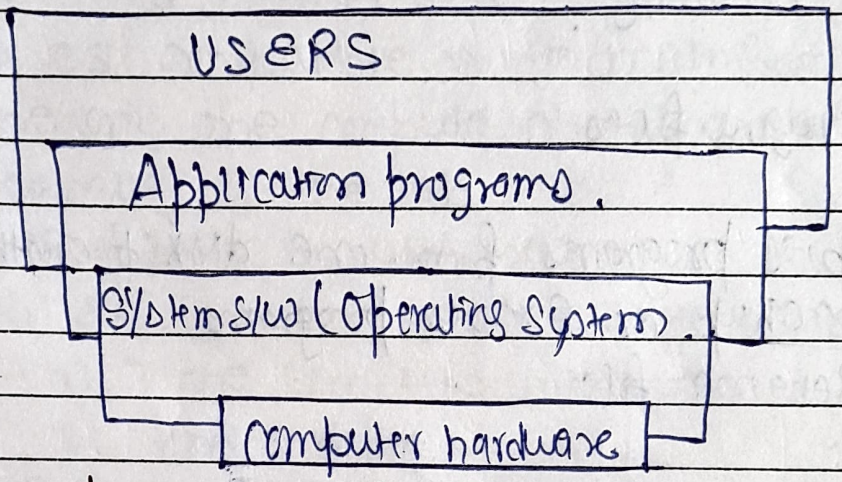
Operating System

An OS is a program that acts as a mediator Interface between S/w, h/w and user.

Purpose: The purpose of an O.S is to provide
① an environment in which a user can execute programs in a convenient and efficient manner.
② make the computer System convenient to interact.
③ use the computer H/w in efficient way.



Logical computer hierarchy.

Functions:-

1. Booting:-

- Copies ~~program~~ BIOS from Rom Chips to main memory
- Loads O.S into computer's main memory

2. Formatting.

formates disks so they can store data and program.

3. manages computer resources

- Keeps track of locations in main memory where programs and data are stored.
- moves data and programs back and forth between main memory and secondary storage via partitioning.

4. managing files.

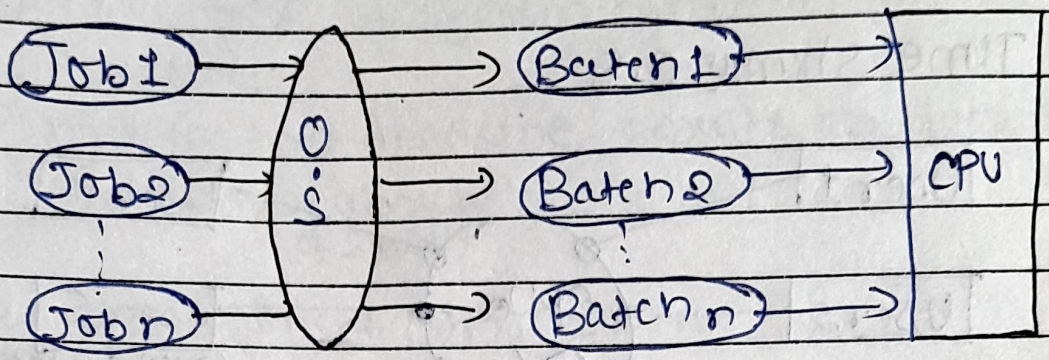
- Copies programs from one disk to another.
- Backup or Erases programs
- Rename files

5. Managing Tasks

Can perform multitasking, multiprogramming etc.,

Classifications of operating Systems

1) Batch O.S



a) Works on a technique where similar types of Jobs are batched together and executed.

