

Operating System (22516)

Overview of Operating System : (Marks 08)

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. MobileOS.

1.3 Command line based OS – DOS, UNIX, GUI based OS –WINDOWS, LINUX.

Introduction:

An operating system is a well organized collection of a basic set of programs. It is supplied along with the hardware for the effective and easy use of the machine.

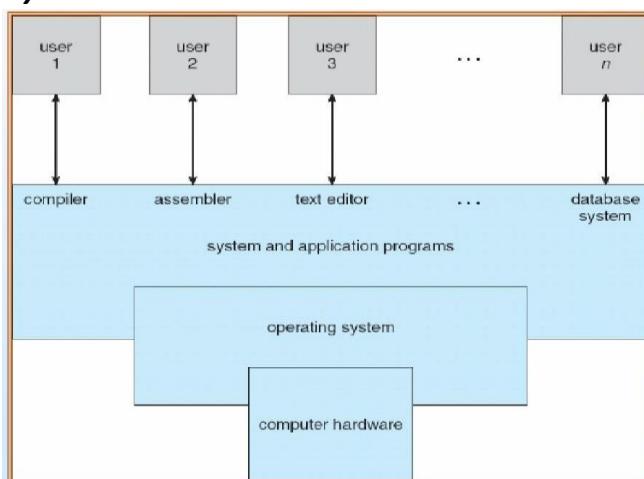
The most important program among these programs is called **kernel** of the operating system.

This kernel program is loaded in the main memory when a computer is initialized during its booting. It resides permanently in the main memory until the system is shutdown.

Operating System (OS) runs on computer h/w and serves as platform for other s/w to run on. An OS is the layer of a computer system between the h/w & the user program as shown below

The OS is the first program run on a computer when the computer boots up. There can be only one Operating System running on a computer.

Components of computer system:



Above fig. illustrates the layered structure of the h/w, s/w & the Operating System.

User- The end user or user is not concerned with the details of computer hardware. A end user views a computer system as a set of applications.

System & Application program- The application program is a set of machine instructions that is completely responsible for controlling the computer hardware. That is, the set of system programs are provided for controlling the computer hardware. Some of these programs are referred to as utilities.

Operating system- Collection of system programs comprises the operating system. The OS maintains details of hardware and provides the programmer with convenient interface for using the system.

Hardware- The OS manages the h/w resources of the computer system.

The main h/w resources in computer system are –

Processor – is part of computer system capable of executing instructions.

Memory – The memory contains all instructions & data used by a processor.

Input/output (I/O) controllers - Processors that know how to transfer data between memory & devices.

User Program

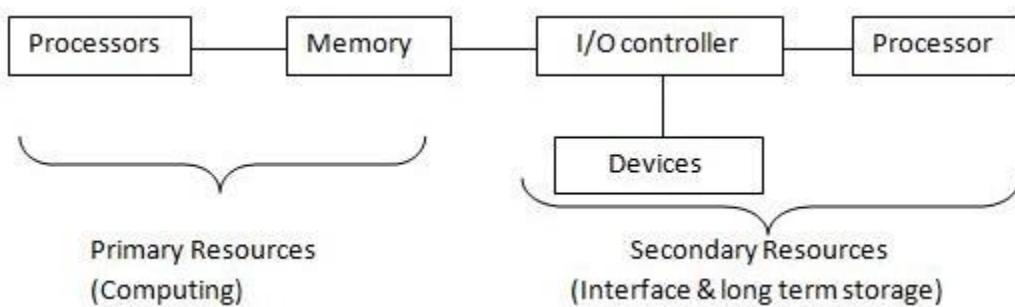
Operating System Interface

Operating System

Hardware Interface

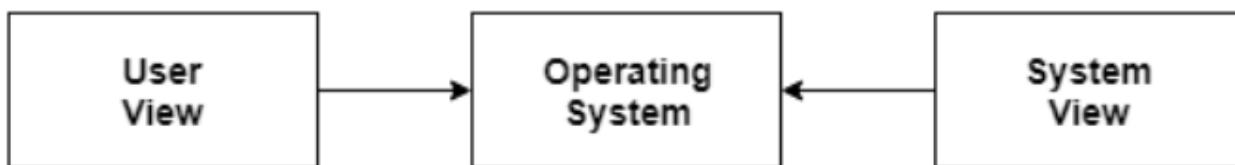
Hardware

Following figure shows the resources of the computer system.



An operating system is a construct that allows the user application programs to interact with the system hardware. Operating system by itself does not provide any function but it provides an atmosphere in which different applications and programs can do useful work.

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. More details about these are given as follows –



User View

The user view depends on the system interface that is used by the users. The different types of user view experiences can be explained as follows –

- If the user is using a **personal computer**, the operating system is largely designed to make the interaction easy. Some attention is also paid to the performance of the system, but there is no need for the operating system to worry about resource utilization. This is because the personal computer uses all the resources available and there is no sharing.
- If the user is using a **system connected to a mainframe or a minicomputer**, the operating system is largely concerned with resource utilization. This is because there may be multiple terminals connected to the mainframe and the operating system makes sure that all the resources such as CPU, memory, I/O devices etc. are divided uniformly between them.
- If the user is sitting **on a workstation connected to other workstations through networks**, then the operating system needs to focus on both individual usage of resources and sharing through the network. This happens because the workstation exclusively uses its own resources but it also needs to share files etc. with other workstations across the network.
- If the user is using a **handheld computer such as a mobile**, then the operating system handles the usability of the device including a few remote operations. The battery level of the device is also taken into account.

There are some devices that contain very less or no user view because there is no interaction with the users. Examples are embedded computers in home devices, automobiles etc.

