**OS:-** Operating System is a program that acts as a intermediate b/w user and H/w.

→ The purpose of an OS is to provide an environment in which the user can execute his programs efficiently.

or OS is a System Software that manages computer H/w and S/w resources and provides common services for computer programs.

→ The OS acts like a government.

– OS as a resource manager or resource allocator.
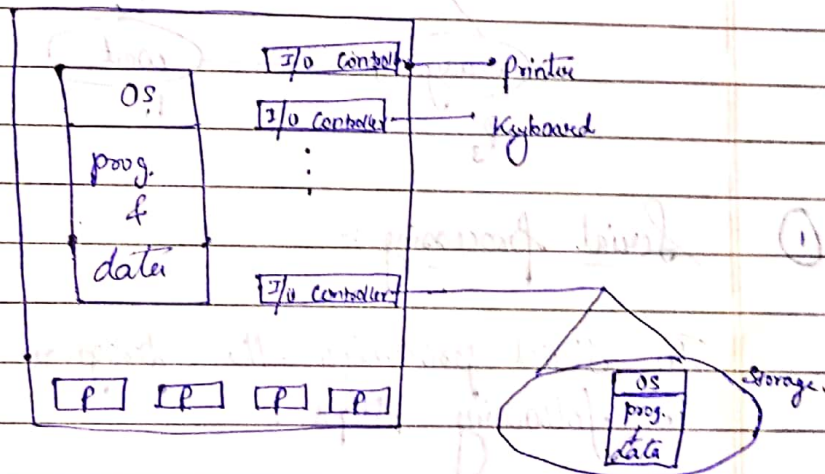
Concern	OS Responsibility
Program	Initiation & termination of programs, provides convenient methods so that several prog. can work towards a common goal.
Resource	Ensuring availability of resources in the system & allocating them to prog.
Scheduling	Decides when and for how long to devote the CPU to a prog.
protection	Protect data & prog. from other users.

Evolution of O.S. :-

① Serial processing
② Batch processing
③ multi programming
④ multi-tasking
⑤ Real-time OS
⑥ Distributed System.
⑦ parallel System.
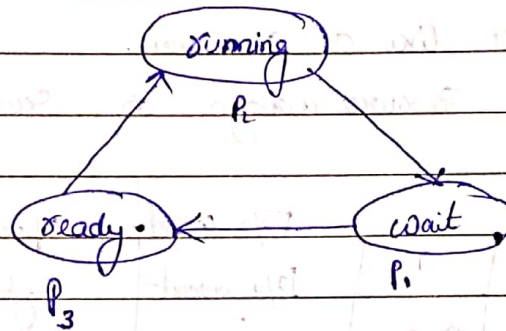
① Serial processing :-

In serial processing the programs are executed in following steps. :-

1) Type the program on punched card.
2) Convert the punched card into card reader.
3) Submit to the computing m/c & error was indicated by light.
4) Take the output on printer.
5) Submit another program.

Disadvantage :

① Difficult & time Consuming
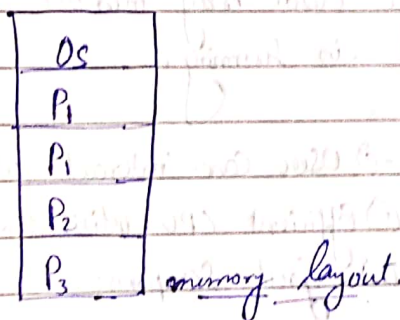② The programmer has to wait for another program.

* **Batch processing** :- To speed up processing jobs with (same CPU scheduling algorithm), same resources and time). where work batched together and were run through the computer as a group.

Disadvantages :- ① lack of interaction b/w user & Job while the Job is executing.

* **Multiprogramming** :- It is a technique to execute multi. programs simultaneously by a single processor.

In multiprogramming - no. of programs resides in main memory at a time.

