(Operating System - 22516)

Unit I: Overview of Operating System

(Weightage - 08 marks)

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Operating System Syllabus

Unit – I Overview of Operating System	1a. Explain the functioning of given component of OS. 1b. Explain characteristics of the given type of operating system. 1c. Identify type of operating system suitable for the given type of application. 1d. Execute command on command line for the given task.	1.1 Operating System – Concept, Components of operating system. operations of OS: Program Management, Resource management, Security and protection. Views of OS: User view, System View 1.2 Different Types of Operating systems- Batch operating system, Multi Programmed, Time Shared OS, Multiprocessor Systems, Distributed Systems, Real time systems, Mobile OS (Android,iOS). 1.3 Command line based OS – DOS, UNIX GUI based OS – WINDOWS, LINUX.

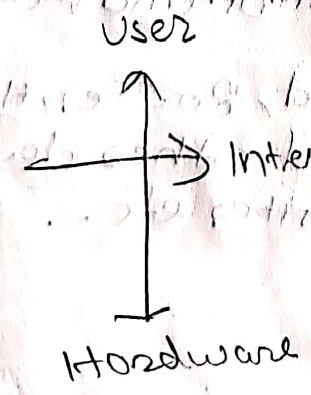
1.1 Operating System - Concept, Components of operating System, operations of OS: Program management, Resource management, Security and Protection.

Operating System ? (Aatma) (heart - CPU) Concept

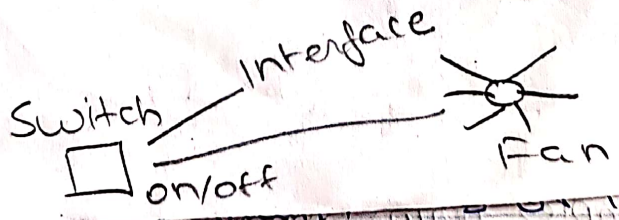
It is a set of programs which controls all the computer resources and provide environment in which user can develop application programs.

An Operating System is a software act as interface between end-user and hardware.

It creates user-friendly environment.



If there is no operating system user can't interact with the hardware. If he wanted to do without O.S the he have to write program for each and every thing.



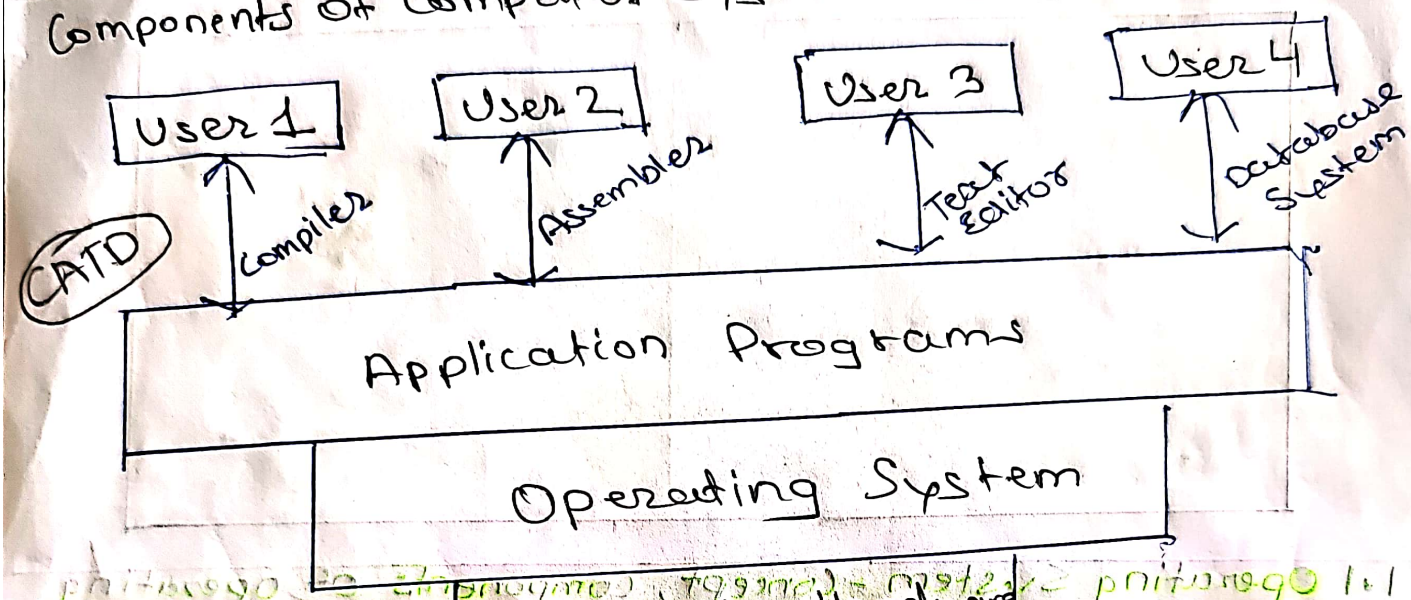
Components of Computer System.

A computer system is a collection of hardware and software components.

Hardware refers to physical computing equipment.

Software refers to the programs written to provide services to users of the system.

Components of computer System Diagram:



Computer system is roughly divided in 4 parts.

computing - keep working on some work

① **Hardware**

Hardware is a physical part of machine which provides basic computing resources.

Examples:- Central Processing Unit (CPU)

- Input devices (keyboard, mouse, microphone, web Camera, and scanner etc)
- Output devices (Printer, monitor and Plotter etc..)
- Networking devices (LAN card, Router, HUB, Switch, modem etc) and other devices like motherboard, DVD writer etc..

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② Application Programs

It is a software that performs specific functions for a user.

They define the ways in which the system resources are used to solve the computing problems of the users.

Examples are Word Processors, Spread sheets, Compilers, web Browsers, Databases, Video Games etc....

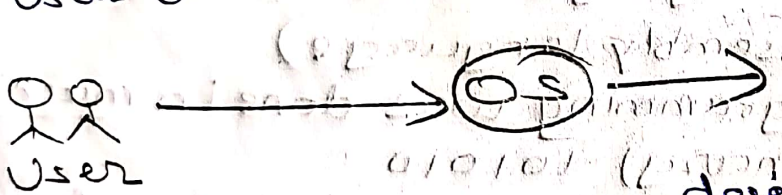
③ Operating System

Operating system is system software that manges a computer resources among various application programs.