System View

According to the computer system, the operating system is the bridge between applications and hardware. It is most intimate with the hardware and is used to control it as required.

The different types of system view for operating system can be explained as follows:

- The system views the operating system as a **resource allocator**. There are many resources such as CPU time, memory space, file storage space, I/O devices etc. that are required by processes for execution. It is the duty of the operating system to allocate these resources judiciously to the processes so that the computer system can run as smoothly as possible.
- The operating system can also work as a **control program**. It manages all the processes and I/O devices so that the computer system works smoothly and there are no errors. It makes sure that the I/O devices work in a proper manner without creating problems.
- Operating systems can also be viewed as a way to make using hardware easier.
- Computers were required to easily solve user problems. However it is not easy to work directly with the computer hardware. So, operating systems were developed to easily communicate with the hardware.
- An operating system can also be considered as a program running at all times in the background of a computer system (known as the kernel) and handling all the application programs. This is the definition of the operating system that is generally followed

1.1 Evolution of operating system

The 1940's - First Generations

First generation 1945 – 1955 - vacuum tubes, plug boards

The earliest electronic digital computers had no operating systems. Machines of the time were so primitive that programs were often entered one bit at time on rows of mechanical switches (plug boards). Programming languages were unknown (not even assembly languages).

Advantages:

- » These computers fast and could calculate data in millisecond.
- » Vacuum tubes were the only electronic component available during those days.
- » Vacuum tube technology made possible to make electronic digital computers.
- » Easily available and inexpensive.
- » Tactile sensitivity is preserved.
- » Color-coded for easier and faster identification of readings.

Disadvantages:

- » The computers were very larger in size
- » They consumed a large amount of energy.
- » They heated very soon due to thousands of vacuum tubes.
- » They were not very reliable.
- » Air conditioning is required.
- » Constant maintenance was required.
- » Not-portable.
- » Costly commercial production.
- » Very slow speed.
- » Limited programming capabilities.
- » Used machine language only.

- » Used punch card for input.
- » Not versatile and less accurate.

Example of First Generation of Computer:

1. ENIAC (1946)
2. EDSAC (1949)
3. EDVAC (1950)
4. UNIVAC-1 (1951)

The 1950's - Second Generation

- Second generation 1955 – 1965 - transistors, batch systems

By the early 1950's, the routine had improved somewhat with the introduction of punch cards. The General Motors Research Laboratories implemented the first operating systems in early 1950's for their IBM 701. The system of the 50's generally ran one job at a time. These were called single-stream batch processing systems because programs and data were submitted in groups or batches.

Advantages of Second Generation of Computer:

- » Smaller in size compared to the first generation of computer.
- » The second generations computers were more reliable.
- » Used less energy and were not heated as much as the first one.
- » Better speed and could calculate data in microseconds.
- » Used faster peripherals.
- » Better portability as compared to the first generation.
- » Accuracy improved.
- » Used assembly language as well.

Disadvantages of First Generation of Computer:

- » Cooling system was required.
- » Only used for specific purposes
- » Constant maintenance was required
- » Commercial production was difficult
- » Costly and not versatile
- » Punch cards were used for input.

Example of Second Generation of Computer:

1. Honeywell 400
2. IBM 7094
3. CDC 1604
4. CDC 3600
5. UNIVAC 1108
6. IBM 7030

The 1960's - Third Generation

- Third generation 1965 – 1980 - ICs and multiprogramming

The systems of the 1960's were also batch processing systems, but they were able to take better advantage of the computer's resources by running several jobs at once. So operating systems designers developed the concept of multiprogramming in which several jobs are in main memory at once; a processor is switched from job to job as needed to keep several jobs advancing while keeping the peripheral devices in use.

Advantages of Third Generation of Computer:

- » Smaller in size as compared to previous generations.
- » More reliable as compared to previous generations.

- » Used less energy as compared to previous generations.
- » Produced less heat as compared to the previous two generations of computers.
- » Maintenance cost was low because hardware failure is rear.
- » Better speed and could calculate data in nanoseconds.
- » Totally general purpose
- » Good storage.
- » Could be used for high-level languages.
- » Less expensive and Better accuracy
- » Commercial production increased.
- » Used mouse and keyboard for input.

Disadvantages of First Generation of Computer:

- » Air conditioning was required.
- » Highly sophisticated technology required for the manufacturing of IC chips.
- » Tactile sensitivity is decreased

Example of Third Generation of Computer:

1. IBM 360/370
2. CDC 6600
3. Honeywell-6000 series
4. PDP(Personal Data Processor)
5. TDC-316
6. IBM-370/168

The Fourth Generation

- Fourth generation 1980 – present personal computers

With the development of LSI (Large Scale Integration) circuits, chips, operating system entered in the system entered in the personal computer and the workstation age. Microprocessor technology evolved to the point that it became possible to build desktop computers as powerful as the mainframes of the 1970s.

Advantages of Fourth Generation of Computer:

- » More powerful and reliable than previous generations.
- » Small in size
- » Fan for heat discharging and thus to keep cold.
- » Fast processing power with less power consumption
- » No air conditioning required.
- » Totally general purpose
- » Less need of repair.
- » Commercial production
- » All types of High level languages can be used in this type of computers
- » Cheapest among all generations

Disadvantages of Fourth Generation of Computer:

- » The latest technology is required for manufacturing of Microprocessors.

Example of Fourth Generation of Computer:

1. IBM PC
2. Apple II
3. VAX 9000
4. CRAY
5. DEC 10

6. STAR 1000

- Operating systems have been evolving through the years.
Following table shows the history of OS.