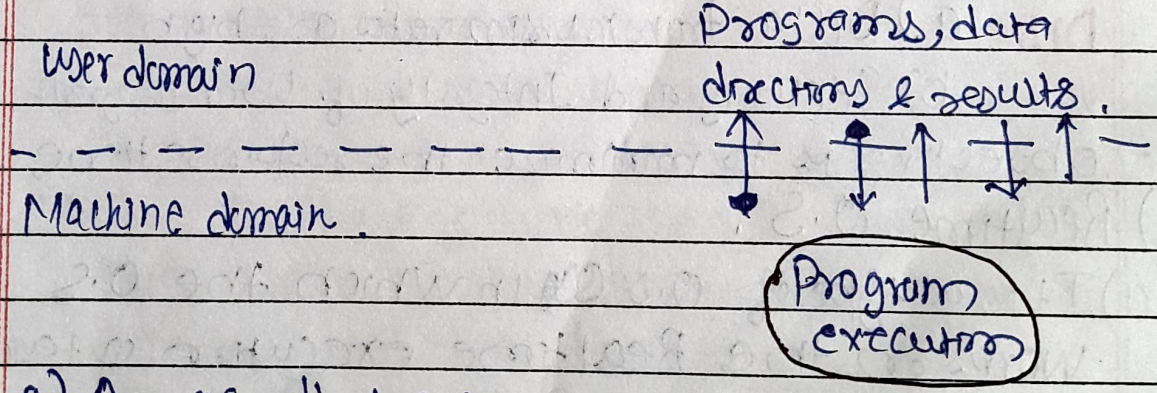
b) This OS compatible with mainframe computer where only one computer operator operates the functionality of the job.

c) Adv:- a) Supports multiuser
b) Easy to manage large work repeatedly.

d) Dis:- a) Time limit is unknown
b) Hard to debug

~~e) Objective to maximize processor use~~.

2) Interactive O.S



a) An OS that allows user to directly interact with the system by providing commands or data through typing or gestures.

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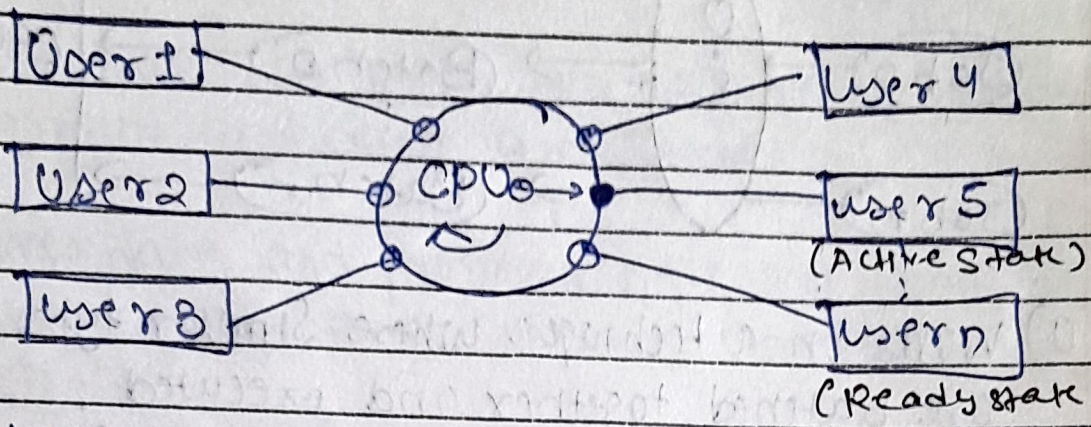
b) Ex:- Word processor and spreadsheet.
c) Almost all OS that are on PCs are interactive OS.

3) Time sharing O.S



a) Works on the concept of sharing Resources in time dependent fashion.
b) It provides the illusion of serving multiple users at a time.
c) It works on round robin fashion.

Adv. a) Effective utilisation
b) Reduces CPU Idle time

Dis a) Data transmission rates are high
b) Security and Integrity of user program.
→ objective is to minimize the response time

4) Realtime O.S:
a) It is a type of O.S in which the O.S works on the Realtime execution of task.
b) A task has to be completed in a given deadline
c) Ex:- flight control system.

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Types of Realtime O.S on the basis of Time delay

a) Hard Realtime System.

1) This type of System can never miss the deadline causes/

2) missing the deadline results decreasing in usefulness of System abruptly.