Examples are microsoft Windows-7, Apple MAC-OS, Ubuntu, Linux etc...

④ Users

User can be categorized into Programmers, Operational users and End Users.



- Programmers: They are designers or producers of software developed for themselves or others.

- Operational users: They are the users reponsible for the installation of software, proper maintenance of software, making it available for users.

- End Users: are the actual users of the applications and perform the specific tasks as per defined.

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~~Operations of OS~~

Evolution/generation of Operating System.

① First generation (1940-1956) - Vacuum tubes, Plug boards.

* These machines had vacuum tubes as a central component.
* machines of the time were so primitive that programs were often entered one bit at a time on rows of mechnical switches (plug boards).
* But the vacuum tubes were having the problem of heating and they required the large space.
* There was no operating system in this generation.
* Programming languages were unknown (not even Assembly language)
* So all the programming was done in machine language. (Binary) 101010
* All the problems were simple numerical calculations.

② Second Generation (1956-1963) - Transistors, Batch Systems.

* In this generation, the vacuum tubes were replaced by transistor.
* So, the problem of size and space is solved.
* The cost was changed dramatically. (low)
* Second generation computers followed Batch System i.e one by one job were executed in the system.

program + data = job

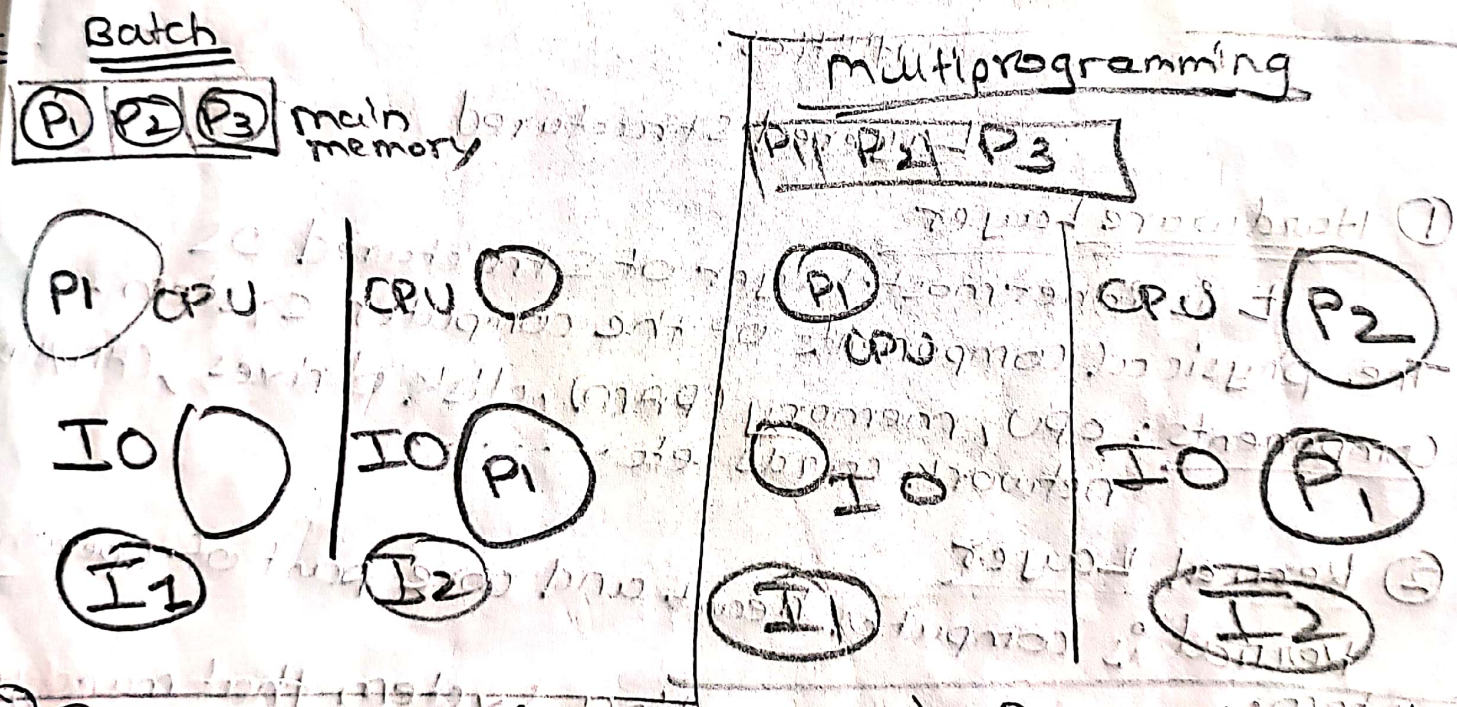
Batch = collection of job.

* These were called single-stream batch processing systems because programs and data were submitted in groups or batches.

* The Assembly language generation.
* The draw back of transistors was leakage current.

③ Third Generation (1964-1971) - ICs and multiprogramming

* The transistors were replaced by Silicon Chip.
* In this generation, operating system designers the concept of multiprogramming in which several ~~job s are~~ jobs are in main memory at ~~once~~ a time; a processor is switched from job to job as needed.
* This meant that processor was not idle while a job was completing its I/O operation. Another job was scheduled on the processor so that its time would not be wasted.
* Users interacted with the third generation computers using keyboard and monitors.

