

OPERATING SYSTEM

5th sem

UNIT-1

A computer system can be divided roughly into four components :-

a) the hardware
b) the operating system

c) the application programs

d) the users

a) The hardware — CPU, memory and the I/O devices provides the basic computing resources for the system.

b) The application programs — such as word processors, spreadsheets, compilers and web browsers — defines the way in which these resources are used to solve user's computing problems.

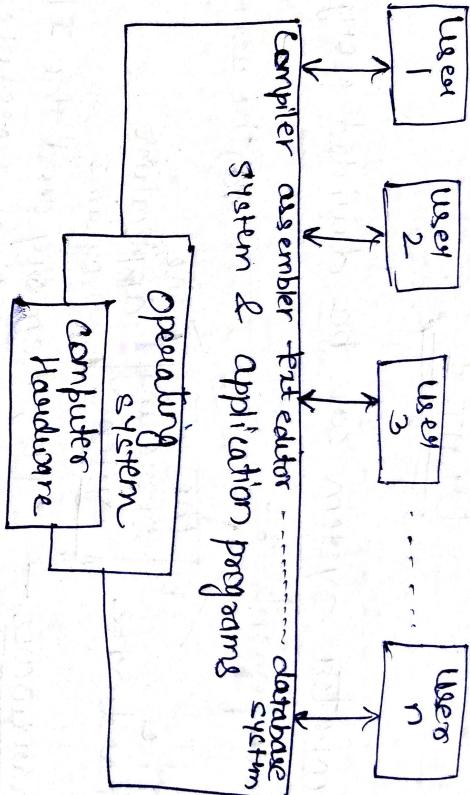
c) Now, the operating system which controls & coordinates the use of the hardware among the various application programs for the various users. It is a program that acts as an interface b/w the software and the computer hardware.

Or

It is a specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

Abstract view of the components of a computer

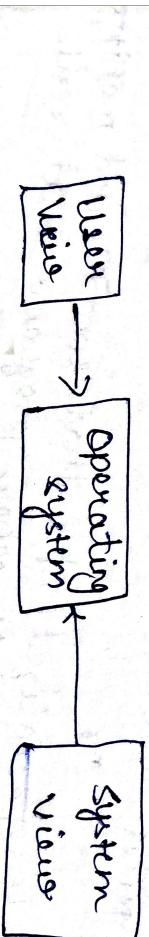
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A OS is similar to a government. Like a government, it performs no useful function by itself. It simply provides an environment within which other programs can do useful work.

- * Operating system is the one program running at all times on the computer with all else being application programs.

The operating system can be observed from the point of view of the user or the system. This is known as the user view and the system view respectively.



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User view :- The user view depends on the system interface that is used by the users.

- If the user is using a personal computer, the OS is largely designed to make the interaction easy.
- If the user is using a system connected to a mainframe or a minicomputer, the operating system is largely concerned with resource utilization.

- If the user is sitting on a workstation connected to other workstations through networks, then the OS needs to focus on both individual usage of resources & sharing through the networks.

System view :- The OS is the bridge between application and hardware. It is most intimate with the hardware and is used to control it as required.

- It is the duty of the OS to allocate (CPU time, memory space, I/O devices etc), ~~to prioritize these processes~~ to the processes judiciously so that the computer system can run as smoothly as possible.
- The OS can also work as a control program. It manages all the processes & I/O devices so that the computer ~~system~~ works smoothly & there are no errors.
- Os were developed to easily communicate with the hardware.

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Mainframe Systems

A mainframe computer is a very large computer capable of handling & processing very large amount of data quickly. They are used by large institutions, such as government agencies & large corporations.

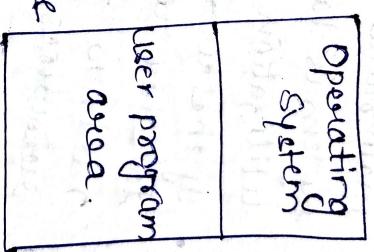
1) Batch systems.

Input devices were :- card readers, tape drives.

Output devices were :- printers, tape drives, and card punches.