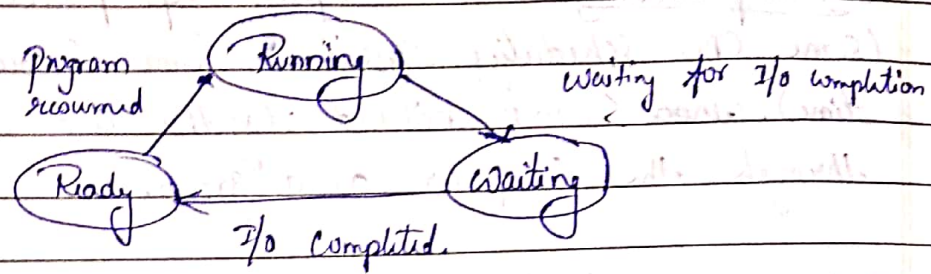| OS |
|---|
| P_1 |
| P_1 |
| P_2 |
| P_3 | memory layout.

Disadvantages :-

1) lack of interaction H/w user & Job while Job is executing.

Advantages :- → CPU is never idle
→ Performance of CPU will increase
→ Throughput of System increases.
→ Waiting time is limited.
— Resource utilization is more.

Program   Running   waiting for I/o completion
resumed

Ready   waiting
                    I/o completed.

* **Time Sharing System :-**

Time sharing or multi-tasking is a logical extension of multi-programming.

Mutliple Jobs are executed by the CPU. Switching b/w them but the Switching occurs so frequently that the user may interact with each program while it is running.

Advantages :- ① User can interact while executing.
② Efficient CPU utilization.
③ Good response.

* **Real-time System :-**

A real time system is used when there are rigid time requirement on the operation of a processor. in this large no. of external events are received and processed in time.

eg :- System that controls Scientific experiment, Medical imaging Sys., industrial control sys. and some display system.

Real-time System comes with 2 flavours :
① Hard Real-time System (Critical task completed in-time)
② Soft Real-time makes the best effort to meet the

response requirement of a real time application but can't guarantee that it will be able to meet under all condition.

Eg:- Picture quality provided by video on demand System may be bad quality but one can still watch the video.

Distributed System :-

A distributed Sys. Consists of Several individual computer Systems connected through high speed Communication line.

→ Distributed System Controls and manages the hardware and software resources of distributed System. Such that its user view the entire system as a powerful monolithic Computer System.

when the program is executed the user isn't aware of where the program is executed or location of the resources accessed.
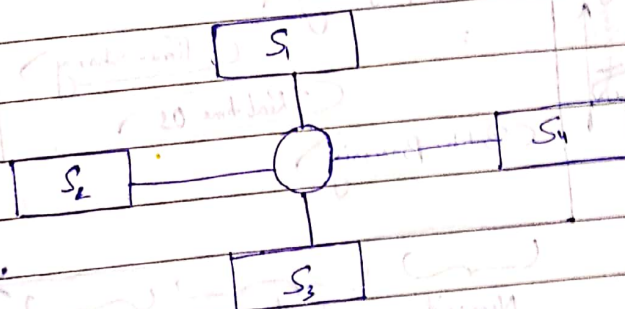
| Features	Description
① Resource Sharing (pointer, compiler, DB)	– Improves resource utilization across boundaries of individual comp. sys.
②. Reliability (Availability).	– Availability of resources and services despite failures.
③. Computation Speedup	– (Load distribution) part of computation can be executed in different sys. to speed up computation.
④ Incremental growth/modular expandability.	Capability of a sys. can be enhanced (due h/w and s/w can be easily added whenever required).
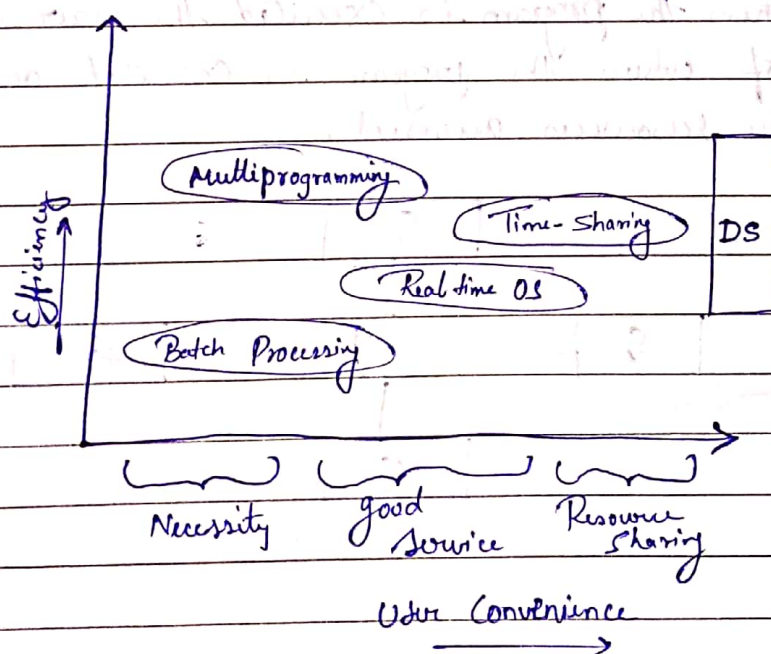
Key features of Class OS