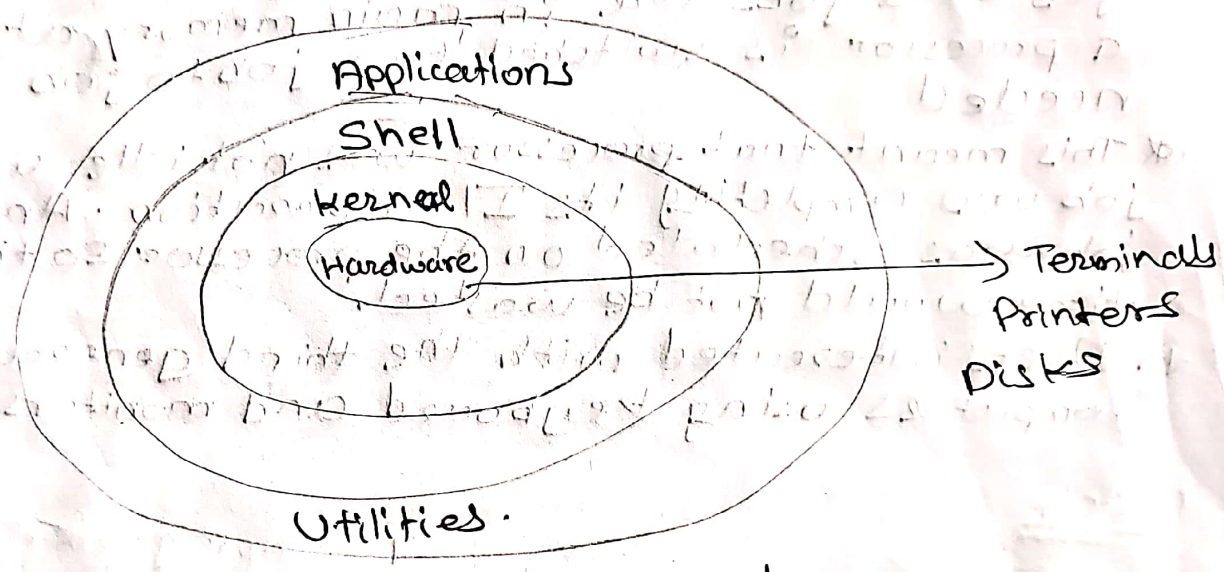


④ Fourth Generation (1971 - Present) - Personal Computers

* In fourth generation computers, the technique used was Large Scale Integration.
* This technique packed thousands of transistor on small area silicon chip.
* Microprocess technology evolved in such a manner that it becomes possible to build desktop computers as powerful as main frames of 1970s.

*Network operating system (NOS) started during same phase.
*DOS, UNIX, LINUX, GUI, windows operating system are the examples.

Structure of OS (Operating System)



Layered Structured

① **Hardware Layer**

It is innermost layer of structured OS.
The physical components of the computer system.
Components: CPU, memory (RAM), disk drives, (HDD/SSD), network cards etc.....

② **Kernal Layer**

Kernal is computer heart and core part of operating system.
The core part of operating system that manages hardware resources and provide essential services.
Components: Process scheduler, memory manager, device drivers, system call interface.

③ **Shell Layer**

The interface between user and kernal, which interpret and executes user command.
In simpler terms, when user send some request shell request to hardware and create interface.

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Batch Operating System

Components: Command line shells (bash, zsh) or graphical shells (GNOME, KDE)

① User Layer

The applications and interfaces that users interact with its outermost layer.

Components: User applications (web browser, office suites, media players).

Operations on OS

Program management

* A process is nothing but program in execution. A program is a set of instructions. When CPU is allocated to a program, it can start its execution.

* A program in execution is the process.

Example: A word processing program run by a user on PC is a process. A process needs various system resources including CPU, time, memory, files, and I/O devices to complete the job execution.

* These resources can be given to the process when it is created or allocated to it while it is running.

* Operating system performs program management or process management and responsible for following operations.

a) Scheduling of processes as well as threads on CPUs.
b) Creation and deletion of system as well as user's processes.
c) Process suspension and its resuming mechanism.
d) Manage process synchronization.
e) Fully support process communication.

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Resource Management

When there are multiple users or multiple jobs running at the same time, resources must be allocated to each of them.

Many different types of resources (files storage, CPU cycles etc...) are managed by operating system.

In Resource management, OS allocates computer resources such as CPU time, main memory, secondary storage, and input and output devices for use.

Following are the major activities of an operating system with respect to resource management.

1. The OS manages all kind of resources using schedulers.
2. CPU scheduling algorithms are used for better utilization of CPU.

Protection

Protection address internal threats within the system. It controls access to processes, programs and user resources to ensure proper system functionality.

This mechanism specifies which file a user can access, view, or modify, allowing safe sharing of memory.

Example:

In a small organization with four employee (e1, e2, e3, e4) and two data resource (r1, r2)

↳ Employees e1, e2 can access r1.

↳ Employee e3, e4 can access r2.

~~If e1 tries to restrict~~

- If e1 tries to access r2, they are restricted and cannot access it.

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Batch Operating System

The users of Batch operating system do not interact with computer directly.

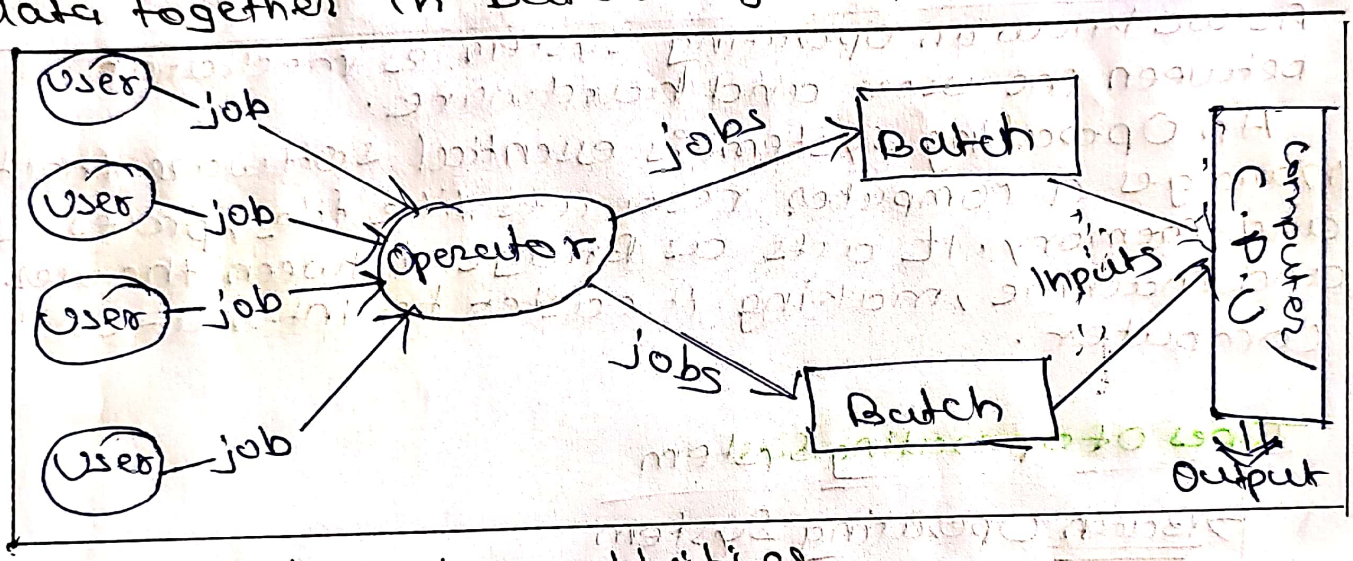
Each user prepares his job on offline device like punch cards and submit it to the computer operator (person).