3) Ex:- Flight control System.

b) Soft Realtime System

a) This type of System can miss the deadline occasionally. causes/

b) missing the deadline results decrease in usefulness of System gradually

c) Ex:- Telephone switches.

5) multiprocessor O.S

a) Works on the concept of parallel computing.

~~The O.S having more than 1 CPUs are known as multiprocessor O.S~~

b) This O.S are used when very high speeds required to process a large volume of data.

c) The Os having more than 1 CPUs in close communication with shared Bus, memory and other peripheral devices are known as multiprocessor O.S.

d) Ex:- Satellite control, Weather forcasting.

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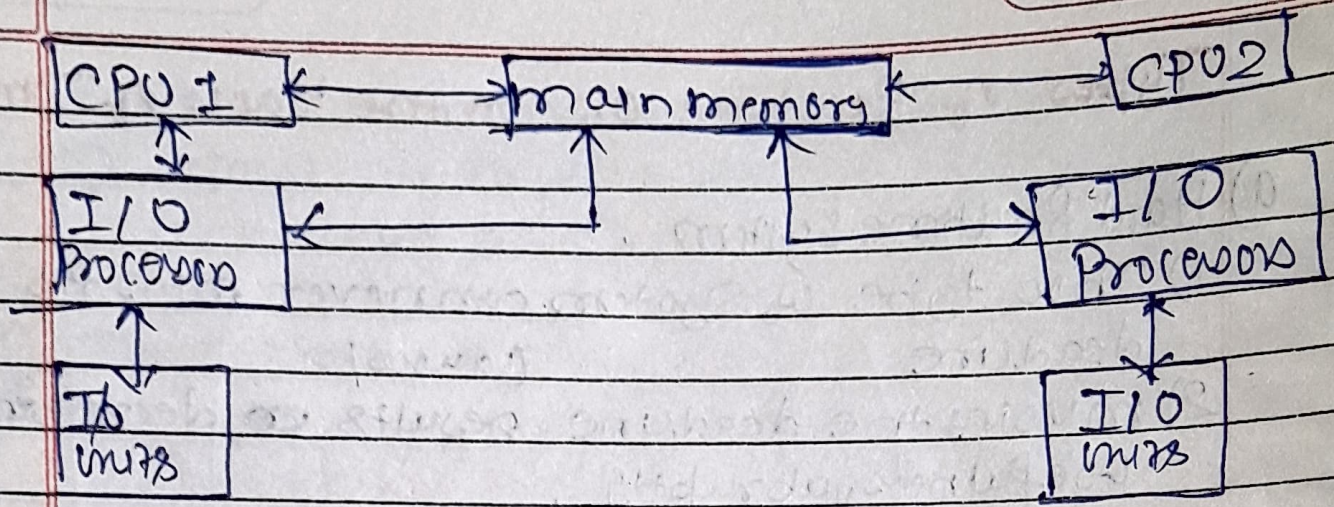

multiprocessor Systems are of two types.

1) Symmetric multi-processing.

a) Each CPU runs identical copy of the O.S
b) and they communicate with one another as needed
b) All the CPU shared the common memory

2) Asymmetric multi-processing.

a) each CPU is assigned a specific task.
b) Has master-slave relation
c) NO communications needed as they are controlled by the master CPU

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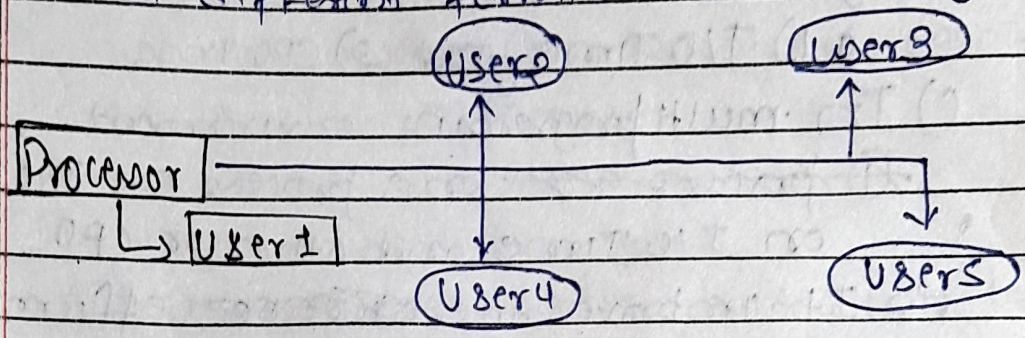
(6) multi user O.S