Class	period	prime concern.
Batch	1960	CPU Idle-time
Multiprogramming	1930	Resource utilization
Time sharing	1970	Good Response
RT S	1980	Meet Deadline
DS	1990	Resource sharing.

Parallel System :-

A system that have more than 1 processor in close communications, Sharing bus, the clock, memory and Sometimes peripheral devices.

This Systems are also called as lightly coupled System. In parallel System no. of processor executing their jobs in parallel.

Multiprocessor OS Controls and manages the h/w & s/w resources Such that the user view the entire system as a powerful uniprocessor system.

Advantages :- • Enhanced performance
• Fault tolerances
• Increased throughput
• Increases Reliability

SPOOLING :-

↓

[Simultaneous peripheral operation online] ing.
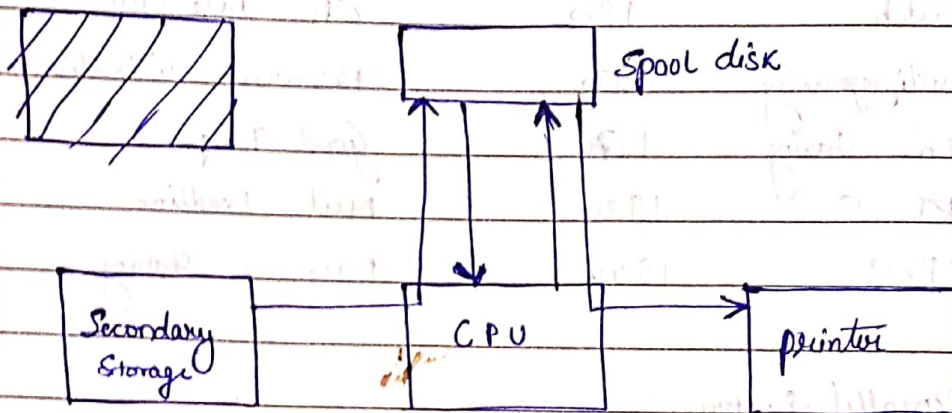
Simultaneous means for eg:- if two or more user issue the print command then the printer can accept the request even if the printer printing some other jobs. When the printer is printing one job at the same time the spool disk can load some other jobs.

Simultaneously the CPU can execute some other jobs in the spool disk.

✱ Services of OS :-

① User interface
② Program ~~execution~~ Creation.
③ program execution
④ File Manipulation
⑤. I/o oprn
⑥. Error detection.
⑦ Resource allocation ⎯⎯⎯ ⎡→ Static (partitioning the resource)
                              ⎣→ Dynamic (pool of resources)
⑧ Accounting
⑨. protection & Security.

2). **Program Creation** :- The OS provides editors & debuggers to assist the programmer in creating programs.

3). **Program execution** :- When a user wants to execute his program the OS must be able to load the program and the data into memory and run it. The program must be able to end its execution either normally or abnormally.

4). **I/o oprⁿ** :- During execution the program may require I/o operations which may involve a file or i/o devices. Since the user can't execute i/o oprⁿ directly the OS must provide some facility to do i/o oprⁿ.

5). **File Manipulation** :- The OS provides the facility to read or write files and create or delete files by name.

6). **Error detection** :- The OS constantly needs to be aware of possible error.

Error may occur in CPU, memory, I/o devices, or in user programs for each type of error the OS should take the appropriate action to ensure correct and consistent computing.

