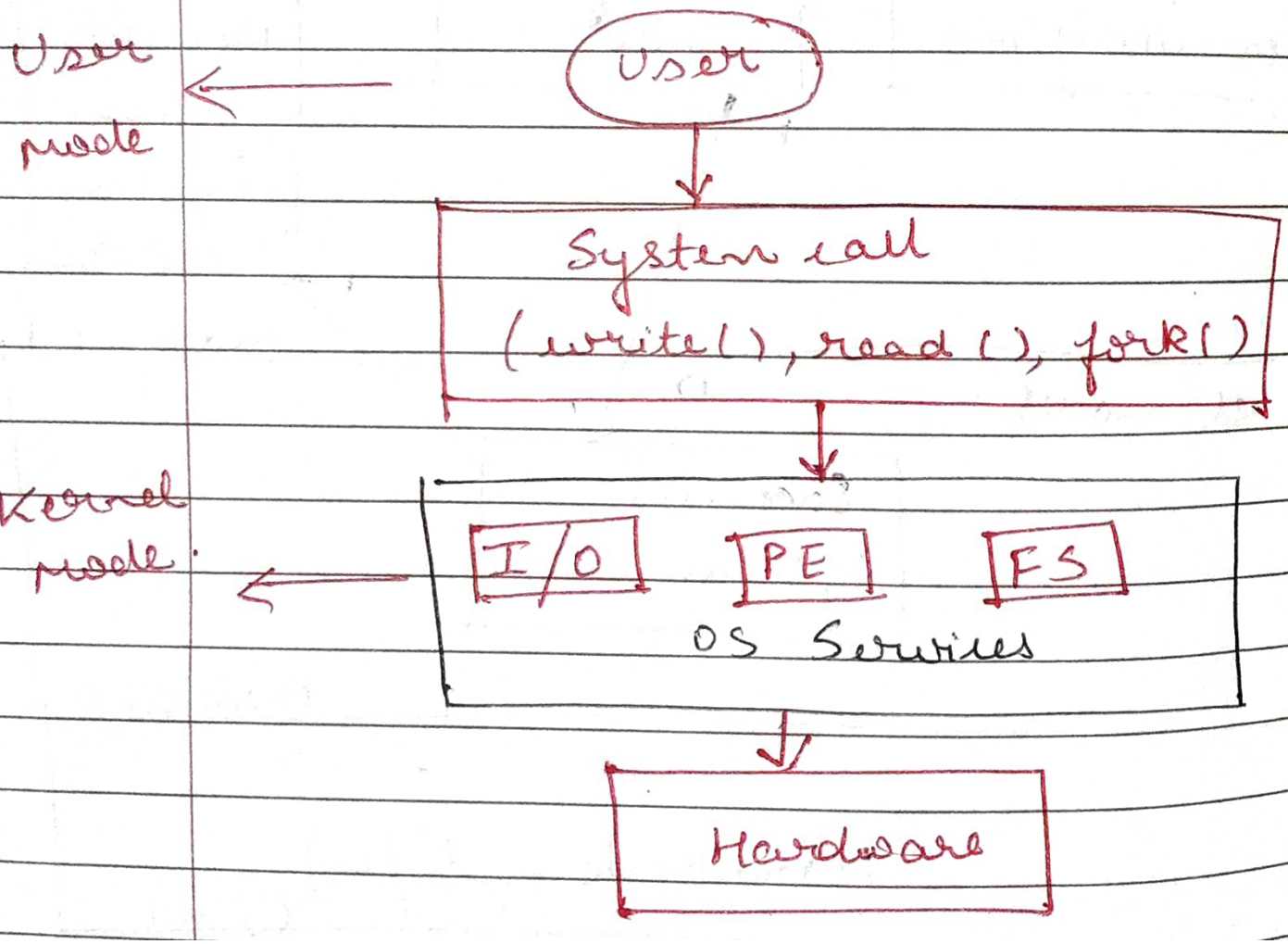
* System calls

→ Is a mechanism to access the operating system servies



* Types of System Calls.
Following are the types:

1] System Calls for process management.
2] System Calls for file management
3] System Calls for directory management
4] System Calls for device management.
5] System Calls for communication management.
6] System Calls for Information maintance.
7] Misrellaneous system call

1 System calls for process management.
① A running program needs to be able to stop execution either normally or abnormally.
② These types of system calls are used for end, abort a process, load and execute a process create and terminate the process.

Type	Examples.
Process management	End, abort, load, execute, create process, terminate process, get process attributes, set process attributes

2 System Calls for file management.
① Some common system calls for file management are open, close, create, save, delete, read, write, etc.
② Also their is a need to determine the file attribute. i.e. get file attribute or set file attribute.

Type	Examples.
File Management	Create file, delete file, open, close, read, write, get file attributes and set file attributes.

3. System call for directory management.

* ① Director management system call involves calling appropsite functions to enquire about directory contains.

Call	Description
mkdir	- Create new directory
rmdir	- Remove an empty directory
link	- Create a newentry, name2 pointing to name1
unlink	- Remove directory entry
mount	- mount a file system
unmount	- unmount a file system.

4. System calls for device management.

① Process usually require several resources to execute
② If this resources are available they will be granted.
② These resources are also though of as devices.
③ Some are physical devices and others are abstract such as a file.
④ User programs request the device and when finished they release the device.

Type	Example
Device Management	Request device, release device, read, write, get device attribute, set device attribute, attach or detach devices.

5. System calls for Communication Management.

(1) There are two models of interprocess communication (IPC), the message passing model and the shared memory model.
(2) Message passing uses a common mail box to pass messages between processes.
(3) Shared memory uses certain system calls.
(4) The two processes exchange information by reading and by writing.

Type	Examples.
Communication Management	- Create communication connection, delete communication connection, send messages, receive messages, transfer status information, etc.

6. System calls for Information maintance.

(1) Some system calls exist purely for transfering information between the user program and the operating system.
(2) An example of this is time or date.
(3) The O.S also keeps information about all its process and provides system calls to report this information.

Type	Examples
Information maintance	Get time or date, set time or date, get system data, set system data; get process, file or device attribute; set process, file or device attributes.