The Batch operating System will work to ~~Sumit~~ Submit similar kinds of jobs together.

Job: Job is collection of program, I/P data and Control Instruction

In Batch operating System, a batch is a sequence of user jobs.

Here operating system collects program and data together in batch before processing starts.



It follow following activities

1. Operating system defines a job which has predefined sequence of command, programs and data in single unit.
2. Operating system keeps a no. of jobs in memory and executes them without any manual information.
3. Jobs are processed in order of submission i.e. First come first served.
4. ~~After~~ when jobs are ~~com~~ executed the operator seperates the similar kind of jobs in batch.
5. As an input Batchs are given to Computer CPU it executes it in FIFO and process it one batch at a time & provide desired output.

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Security

Security address external threats to the System. It safeguards System resources like data, disks and memory from harmful modifications and unauthorized access.

Mechanisms such as encryption and authentication are used to verify users before granting access.

Attributes of security - Confidently, Integrity, Availicability.

Example: In the same organization, data resources are shared among employees. However someone outside the company cannot access this info - due to security measures.

1.2 Different types of Operating Systems:

As we know an Operating system is mediator between the user and hardware.

An Operating system is essential software that manages a computer resources like files, processes and memory. It acts as Bridge between the user and machine, making it easier to interact with computer.

Types of operating System

1. → Batch Operating System
2. → Multiprogrammed Operating System
4. → Time Shared OS → {Multitasking}
5. → Multiprocessor Systems
6. → Distributed Systems
7. → Real time Systems
8. → Mobile OS
   - → Android
   - → IOS

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Advantages of Batch Operating System

1. It is useful when we working with larger files, which can take more time to execute.
2. multiple users can share batch systems.
3. The idle time for B.O.S is very less.
4. Easy to manage large work repeatedly in batch systems.

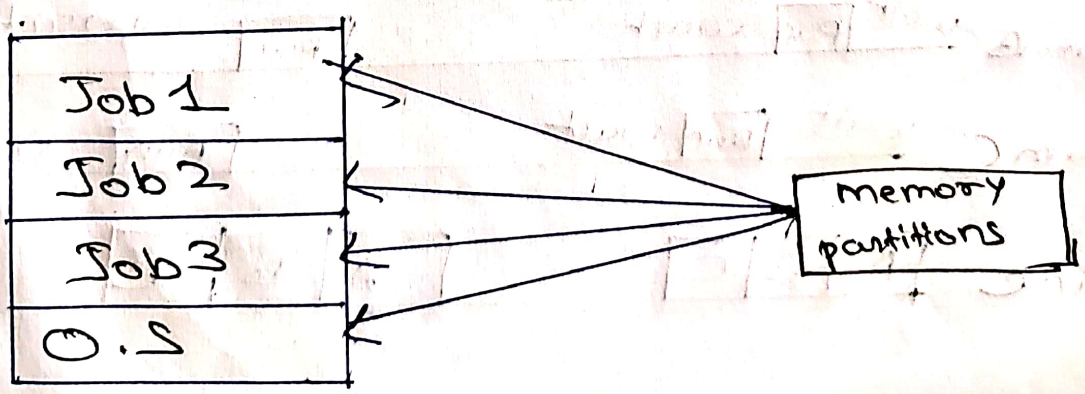
Disadvantages

1. They are hard to Debug.
2. It is sometimes costly.
3. once the job is submitted user can't interact with it later.
4. The other jobs have to wait if any unknown job fails.
5. Difficult to predict time required for job.

Applications: Payroll systems, Bank statements etc.

Multiprogrammed Operating System

Multiprogramming operating system can be simply illustrated as more than one program present in main memory and one of them kept ~~for~~ in execution. This is Basically used for better execution of resources.



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Programming

The operating system keeps several jobs in memory at a time.

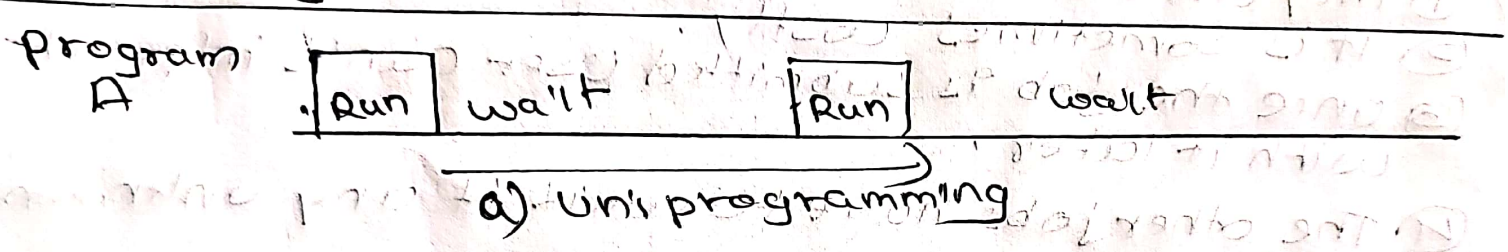
~~The operating systems keeps several job in memory at a time.~~