Generation	Year	Electronic devices used	Types of OS and devices
First	1945 – 55	Vacuum tubes	Plug boards
Second	1955 – 1965	Transistors	Batch system
Third	1965 – 1980	Integrated Circuit (IC)	Multiprogramming
Fourth	Since 1980	Large scale integration	PC

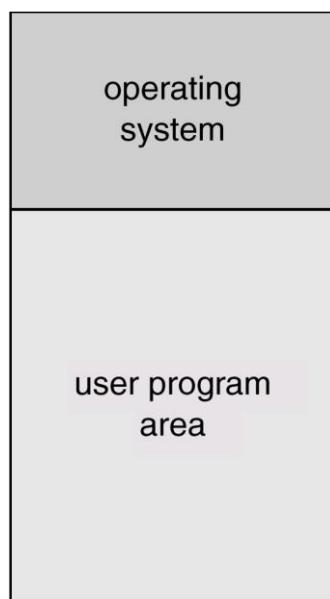
Evolution of operating system

- Batch
- Multi programmed
- Multitasking
- Time sharing
- Multiprocessor Systems
- Distributed Systems
- Real Time system

Batch OS

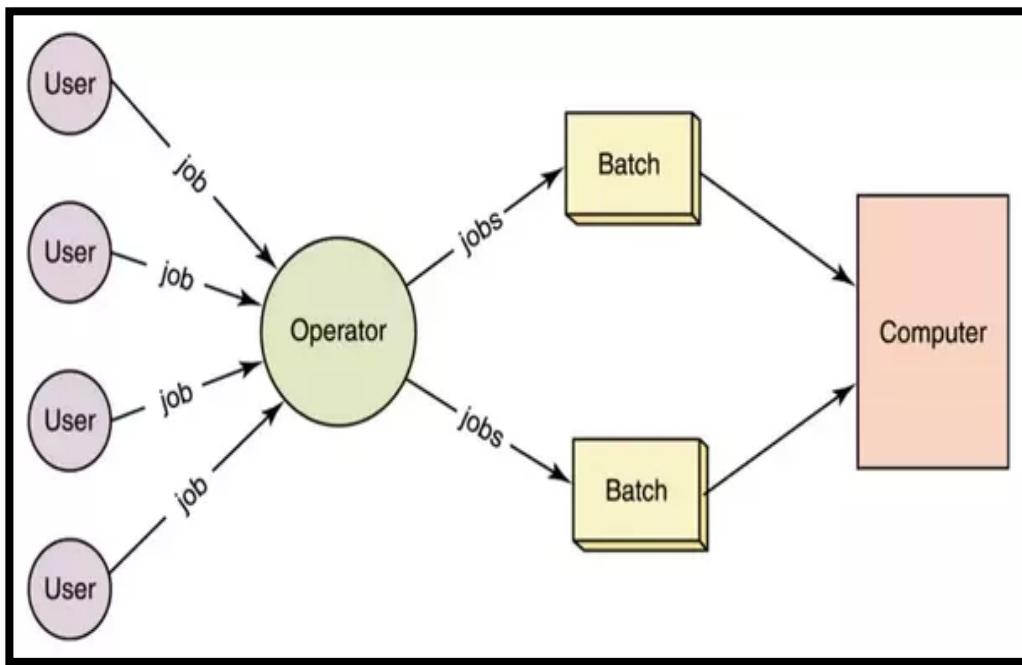
Batch Systems:

Memory Layout of Batch System



- The users of batch operating system cannot directly interact with the computer. Each user prepares his job and data on an off-line device like punch cards and submits it to the computer operator.
- To speed up processing, jobs with similar needs were batched together.

- In batch system jobs are processed in the order of submission i.e first come first served fashion.
- batched system required that a program , itsrelated data and the control commands should be submitted together.
- Memory is divided into two permanent partitions, one for resident operating system and other dynamically used to load the transient programs for execution.
- In batch systems the CPU may be idle for some time because the speed of the mechanical devices slower compared to the electronic devices.
- Later improvement in technology and introduction of disks resulted in faster I/O devices.
- Example: Payroll system, stock control and billing systems.



Advantages of Batch Systems:

1. It allows sharing of resources among many users.
2. Move much of the work of the operator to the computer.
3. Increased performance since it was possible for job to start as soon as the previous job finished.

Disadvantages of Batch Systems:

1. Priority scheduling is not possible in batch processing system..
2. Difficult to debug the program.
3. A job can enter into infinite loop.
4. A job could corrupt the monitor.
5. Due to lack of protection scheme, one job may affect the pending jobs.

Multi programming Operating System:

- If there are two or more programs in the memory at the same time, sharing the processor, this is referred as multiprogrammed OS.

- It increases the CPU utilization by organizing the jobs so that the CPU will always have one job to execute.
- As several jobs are loaded in memory at the same time, it requires some form of memory management.
- Multi programmed systems monitors the state of all active program and system resources and ensures that CPU is never idle until there are no jobs.
- While executing a particular job, if the job has to wait for any task like I/O operation to be complete then the CPU will switch to some other jobs and starts executing it and when the first job finishes waiting the CPU will switch back to that. This keeps the CPU & I/O devices busy.
- The following figure shows the memory layout of multi programmed OS-