7). When multiple users are executing on the system at the same time the Resources must be allocated to each of them.

8. **Accounting:-** OS keeps track of which users use how much and what kind of resources.

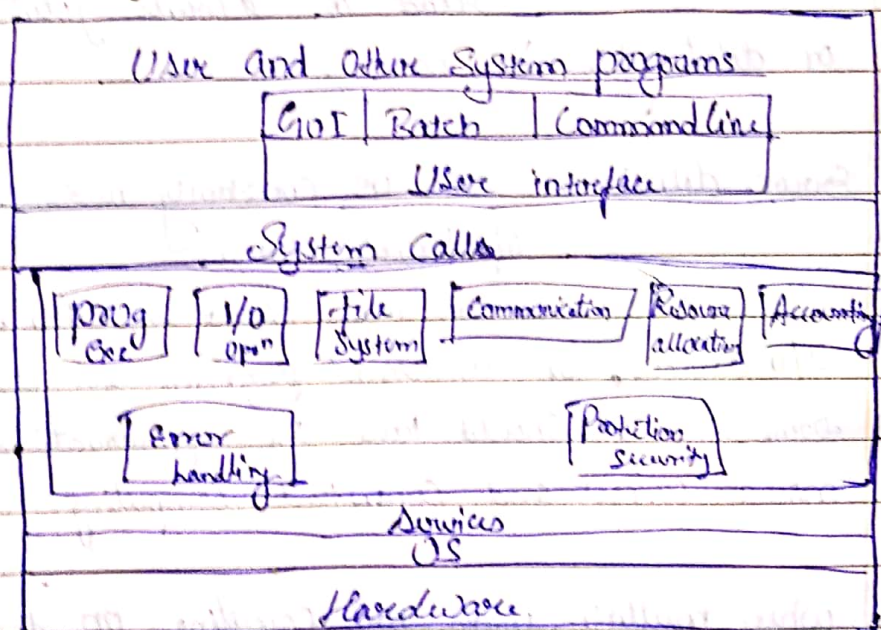9. **Protection:-** Protection involves ensuring that all access to system resources is controlled.

OS provides security mechanism to protect unauthorized uses of file in the networking environment.

MDR (Memory data Register) :

The MDR contains the data to be written into read out of the addressed location.

Now we will

A view of OS Services :-

```
┌──────────────────────────────────────────────────────┐
│        User and Other System programs                │
│         ┌────┬────────┬──────────────┐               │
│         │ GUI│ Batch  │ Command line │               │
│         └────┴────────┴──────────────┘               │
│                  User interface                       │
│                  System Calls                         │
│  ┌──────┬──────┬────────┬───────────────┬────────┬────────┐ │
│  │ prog │ I/O  │ file   │ Communication │ Resource│Accounting│ │
│  │ Exe  │ Opᵉⁿ │ System │               │allocation│        │ │
│  └──────┴──────┴────────┴───────────────┴────────┴────────┘ │
│  ┌──────────┐                    ┌──────────┐        │
│  │ Error    │                    │ Protection│        │
│  │ handling │                    │ security │        │
│  └──────────┘                    └──────────┘        │
│                    Services                          │
│                      OS                              │
│                   Hardware                           │
└──────────────────────────────────────────────────────┘
```

System Call :

- System call is a interface b/w process and os.
- System call is a request that a program makes to the os.
- ★ System calls can be roughly categorised into 5 types:

1) Process Control :- • Create & terminate process
   - • Load & execute
   - • Allocate & free memory
   - • Get process attribute & set process attribute.
   - • Wait event & Signal event.
   - • End and Abort.

2) File Manipulation :- • Create & delete file
   - • Open and close
   - • Read and write
   - • Get file attribute and set file attribute.

3) Device Manipulation :- • Request device and release device.
   - • Get device attribute and set device attribute.
   - • Logically attached and detached devices.

4) Information Maintenance :- • Get time or date and set time or date.
   - • Get system data and set system data.
   - • Get the no. of user and amt of disk space and no. of user working.

5) Communication :- • create & delete communication.
                     • Send & recieve message.
                     • Transfer status conformation.