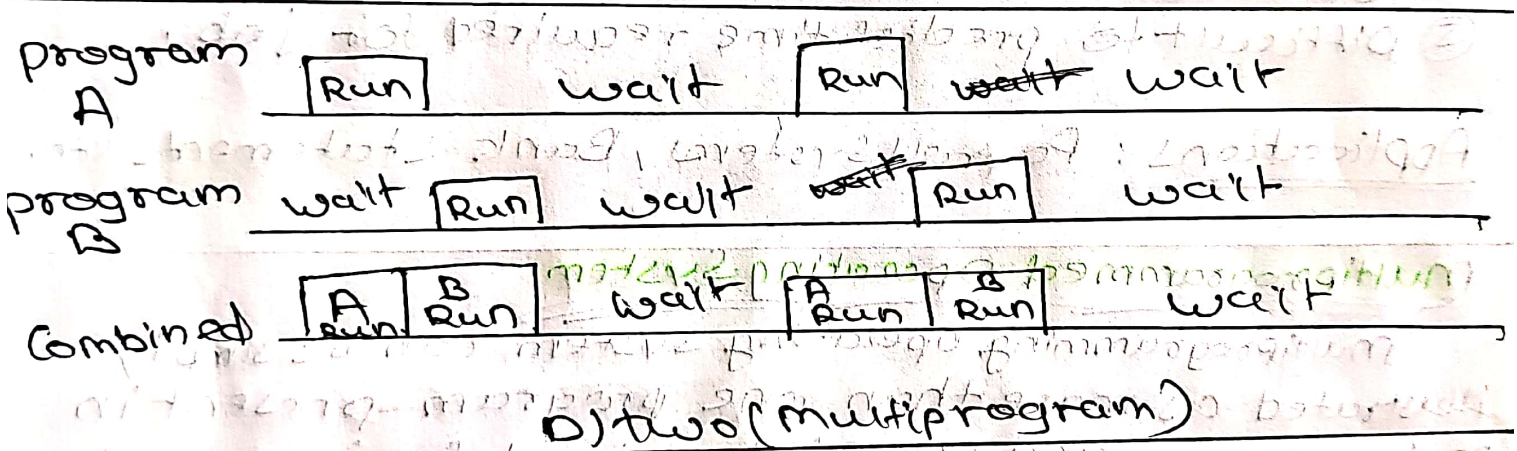
O.S picks and begin to execute one of job in memory. Eventually the job may have to wait for I/O operation to complete.

In Non-Programming ~~mode~~ System: CPU will sit idle.

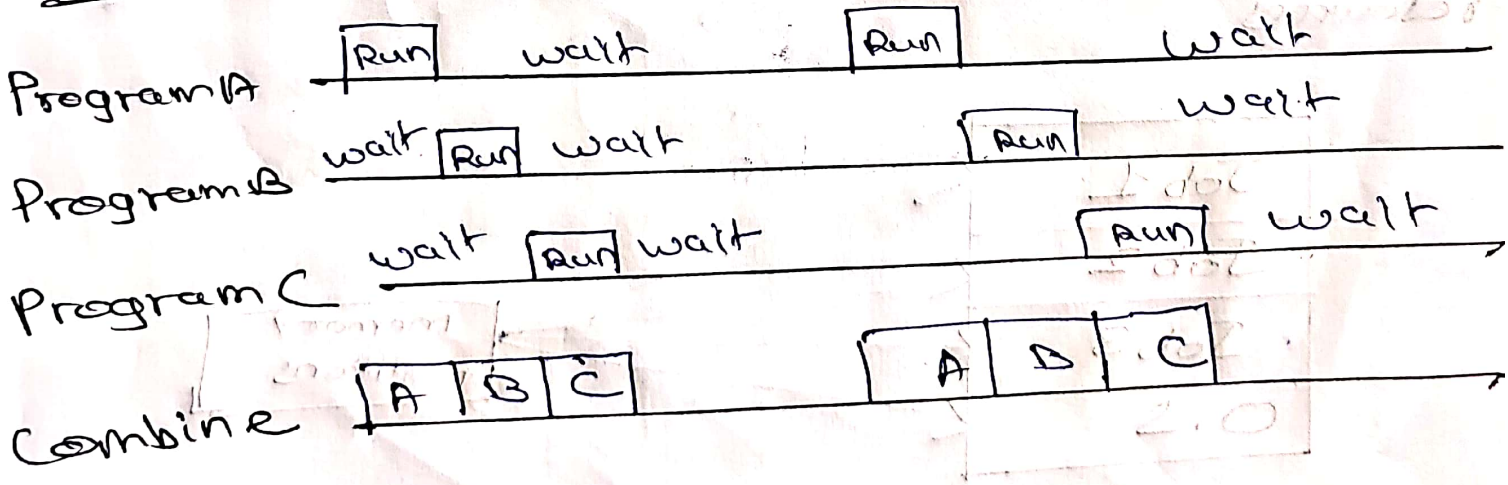
As long as there is always some job to execute, the CPU will never be idle.

Throughput of system will also increase.





3 programs



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Advantages of multi-Programming

* It provides less response time.
* It may help to run various jobs in single application simulateneously.
* Short-time jobs are done quickly in comparision to long time jobs.
* Helps in reducing output time i.e executes no. of program simultaneously by single processor.

Disadvantages

* ~~There is expensive in~~
* There is not any facility for user interaction of system resources with the system.
* multi programming system requries CPU scheduling
* maintainence is expensive in multiprogramming.
* It has a large no. of jobs, the long-term jobs will require long wait.

Multitasking Operating System

~~It is also known as Time sharing operating System.~~

It is logical extension of multiprogramming.

A multitasking operating system that is capable of running more than one task at a time.

These executions are called as concurrent or simultaneous execution.

In multitasking operating system, the code as well as data of several processes is stored into main memory.

It also maintains synchronization between I/O devices and processes so that user can use different application in ~~background~~, foreground.

In multitasking only CPU is involved, but it switches from one program to another so quickly that it gives the apperance of executing all the programs at same time.