Batch processing is a technique in which an OS collects the programme data together in a batch before processing starts.

- User prepared a job (program, data & control information) & submitted it to the computer operator in the form of punch cards.
- Jobs are processed in the order of submission i.e., first come first served fashion.
- When a job completes its execution, its memory is released & the output for the job gets copied into an output spool for later printing or processing.

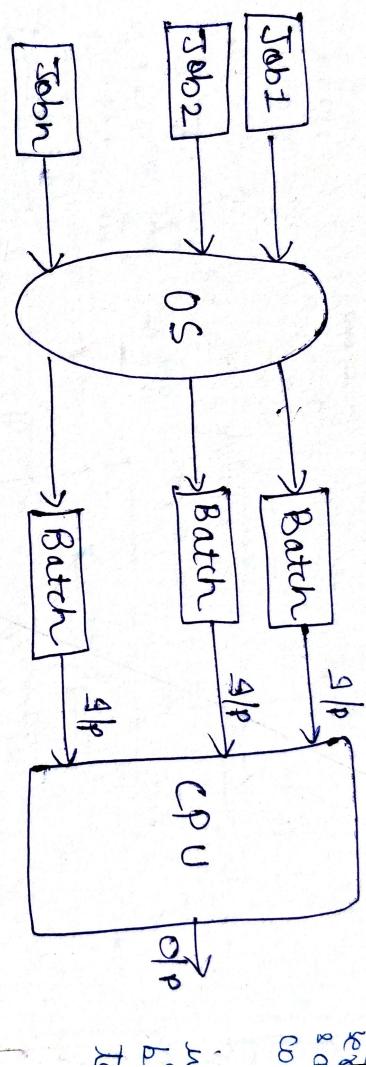


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⑤

- To speed up processing, operators batched together jobs with similar needs & ran them through the computer as a group.

for eg. FORTRAN BATCH, COBOL Batch etc.



Advantages

- In a batch, job executes one after another, saving time from activities like loading compiler.
- During a batch execution, no manual intervention is needed.

Disadvantages

- Memory limitation
- Interaction of I/O & CPU devices directly with CPU.

Spooling

Simultaneous peripheral operations online.

(7)

Input and output devices are selectively slow as compared to CPU (digital in nature).

$$\text{e.g. } 2.3 \text{ GHz} = 2300000000 \text{ Hz}$$

In 1 sec CPU performs 2.3×10^8 instructions.

In spooling, data is stored just onto the disk and then CPU interact with Disk (digital) via Main Memory.

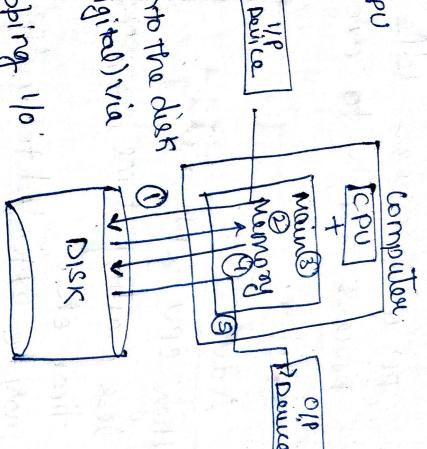
→ Spooling is capable of overlapping I/O operations for one job with CPU operations of other jobs.

Advantages

- No interaction of I/O & O/P with CPU.
- CPU utilization is more as CPU is busy most of the time.

Disadvantages

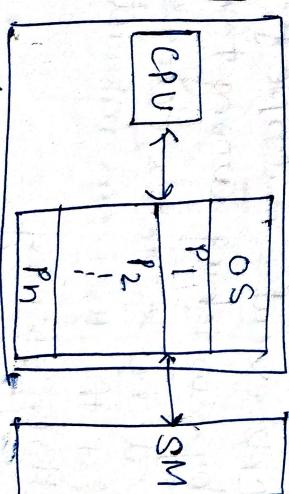
- In starting, spooling was uniprogramming.



Multiprogrammed OS

Multiprogramming increases CPU utilization by organizing jobs so that the CPU always has one to execute.