a) An O.S which allows multiple users to access the single system with one O.S unit.
b) used in large mainframe computers.
c) In this O.S different users connects at different terminals and through network.



Adv. a) Performs multiple tasks at one time.
b) Share different peripherals Ex'. - printers.

There are 3 types of multi user O.S.

1. Distributed System.
a) In this, different computers are managed in such away so that they can appear as a single computer.
b) a sort of Network is formed through which they can communicate with each other.

2. Time Sliced Systems:
a) In this a short period is assigned to each task.
b) time slices a so small that it will appears to the users that they are using the mainframe computer at the same time

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6. Multiprocessor Systems:

1) Multiprogram O.S

a) It is an extension of Batch processing and keep CPU Busy.

b) Each process needs two types of System time.

i) I/O Time 2) CPU Time

c) In multiprograming environment. one process can work on I/O Time and other on CPU.

∴ It improves the efficiency of the System.

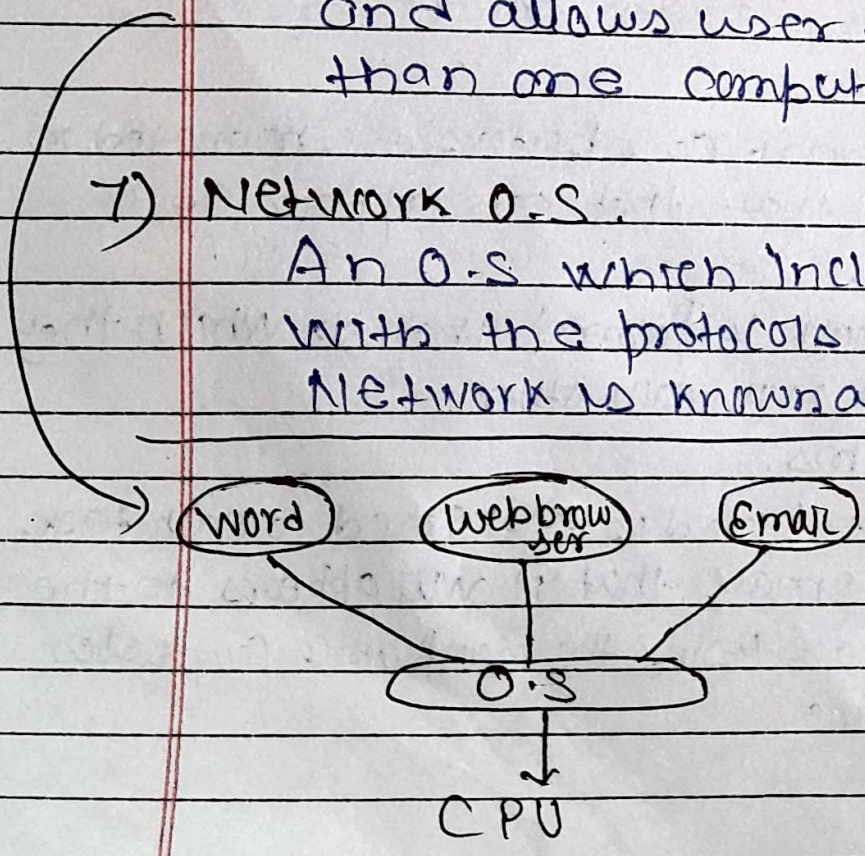
Objective is to maximize processor use

1a) Multitasking / Multiprocess O.S

Logical Extension of multiprograming. and allows user to perform more than one computer task at a time

7) Network O.S.