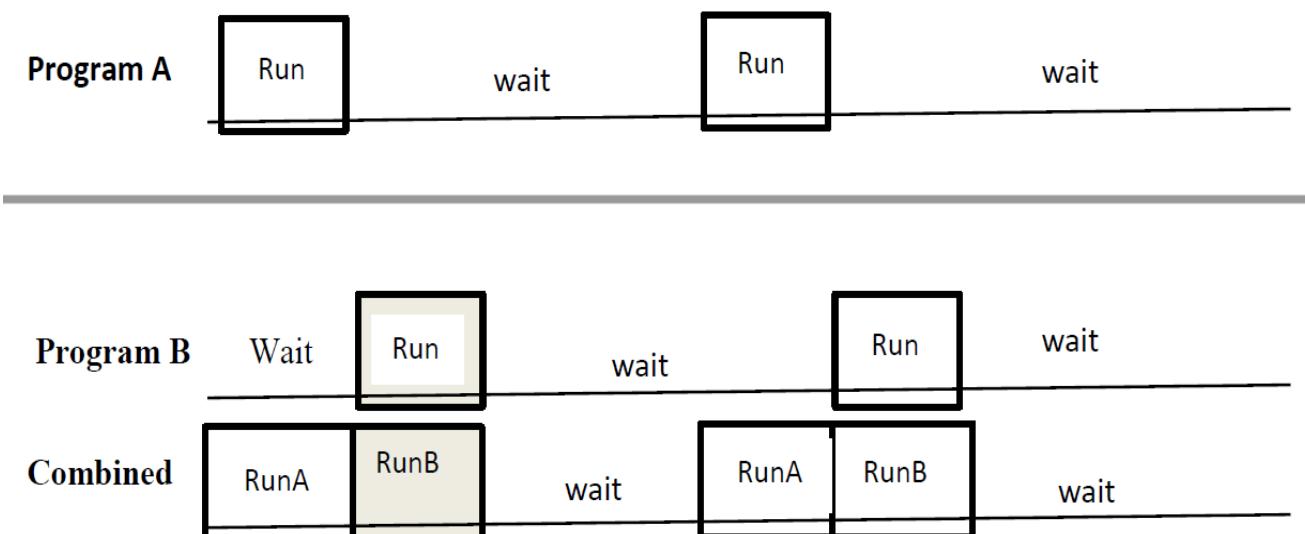


Fig.Multiprogramming with two programs

Advantages

1. High CPU utilization.
2. It appears that many programs are allotted CPU almost simultaneously.
3. Main Memory utilization.
4. The allocation of a computer system and its resources to more than one concurrent application is possible.

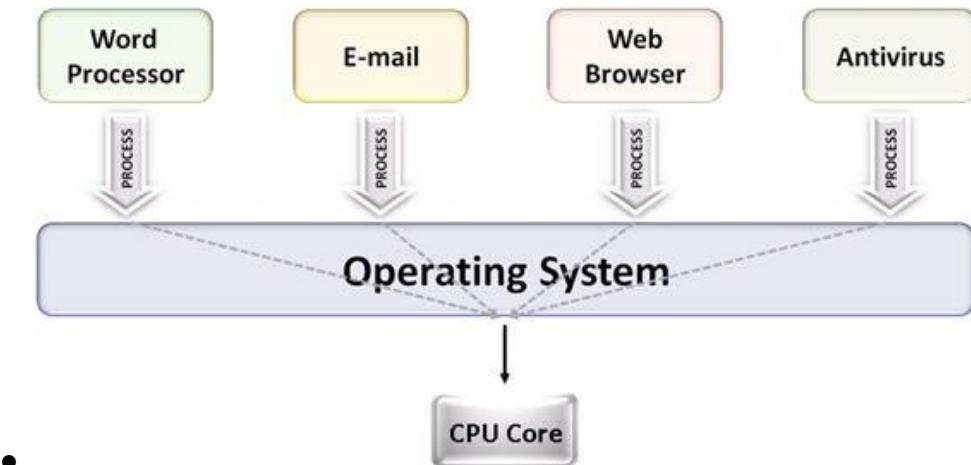
Disadvantages

1. CPU scheduling is required.
2. To accommodate many jobs in memory, memory management is required.
3. multiprogramming also relies on I/O hardware features.

Multitasking operating system:

- A multitasking operating system is any type of system that is capable of running more than one program at a time.
- The multitasking is achieved by simultaneous maintenance of code and data of several processes in the memory at the same time, and the CPU and I/O resource are multiplexed among the active tasks; i.e. the CPU

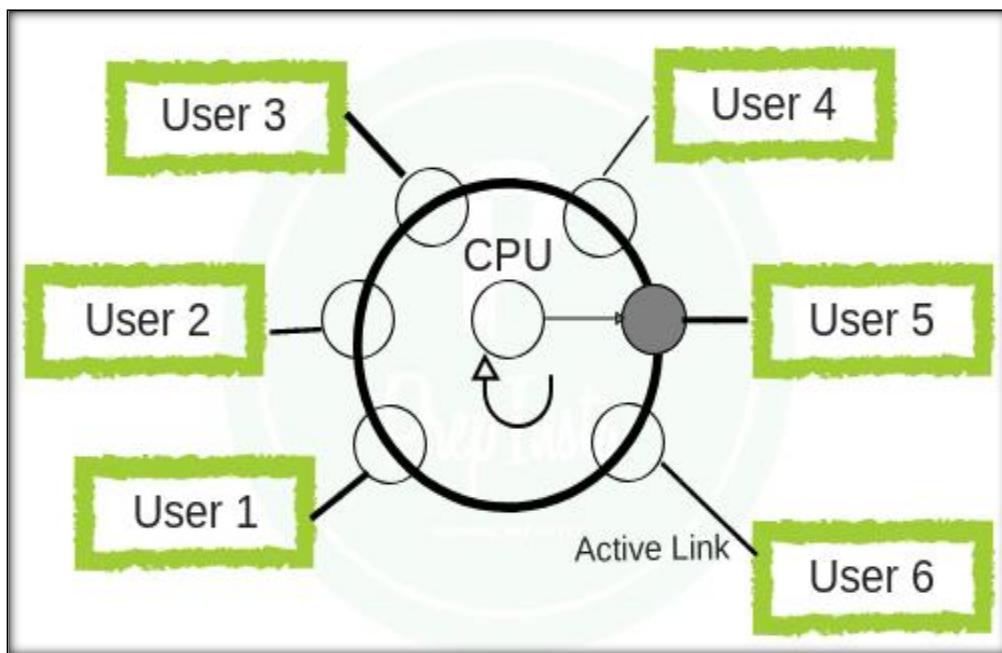
switches from one task to another for reading and processing, but the switching occurs so frequently that the users may interact with each program while it is running.