- Multiprogramming means more than one process in Main Memory which are ready to execute.



- Processes generally require CPU time & I/O time. so if running process perform I/O or some other event which do not require CPU then instead of sitting idle,

- (8) CPU make a context switch and pick some other process & this idea will continue.
- CPU will never idle unless there is not any process ready to execute or at time of context switch.

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Advantages

- High CPU utilization.
- Less waiting time, response time etc.
- May be extended to multiple users.
- Now-a-days useful, when load is more.

Disadvantages

- Difficult scheduling.
- Main memory management is required.
- Memory fragmentation
- Paging (non-contiguous memory allocation)



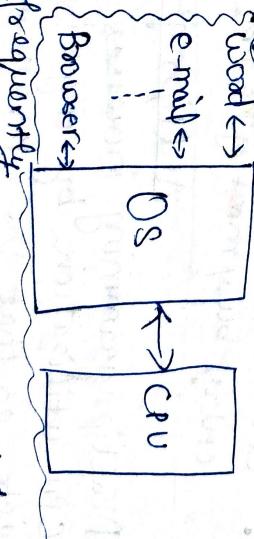
Multitasking OS

Time-sharing OS

Time sharing OS (multi-tasking) is a logical extension of multi-programming.

The CPU executes multiple jobs by switching among them, but the switches occur so frequently that the user can interact with each program while it is running.

A time-shared OS allows many users to share the computer simultaneously. As the system switches rapidly from one user to the next, each user is given the impression that the entire computer system is dedicated to his use, even though it is being used by many users.



Main idea is better response time & executing (9)
multiple process together.

Advantages

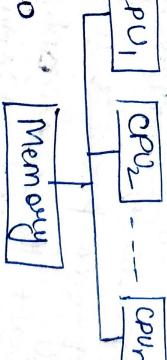
- All tasks are given a suitable amount of time & no waiting time occurs for the CPU.
- Multiple users running multiple programs can be best handled by multitasking OS.
- Computer resources like RAM, Processor, I/O devices, hard drive etc. are better managed in multi-tasking OS.

Disadvantages

- When a computer user opens many programs at a time, the computer becomes slow.
- By doing multi-tasking, the processor becomes busy all the time & CPU heats up.
- Limitation of processors.

MULTIPROCESSING OS

These systems have more than one processor in close communication. The computer & bus, the clock & sometime memory & I/O



- These systems have more than one processor in close communication, sharing the computer & bus, the clock & sometime memory & I/O devices, different process may run on different CPU, so have parallel execution.
- Multiple processor system are of two types

SMP : Symmetric Multiprocessing
ASMP : Asymmetric Multiprocessing

SMP :- One OS controls all CPU, each CPU has equal rights.

ASMP :- This scheme defines master-slave relationship. A master processor controls the system; for a master processor either look to the master processor or have predefined tasks. The master processor schedules & allocates work to slave

processors & handles work among them.

Advantages

- Increased throughput :- By increasing the no. of processors, we get more work done in less time.
- Economy of scale :- Multi-processor systems can save more money than multiple single processor systems, because they can share peripherals, mass storage & power supplies.
- Increased reliability :- If functions can be distributed properly among several processors, then the failure of one processor will not halt the system, only slows it down. This ability to continue providing services proportionately to the level of surviving hardware is called

graceful degradation

Disadvantages ⑩

- More complex.
- To design a complete circuitary arrangement of processors is little complex.
- Overhead or coupling reduce throughput.
- Large main memory.

DISTRIBUTED OPERATING SYSTEM

Distributed systems use multiple central processors to serve multiple real-time applications & multiple users.

Data processing jobs are distributed among the processors accordingly.

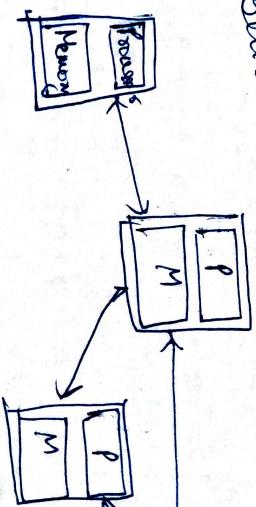
- Processors communicate with one another through various communication lines (such as high-speed buses or telephone lines). These are referred as loosely coupled systems or distributed systems.
- Each processor is having its own local memory. Processor's in a distributed system may vary in size & function. These processors are referred as sites, nodes, computers & so on.