An O.S which includes S/W and associated with the protocols to communicate with the Network is known as Network O.S.



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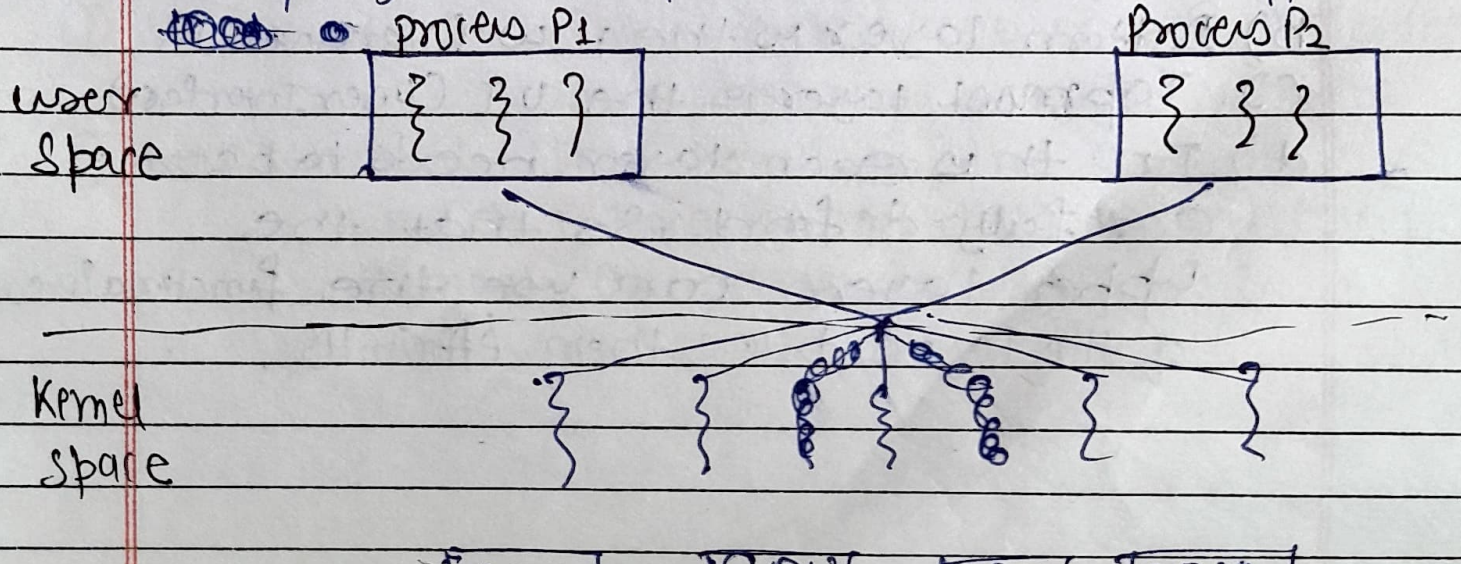
(8) Multi threading O.S.

a) It is an extension of multi tasking O.S.
We can subdivide specific operations within a single application into individual threads.
b) Each of these thread run in parallel.
c) The O.S divides processing time not only among diff. applications but also among each thread within an application.

In multi threaded program,
application might gets divided into 4 threads.
1) User interface thread
2) Data acquisition thread
3) network communication thread.
4) Logging thread.

We prioritize each of these so that they operate independently.

Thus in multi-threaded application, multiple tasks can progress in parallel with other applications.