Time sharing Systems:

- Time sharing is a technique which enables many people, located at various terminals, to use a particular computer system at the same time.
- Time-sharing is a logical extension of multiprogramming for handling multiple interactive jobs among multiple users.
- In this, Processor's time is shared among multiple users simultaneously is termed as time-sharing.
- The main difference between Multiprogrammed Batch Systems and Time-Sharing Systems is that in case of multiprogrammed batch systems, objective is to maximize processor use, whereas in Time-Sharing Systems objective is to minimize response time.
- Multiple jobs are executed by the CPU by switching between them, but the switches occur so frequently. Thus, the user can receive an immediate response. For example, in a transaction processing, processor execute each user program in a short burst or quantum of computation. That is if n users are present, each user can get time quantum. When the user submits the command, the response time is in few seconds at most. Operating system uses CPU scheduling and multiprogramming to provide each user with a small portion of a time. Computer systems that were designed primarily as batch systems have been modified to time-sharing systems.
- The concept of time sharing system is shown in figure.

In above figure the user 5 is active but user 1, user 2, user 3, and user 4 are in waiting state whereas user 6 is in ready status.



As soon as the time slice of user 5 is completed, the control moves on to the next ready user i.e. user 6. In this state user 2, user 3, user 4, and user 5 are in waiting state and user 1 is in ready state. The process continues in the same way and so on.

Advantages

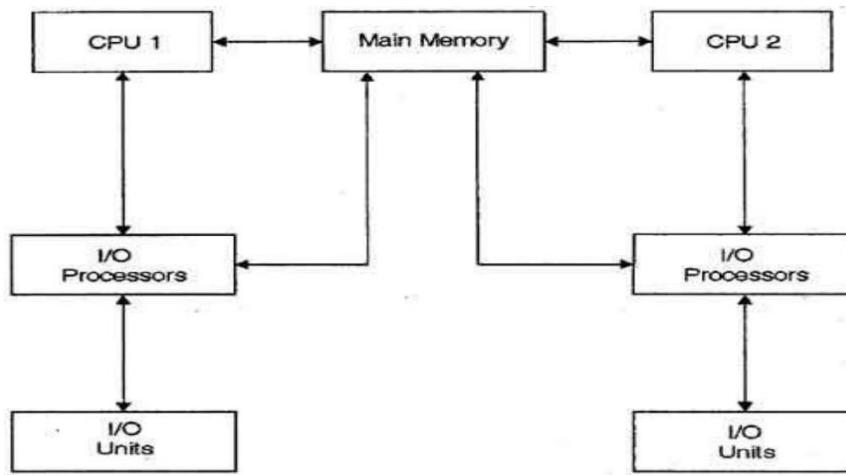
1. Provide advantage of quick response.
2. Avoids duplication of software.
3. Reduces CPU idle time.

Disadvantages

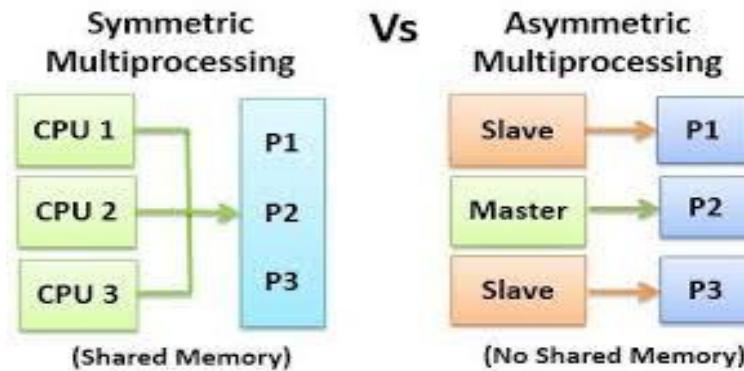
1. Problem of reliability.
2. Question of security and integrity of user programs and data.
3. Problem of data communication

Multiprocessor Operating System :

- Multiprocessor **Operating System** refers to the use of **two or more** central processing units (**CPU**) within a single computer system.
- These multiple CPUs are in a close communication sharing the computer bus, memory and other peripheral devices. These systems are referred as ***tightly coupled systems***.
- These types of systems are used when very high speed is required to process a large volume of data.
- These systems are generally used in environment like satellite control, weather forecasting etc. The basic organization of multiprocessing system is shown in fig.



There are two types of multiprocessor systems:



1. Asymmetric multiprocessing:

In this system, a specific task is assigned to each processor. The system has one master processor and others are slave processors. A master processor controls the system and slave processors follow the instructions of master to perform the task.

2. Symmetric multiprocessing:

In this system, no master slave concept used. All processors act as peer processors.

Advantages:

1. Less time duration required for the large process.
2. Increase throughput. i.e more work done in less time.
3. Economy of scale.
4. Increased reliability.