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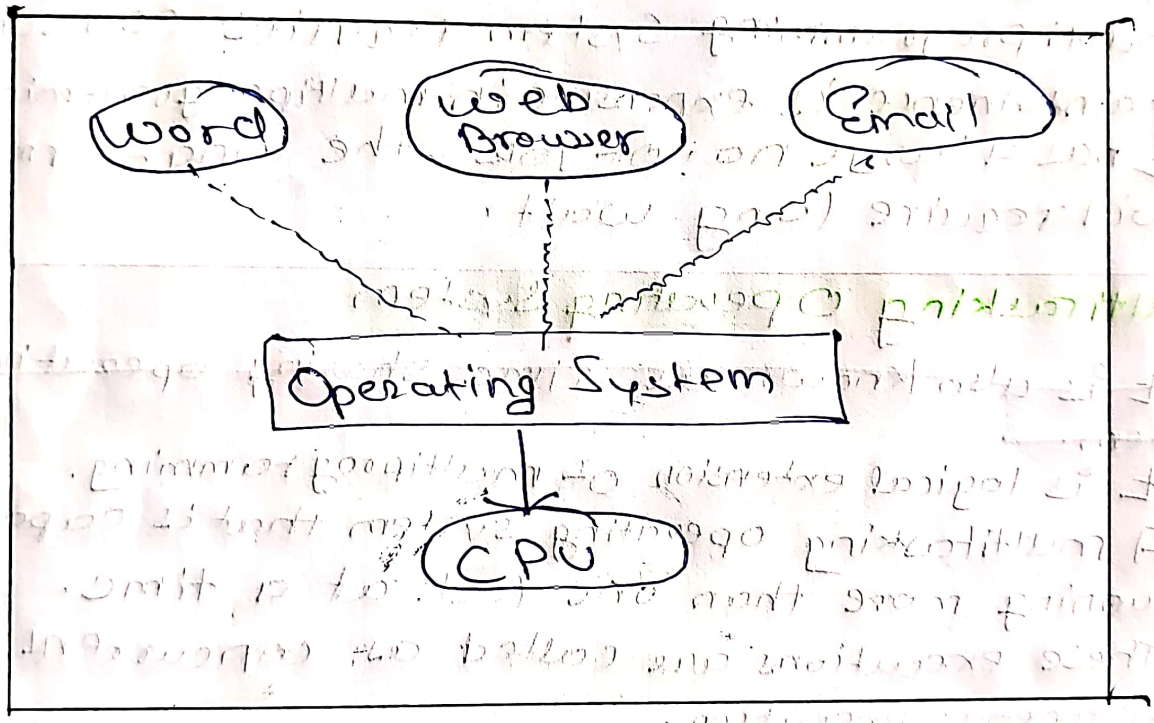
In multitasking the resources are made continuously working. Thus idle time of peripherals gets reduced.

For example, when you are printing a document 100 pages you can do other jobs like typing a new document. So, more than one task is performed.

The user gives instructions to Operating System or program directly and receives an immediate response.

Types

Co-operative Preemptive.



Advantages	Disadvantages
* It helps in increasing the overall performance of C.S.	* Systems get heated in case of heavy programs multiple times.
* It comes with proper memory management.	* Require more system resources.
* Multiple Programs can be executed simulateneously in Multi-Tasking Operating System.	* To perform multiple task at single time, the CPU speed must be very high.

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Multiprocessor Operating System

Multiprocessing operating system is a type of operating System in which more than one CPU is used for the execution of resources. It betters the throughput of System.

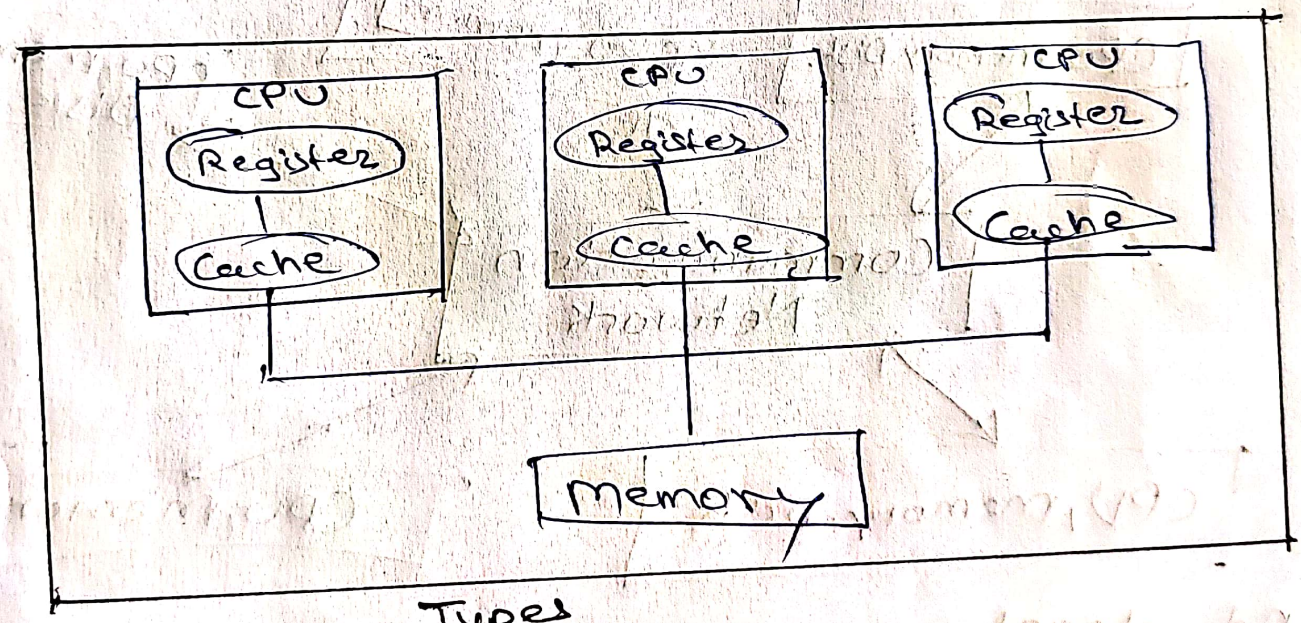
Multiprocessor Operating System in which more than one processors are placed in single cabinet in close communication.

They can share the computer bus and sometimes clock, memory and peripheral devices.

Every processor has its own memory (cache memory)

They are also called Parallel Systems or Tighted Coupled System.

Main Advantage of this is to get maximum work done in shorter period



Types

- Asymmetric
- Symmetric

Advantages

- Increases throughput of system
- It is robust, even if one processor fails, we can proceed with another processor

Disadvantages

- Large main memory required
- Complex OS is required
- Expensive
- Speed will affect if one processor fails.

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~~Multiprocessor Operating System~~