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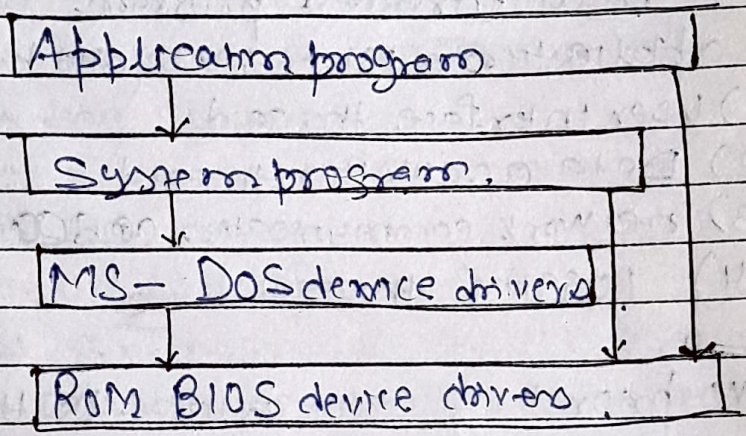
Operating System Structure

1. Simple structure.

a) O.S such as MS-DOS and the original Unix did not have well defined structures.

b) Hence there is no CPU Execution mode
∴ Errors in applications could cause the whole System to crash.



2. layered approach.

a) One of the way to achieve modularity in the O.S
b) Bottom layer is the H/W (Hardware)
c) Topmost layer is the UI (User Interface)
d) In this each layer needs to be carefully defined, So that the upper layers can use the functionalities of the layers below them efficiently.

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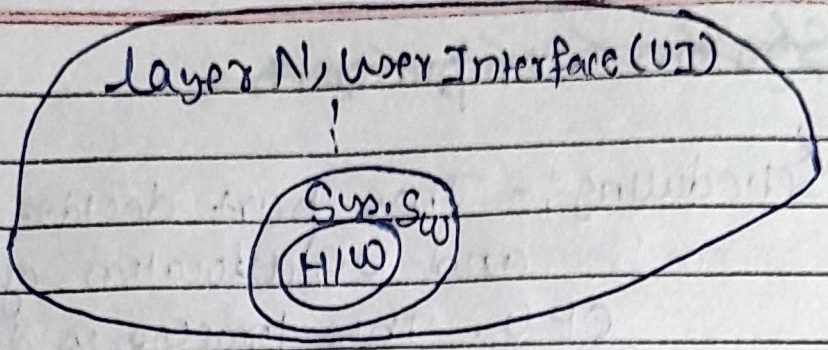


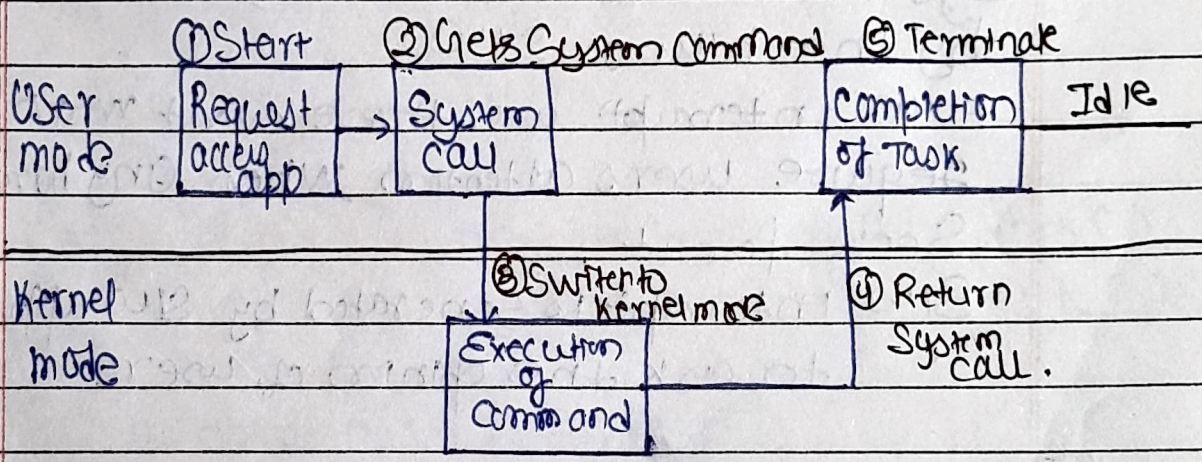
Operating System modes.