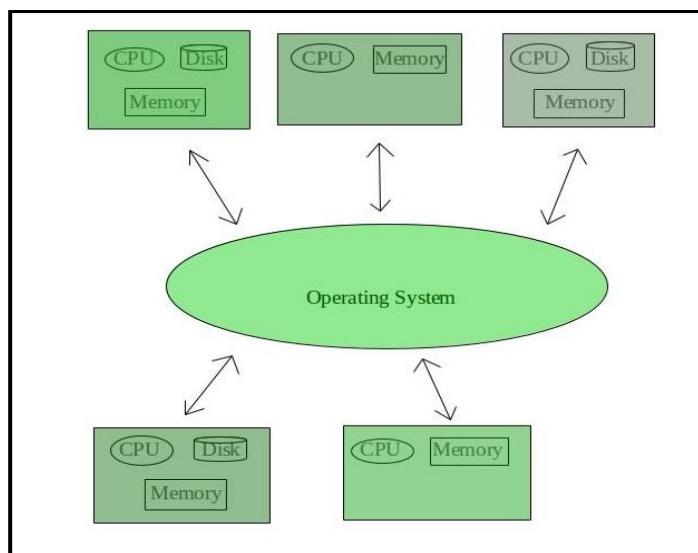
Disadvantages:

1. If one processor fails then it will affect in speed.

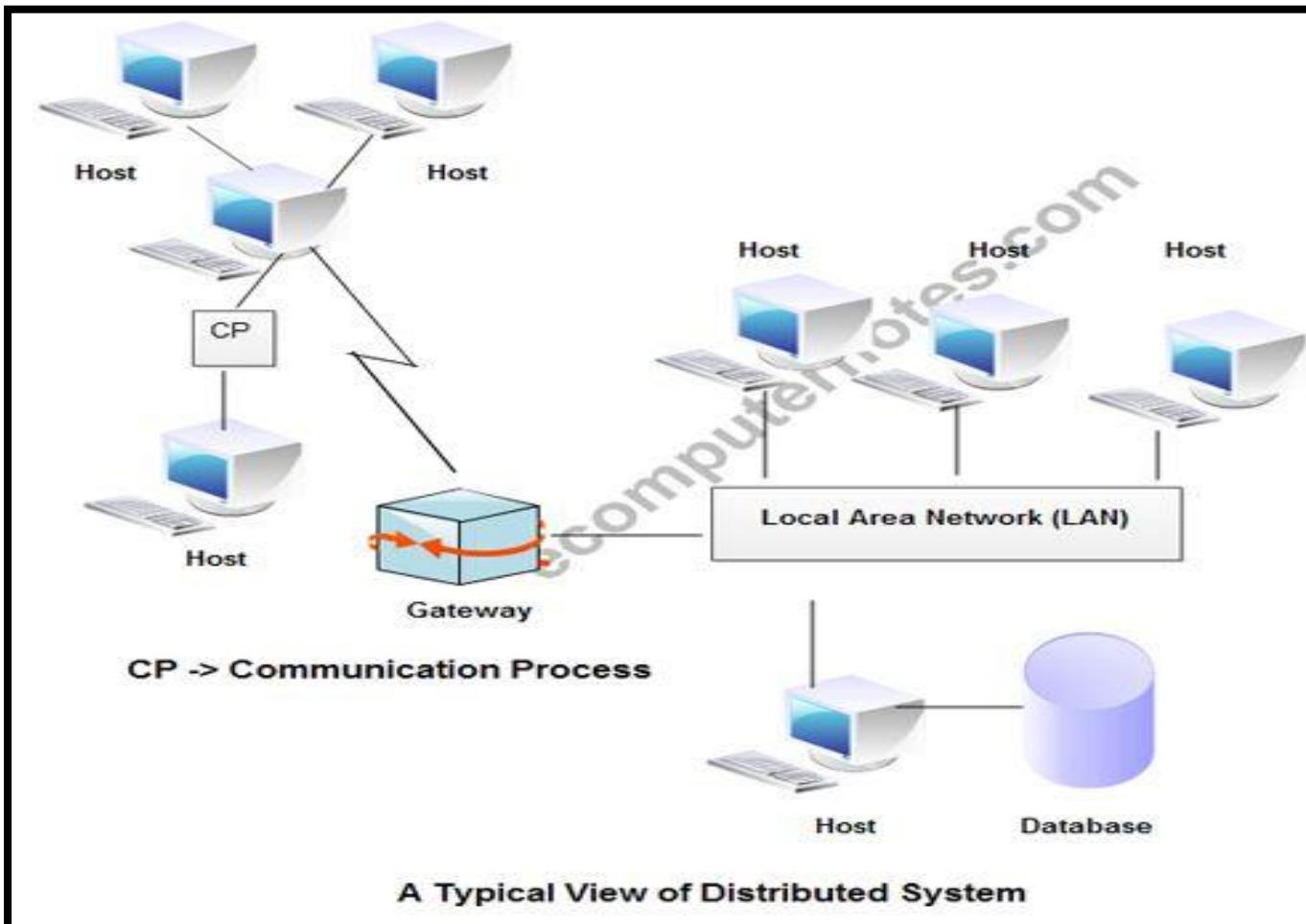
2. These systems are expensive.