Distributed Operating System

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

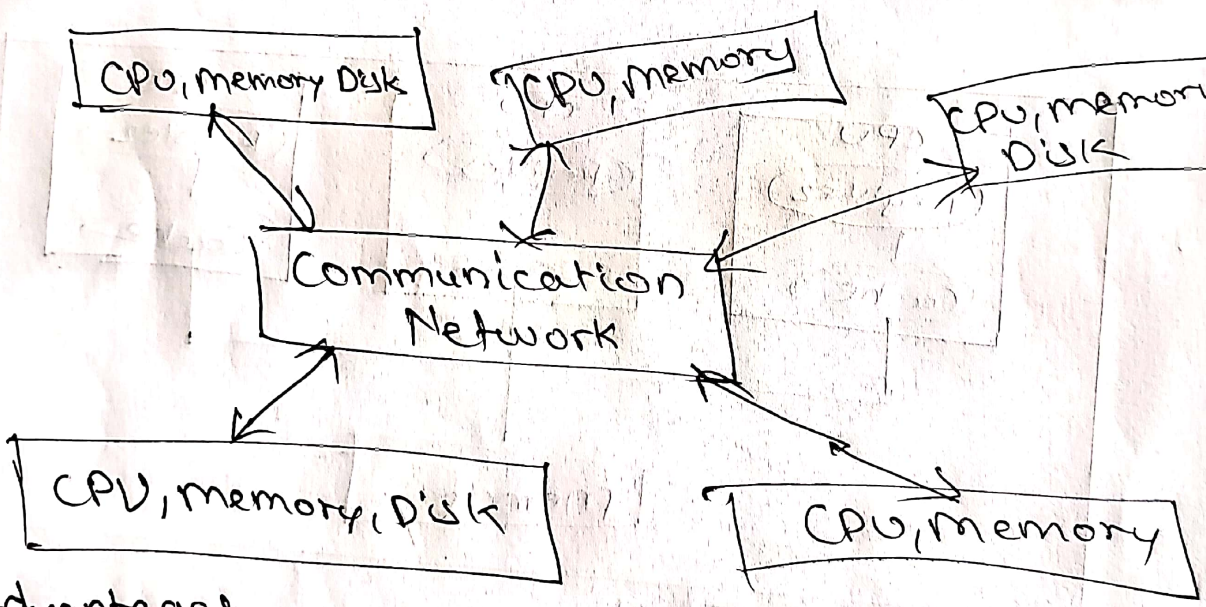
Data processing jobs are distributed among the processors accordingly.

The 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.

Processors in a distributed system may vary in size and function.

These processors are reffered as sites, nodes, computers, and so on.



Advantages

- Better services to customer.
- Reduction of delays in data processing.
- Reduction of load on the host computer.
- If one site fails in distributed system, the remaining sites can potentially continue operating.
- With resource sharing facilities, a user at one site may be able to use resources available at another.

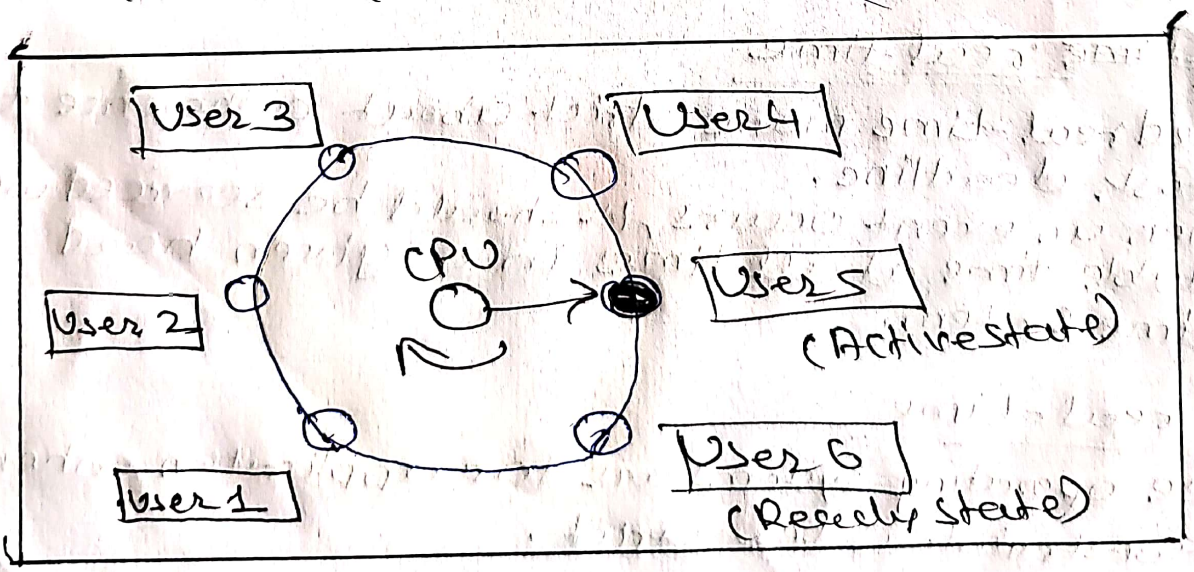
Disadvantages

- Failure of main network will stop entire communication
- To establish distributed systems the language is used not well-defined yet.
- These types of systems are not readily available as they are very expensive.

Example: Locus etc...

Time sharing Operating System

- Each task is given some time to execute so that all the tasks work smoothly.
- Each user gets the time of CPU as they use a single system.
- These system are also known as multitasking systems.
- The task can be from a single user or different users also.
- The time that each tasks gets to execute is called Quantum.
- After this time interval OS switches over to next task.



Examples: IBM VM/CMS
Windows Terminal services
TSO

Advantages

- Each task get equal opportunity.
- Fewer chances of duplication of software
- CPU ideal time can be reduced
- Avoids duplication of software.

Disadvantages

- Reliablity problem.
- Data communication problem.
- One must take care of the security and integrity of user programs and data.

Real-Time Operating Systems

These types of OS serve real time systems. The time interval required to process and respond to inputs are very small.

This time interval is called response time.

Real time systems are used when there are time requirements that are very strict like missile systems, air traffic control, robots etc....

Types of Real time OS

- Hard Real-time
- Soft Real-time

Hard ~~time~~ real-time

Hard real-time means strict about adherence to each task deadline.

When an event occurs, it should be serviced within predictable time at all times in a given hard real time system.

Soft real-time

These operating systems are for application when time constraint is less strict.

Applications

- Flight Control Systems
- Simulations.

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Advantages

- maximize utilization of devices and system.
- Focus on running applications over Queued ones.
- Designed to be error-free.
- Efficient memory allocation.

DisAdvantages

- supports only few simulataneous tasks.
- Can be resource-intensive.
- They are expensive
- Algorithms can be complex and difficult to designed.

Mobile OS

A mobile Operating Systems is one that controls smartphones, personal Digital Assistants (PDAs), tablet PCs, and information appliances.

A mobile operating system, also known as a OS, a mobile platform, or a handheld Operating System, is the Operating System that controls a mobile device.

Types of mobile OS

- Android
- IOS

Android

The Android Operating Systems is an open source operating system primarily used in mobile devices. written primarily in JAVA and based on the Linux operating system, it was initically developed by Android Inc and was eventually purchased by Google in 2005.