Advantages :-

- 1) Resource sharing facility :- A user at one site may be able to use the resources available at another.
- 2) One fails other works :- If one site fails in these system, the remaining sites can potentially continue operating.
- 3) Reduction of load on the host computer.
- 4) Reduction of delays in data processing.
- 5) Better service to the user.

e.g. DOS

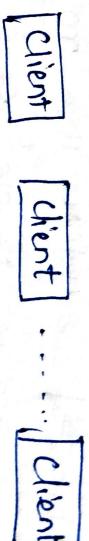
Telephone nw
Mobile computing
Computer nw
such as
internet.



→ client - server system

(12)

Server is categorized as :-



a) computer server

No.

system :- It provide an interface to which clients can send request to perform an action, in response to which they execute the action & send back result to the client.

b) file - server system :- provide a file - system interface where clients can create, update, read & delete files.

Disadvantages of D'os

- Since the data is accessed from a remote system, performance is reduced.
- No traffic is increased in a distributed database.
- Different data formats are used in different systems.
- While recovering a failed system, the DBMS has to make sure that the recovered system is consistent with other systems.

Personal Computer System

(3)

- This is also known as single user system & portable.
- I/O devices :- keyboard, mouse, display screen, pointing devices

- Laptops, smart cards, wireless devices
- Single user system may not need advanced CPU utilization & protection features.

Advantages :-

- a) User convenience
- b) Response is more.

Real - Time Systems

A real-time system is used when rigid time requirement have been placed on the operation of a processor or the flow of data ; thus, it is often used as a control device in a dedicated application.

→ System that control scientific experiments,

medical imaging systems, industrial control

systems are real-time systems.

→ Processing in real-time system must be done within the defined constraints ; or the system will fail . They are of two types :-

Hard real-time system

A less restrictive type of real-time system is a soft real-

A hard real-time system guarantees that critical tasks be completed on time if response time is too long.

that property until it completes other tasks, & certain

used in virtual reality &

(2) OS - A Resource Manager

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In a computer system, there are lots of resources such as CPU (Processors), Memory, I/O devices (hard disk, mouse, keyboard, printer, scanner etc). Now, if a computer is used by more than one user than the users will fight for these resources to access. Os, now is used to allocate these resources to the different users.

- The resources are allocated equally.
- The resources are protected from ~~cross~~-access i.e. once a resource is allocated to some process, that same resource cannot be used by another process until the current running process voluntarily release that resource.
- Access to the resource is synchronized so that operations are correct & consistent.
i.e. when more than one process is executed than the processes should be synchronized & in a sequence so that result would be correct.
- Deadlock are detected, resolved & avoided.
- Resource sharing in two ways:-
 - Time sharing
 - Space sharing

★

Goals of Operating system

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~~Convenience~~
Convenience

Efficiency

a) Primary goal :- convenience / user friendly.

An operating system primary goal is the convenience because the OS is mainly designed for naive users & the most of the people who are using the OS are don't know much about it.

b) Secondary goal :- Efficiency.

The secondary goal of the OS is Efficiency. For supercomputer and main frame, the primary goal is efficiency because they are made for the programmes.

★. Functions of Operating System

a) Resource Manager :- OS will manage all the resources those are attached to the system means all the input / output devices like memory & processor & all the resources like ~~OS does not manage all these resources~~.

Output devices & ~~OS does not manage all these resources~~

of the system.

b) Storage Management :- OS controls all the storage operations means how the data or files will be stored into the computers.

c) Process Management :- All the processes that are given by the user or the process those are system's own.

by the user or the process those are system's own.

d) Memory Management :- OS manages the memory of the computer system i.e. it allocates & deallocates the memory from the processes.

e) N/w management f) Protection.