Distributed Operating System:

- In distributed systems, many computers are grouped to work together for communication among them. They are connected to each other through LAN or MAN.
- In these systems, the resource distribution is hidden from the users and application program.
- These systems are referred as ***loosely coupled systems*** in which computers possess no hardware connections at the CPU - memory bus level, but are connected by external interfaces that run under the control of software. Each processor has its own local memory, buses and clock.
- Processors communicate with one another through various communication lines, such as high speed buses or telephone lines. If one machine fails, another machine completes the task of failed machine.
- A Distributed OS provides a virtual machine abstraction to its users and wide sharing of resources such as computational capacity, I/O and files etc.
- Distributed OS diagram [to draw in exam]



Distributed OS for Reference



Advantages:

1. Sharing of resources.
2. Higher Reliability.
3. Better price performance ratio.
4. Higher throughput and shorter response time.

Disadvantages:

1. It is very hard to build well.
2. There are no commercially successful examples.

Real-Time Systems

- Real time system is one which was originally used to control autonomous systems like satellites, robots, hydroelectric dams etc.
- Real time system is one that must react to I/p & responds to them quickly.

- A real time system should not be late in response to one event.
- A real time system should have well defined time constraints.

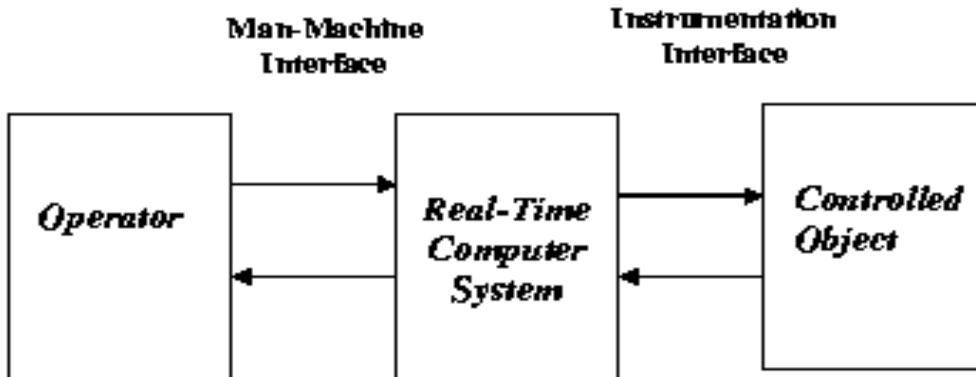


Figure 1: Real-Time System

- The primary objective of real time systems is usually speed of access, rather than efficient utilization of resources.
- Real time systems are of two types
 1. Hard Real Time Systems

A **hard real time system** guarantees that the critical tasks to be completed on time. This goal requires that all delays in the system be bounded from the retrieval of stored data to time that it takes the OS to finish the request.

Examples: Air traffic control systems are examples for hard real-time systems

2. Soft Real Time Systems

In **soft real time system** is a less restrictive one where a critical real time task gets priority over other tasks & retains the priority until it completes. They have limited utility than hard real time systems. Soft real time systems are used in area of multimedia, virtual reality & advanced scientific projects. It cannot be used in robotics or industrial controls due to lack of deadline support.

- Real time OS uses priority scheduling algorithm to meet the response requirement of a real time application.
- Soft real time requires two conditions to implement, CPU scheduling must be priority based & dispatch latency should be small.
- **Example:** -airline reservation Mobile phone, digital cameras and orchestra playing robots.

Advantages and disadvantage

Advantages of Batch OS:

1. It allows sharing of resources among many users.

2. It shifts the time of job processing to when the computing resources are less busy.
3. It avoids idling of computer resources with minute by minute human interaction and supervision.
4. For large systems the hardware required to implement a batch processing system can often be cheaper than that required to implement a transaction or real time system to do the same job.
5. Batch processing can be carried out automatically at a time when the computer system would not normally be used. E.g overnight

Disadvantage of Batch OS:

1. It is difficult to provide desired priority scheduling in batch processing.
2. ebugging the program is more difficult.
3. There is always a delay before work is processed and output is obtained.
4. A job could enter an infinite loop.

Advantages of multiprogramming system:

1. High CPU utilization.
2. It appears that many programs are allotted CPU almost simultaneously.
3. Main memory utilization.
4. The allocation of computer system and its resources to more than one concurrent application is possible.

Disadvantages of Multiprogramming System:

1. CPU scheduling is required.
2. It requires memory management, as multiple jobs are stored in memory.
3. Multiprogramming also relies on I/O hardware features.

Advantages of Time-sharing System:

1. High CPU efficiency.
2. Each user gets CPU time.
3. In this CPU is not idle.
4. It executes multiple programs by switching among them and run each program for fraction of seconds.

Disadvantages of Time-sharing System:

1. Complex OS is required.

2. Since all output devices are centralized on a single PC therefore there will be time delay from one person to another.

Advantages of Desktop system:

1. It has more expansion options.
2. Easy to upgrade.
3. Processes are faster.

Disadvantages of desktop System:

1. Larger footprint.
2. It needs keyboard, mouse and monitor, so heavy in weight.
3. It can be noisy.

Advantages of Multiprocessor Systems:

1. Less time duration required for the large process.
2. Increase throughput.
3. Economy of scale.
4. Increased reliability.

Disadvantages of Multiprocessor Systems:

1. If one processor fails then it will affect in the speed.
2. Multiprocessor systems are expensive.

Advantages of Distributed Operating System:

1. Resource sharing: Sharing of software resources such as databases and hardware resources such as hard disks, printers and CDROM can be done in a very effective way among all the computer and users.
2. Higher reliability: Availability is the important aspect of reliability. Availability of the resources can be increased by having multiple resources located at different sites.
3. Better price performance ratio: Reduced price of microprocessor and increased computing power gives good price –performance ratio.
4. Shorter response time and higher throughput.