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IOS

IOS is the operating system created by Apple Inc. for mobile devices.
The IOS is used in many of mobile devices for apple such as iPhone, iPad, iPod etc..
IOS is used alot and only lags behind Android terms of popularity.

Command Line Based OS

The Command Line Interface interacts with the Operating System by typing commands/instructions on a command Line.
Various Commands need to be typed for carrying out various jobs like creating, deleting, renaming or printing a file.
Usually in CLI each command represents an executable program, which is run when the command is typed with proper parameters.

Types

- MS-DOS
- UNIX

DOS

DOS stands for Disk Operating Systems.
It was developed by Microsoft. So, Microsoft Disk Operating System.
It is a single user, non-graphical line oriented command or menu-driven operating system.
It has simple interface but interface is less user friendly.
Example: dir, mkdir etc.....

(1981-2000)

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...mand Line

Unix OS

Developed in 1970 by Ken Thompson at Bell Laboratory.
Unix runs on a wider range of systems than any other O.S.
It allows people to work together and share information in controlled way.
Unix provides power and flexibility.

GUI Based OS

A graphics-based operating system interface that uses icons, menus and a mouse (to click on the icon or pull down the menus) to manage interaction with system.

types
- Windows
- Linux

windows

- Windows is developed by Microsoft.
- It is forerunner to the Apple Macintosh.
- Microsoft provided MS-DOS a graphical user interface called windows.

Components:
1. Hardware Abstraction Layer
   - provides portability across platforms.
2. KERNEL
   - It is responsible for handling all kind of programs and process.
3. Executive
   - It is written in C and includes 10 components.

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Linux

- It is free and open source OS
- It supports GUI
- It supports multiple languages.
- It supports multiple users, multithreading, multitasking & networking as well.
- It is portable and can be installed on any machine

Component

Kernel - Responsible for handling all kind of programs and process.

System libraries - Provides interaction with kernel.

System utilities - These are the programs that carry out individual specialized management task.

End

~~Changlle~~

Challenges

1. GUI vs CLI OS (Fixed)
2. Time sharing vs Real time.
3. multiprogrammed vs multitasking.

Expected

4. multiprogramming vs multitasking vs multiprocessing.
5. iOS vs Android
6. User view vs System view.

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Command Line Based OS	Graphical User Interface OS
Interaction is by typing commands	Interaction with devices is by graphics and visual components and icons.
Commands needs to be memorized	visual indicators and icons are easy to understand
Less memory is required for storage.	more memory is required as visual components are involved
Accuracy is High	Accuracy is Low
CLI is difficult to use	GUI is easy to use
CLI is faster than GUI	GUI is slower than CLI
CLI operating system only needs keyboard.	while GUI needs both mouse & keyboard.
CLI apperance can't be changed or modified.	GUI apperance can be changed or modified
There are no graphics	graphics are used.
Does not avoid spelling mistakes and typing errors	whereas GUI avoid type errors and spelling mistake.
CLI do not use any pointing devices	while GUI uses pointing devices, for selecting and choosing item.
In CLI we can obtain high precision	In GUI we can obtain low precision
Input is entered on cmd command prompt only.	while GUI, the input can be entered anywhere on the screen.

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multtth

Features	Time sharing	Real time O.S
Definition	A time sharing system allows several users to use a computer system from various location simultaneously.	A Real time OS completes a task within a specific time.
Computer Resources	User may share the resources between users.	Resources are alloted to a process for a fixed amount of time before reallocating to another process.
Switching	A switching method/function is available	The switching method/fun^n is not available.
modification of program	Any modification may be possible in program	Any modification may not be possible in the program.
Response	The response is generated within seconds.	The user must get the response within specified time constraint.
Process details	It runs the multiple applications simulateneously	It runs only single application simulateneously.
Basic	It focus is on responding quickly to a request	It focuses on completing computer task before the deadline.

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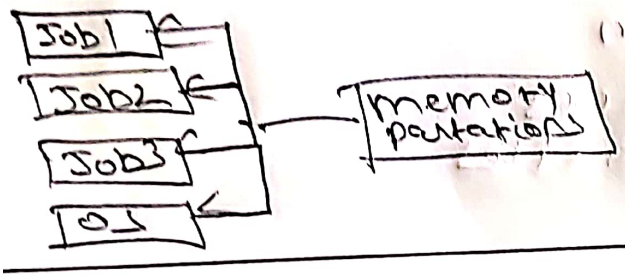
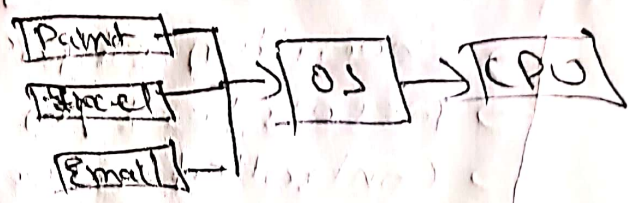
multiprogramming, multiple processes run concurrently at the same time on a single processor.	multitasking is when more than one task is executed at single time utilizing multiple CPUs.
It is based on the concept of context switching.	It is based on concept of time sharing.
It takes more time to execute the processes.	It takes less time to execute the tasks.
It utilizes the single CPU for execution of processes.	It utilizes multiple CPU for ~~exec~~ allocation of task.
~~It takes~~ ~~pac~~ more It speed is slow Easy to use	It Speed is fast, Difficult to use
	

iOS	Android
Apple is Developer	~~Microsoft~~ Google is Developer
s Family - ~~L~~Unix, OS X	OS Family - Linux
No, ~~except of~~ widgets except Notification center	Yes, there are widgets
rogrammed in C, C++, C#	Programmed in C, C++, java.
Closed, with open source components	Open source
nessaging - iMessage	messaging - Google Hangouts
Launched in 2007	Launched in 2008
Costly	Cheaper

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View of OS

User view → System view

we can understand the role of operating system more fully by exploring it from two different viewpoints namely.

User view

The Operating system is an interface, hides the details which must be performed and present as virtual machine to user that makes it easier to use.

It provides following services

- Execution of program
- Access to I/O devices
- Controlled access to files
- Error detection.

System view

Operating System is a program that functions in same way as other programs.

It is set of instruction that executed by the processor.

Operating System acts as a program.

- Hardware upgrade
- New services
- Fixes the issues of resources
- Control the user and hardware operations.

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