① User mode

User applications

Kernel mode

Scheduler	Supervisor	Memory Manager	Interrupt Handle	Security

② 

An OS works in 2 modes.

① User mode :- This mode handles user defined operations and applications to interact with OS.

② Kernal mode :- This Kernel is the core of O.S which interacts with H/W and covers almost all services provided by O.S.

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~~System Components~~

(A) Scheduling:- This part decides the allotment and deallocation of process from CPU. This process is done with the help of Scheduler.

(B) Supervisor:- Kernel acts as a supervisor as it manages the resources and supervises the tasks done by it.

(C) Interrupt handling:- Interrupt is a priority System call which can be generated either by the h/w or s/w.
H/w interrupt are those event which require users attention when any hardware seeks for it.
S/w interrupt is generated by s/w app. to ask the opinion of user.

(d) Security and protection:- It refers to the ~~protection~~ independency of process from each other. It guarantees that no process will effect the execution of another process

System call

- System call are programatic way of switching b/w the O.S mode, System calls are responsible to execute each and every task given by the user or necessary for convenient functioning of O.S

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- System call provides the services of O.S to the user programs via API (Application Program Interface)
- System calls are the only entry points into the kernel System.

Services of System call.

1. Process creation and management
2. main memory management
3. file management.
4. I/O device handling
5. Protection.
6. Networking.

Types of System call.

(1) Process control :-	create process()	fork()
	Exit process()	Exit()
(2) file manipulation :-	Create file()	Open()
	Read file()	read()
	Write file()	Write()
	Close Handle()	Close()
(3) Device manipulation :-		
	Read console()	read()
	Write console()	write()
4. Information maintenance		
	Get current Process ID()	getpid()
	Set Timer	alarm()
	Sleep	Sleep()
5. communication :	create pipe()	pipe()

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Components of O.S

① Process management

- It is the procedure of managing the process for synchronisation and execution.
- Note:-
  A program is fragmented in small parts for smooth execution of Computer System.
- A part of program in execution is known as process.
- Allocated the processor to a process.
- Deallocate processor when a process is no longer required or has been terminated
- manages the → process Scheduling.
  process Synchronization
  process communication
  deadlock handling.

② file management :-

- file creation or deletion
- keeps track of information, location, users status etc., These collective facilities are called as file system
- Support for hierarchial file systems.

③ Command Interpreter :-

- It is used for user Interaction using Command line interface (CLI)
- It accepts and execute the command entered by the user in CLI
- Ex:- Cmd in Windows
  System call in unix.

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④ memory management.

- maintain bookkeeping info: what part of memory are in use by whom; also what part are not in use
- It decides which process will get memory when and how much.
- Allocate / Deallocates the memory when process request or termination of that one.

⑤ Device Management.

- Allocates / Deallocates devices in the efficient way.
- ~~Dect~~ Decides which process gets the device when and for how much time.
- keeps track of all devices drivers which are peripherally connected.

Operating System Services

1. Program Execution.

a) The purpose of a computer is to allow the users to execute program in an efficient manner.
b) The O.S provides environment to ~~conven~~ run the programs conveniently.
c) TO run a program
   ① Program loads into the RAM.
   ② Loaded programs gets assigned CPU time for its execution.

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2. I/O Operations.

a) Each program needs I/p to process it and produces it as O/p.
b) Hence I/O devices are involved in execution of program.
c) The I/O services are provided by the O.S

3. File System manipulation.

While working on the computer, Generally user needs to manipulate files ex:- open, Read, write save, close etc.,

4. Communication: / Signal:

a) OS performs the communication among various types of process in the form of Shared memory.

b) Signal notifies a process that a particular event has occured.

5. Error detection.

a) It is the main function of O.S to detect the errors ex:- memory overflow, I/O device error.

b) After detecting the errors, O.S takes appropriate action for consistent computing.

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6. Resource Allocation.

a) In multitasking environment, when multiple Jobs are running at a time, it is the responsibility of th an O.S to allocate the required resources to each process for it's better utilization.

7. Network management. It manages the code and protocol corresponding to the network access points.

8. Protection and Security and Authentication.

Authentication :- It Refers to the process of verifying the identity of users or processes. before granting access to System resources.

Ex:- username, password, biometrics, Smartcards etc

Protection and Security:- This refers to the mechanism put in place to control access to computer System and its resources for preventing unauthorised access and manipulation of data.

Ex:- Encryption

In various Books Components of O.S are also the Services provided by the O.S

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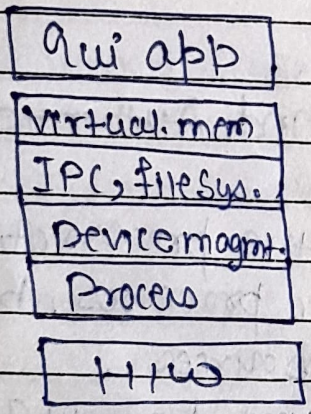
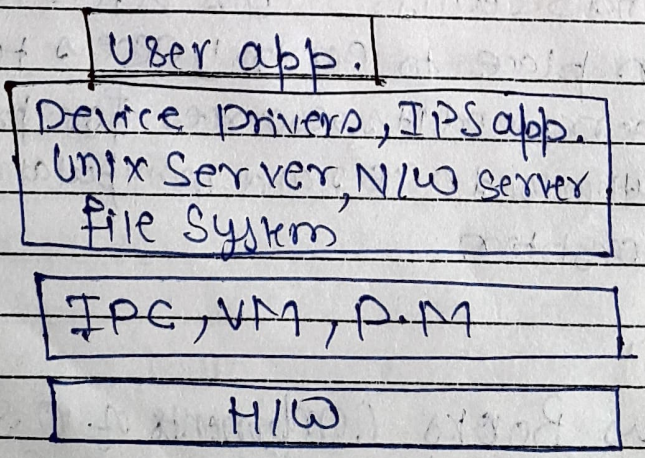
Kernel

a) Kernel is the hub of the O.S
b) Allocates time and memory to programs.
c) handle file storage and communication in response to the system call.
d) That part of O.S that interacts with H/W
e) There are 2 types of kernel architecture.
1) monolithic kernel ex:- Unux.



2) micro - kernel. ex:- Unix.



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A) Monolithic kernel.

1) All the parts of a kernel like the scheduler, file System, memory management, networking stacks, device drivers etc., are maintained in one unit within the kernel.
2) It provides Resource management b/w apps and H/w
3) The user space and kernel space has same address spaces.
4) This type of architecture increases the size of O.S.
5) Fast execution but if any one service fails then whole system is bound to fail.
6) It provides, CPU Scheduling, file management, Basic services by System call and Interrupt handling.

Note:-
The whole O.S is considered as a single program, in monolithic ex:- Unux, wings, WinXP.

B) Micro kernal:-
1) Only the important parts like IPC, basic scheduler, basic memory handling are put into the kernel.
2) Communication happens via message passing. others are maintained as server processes in user Space
3) It works on the concept of Bare minimum i.e., only basic functionality are provided in kernel.
4) It is more stable and secure than monolithic kernel
5) The Address spaces for user and kernel is different. It is flexible modular but slow than monolithic kernel.

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Diff.

Monolithic kernel	Micro Kernel.
1) kernel size is large	kernel size is small.
2) O.S is complex to design	O.S is simple to design.
3) All the O.S services are included in the kernel.	follows Bare minimum approach with IPC etc.,
4) Request may be serviced faster.	Request may be serviced slower.
5) No message passing and no context switching are required while the kernel is performing the job	Micro-kernel requires message passing and context switching.

Re-entrant kernels.

a) Many process or threads can execute at same time without effecting others. If a resource is shared b/w two process then the kernel puts another process into I/O way till 1st process completes its execution.

b) It can modify local data, but cannot access global data.