Disadvantages of Distributed operating system:

1. It is very hard to build well.
2. There are no current commercially successful examples.

Advantages of real time processing:

1. The system is immediately updated.

2. There will be no processing lag caused by the system.

 1. The system must always be online.
 2. These systems are very expensive to produce and require lots of development time and backup hardware.

Mobile OS:

- A mobile operating system, also called a mobile OS, is an operating system that is specifically designed to run on mobile devices such as mobile phones, smartphones, PDAs, tablet computers and other handheld devices.
- Much like the Linux or Windows operating system controls your desktop or laptop computer, a mobile operating system is the software platform on top of which other programs can run on mobile devices.
- The operating system is responsible for determining the functions and features available on your device, such as thumb wheel, keyboards, WAP, synchronization with applications, email, text messaging and more.
- The mobile OS will also determine which third-party applications (mobile apps) can be used on your device.

Types of Mobile Operating Systems

When you purchase a mobile device the manufacturer will have chosen the operating system for that specific device.

9 Popular Mobile Operating Systems

1. Android OS (Google Inc.)

The Android mobile operating system is Google's open and free software stack that includes an operating system, middleware and also key applications for use on mobile devices, including smartphones.

Updates for the open source Android mobile operating system have been developed under "dessert-inspired" version names (Cupcake, Donut, Eclair, Gingerbread, Honeycomb, Ice Cream Sandwich) with each new version arriving in alphabetical order with new enhancements and improvements.

2.iPhone OS / iOS (Apple)

Apple's iPhone OS was originally developed for use on its iPhone devices. Now, the mobile operating system is referred to as iOS and is supported on a number of Apple devices including the iPhone, iPad, iPad 2 and iPod Touch. The iOS mobile operating system is available only on Apple's own manufactured devices as the company does not license the OS for third-party hardware. Apple iOS is derived from Apple's Mac OS X operating system.

3. Bada (Samsung Electronics)
4. BlackBerry OS (Research In Motion)
5. MeeGo OS (Nokia and Intel)
6. Palm OS (Garnet OS)
7. Symbian OS (Nokia)
8. webOS (Palm/HP)

9. Windows Mobile (Windows Phone)

Functions of an Operating System:

1. Resource management :

The resource management function of an operating system allocates computer resources such as CPU time, main memory, secondary storage and input and output devices for use.

2. Data management:

The data management functions of an operating system govern the input and output of the data and their location, storage, and retrieval.

3. Job management :

A job is a collection of one or more related programs and their data. The job management function of an operating system prepares , schedules, controls and monitors jobs submitted for execution to ensure the most efficient processing.

4. The allocation of memory: The allocation of memory is done by operating system for the programs to be executed.

5. Standard means of communication between user and computer:

The operating system establishes a standard means of communication between users and their computer systems by providing a user interface and a standard set of commands that controls the hardware.

6. Operating system enables startup application programs.

7. Operating system provides number of services such as, for programmers utilities like debugger, editors,

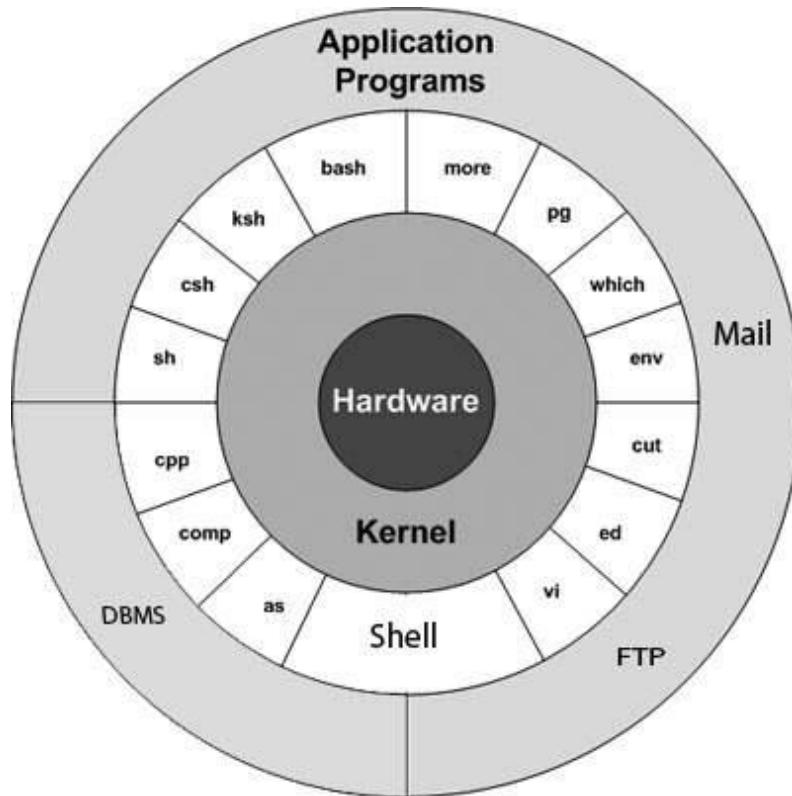
file management etc. for the end users it provides interface to the application program, for programs it loads instructions and data into memory, prepares I/O devices for usage, handles interrupts and error conditions.

Unix operating system:

The Unix operating system is a set of programs that act as a link between the computer and the user.

The computer programs that allocate the system resources and coordinate all the details of the computer's internals is called the **operating system** or the **kernel**.

Users communicate with the kernel through a program known as the **shell**. The shell is a command line interpreter; it translates commands entered by the user and converts them into a language that is understood by the kernel



The UNIX system is functionally organized at three levels:

- The kernel, which schedules tasks and manages storage;
- The shell, which connects and interprets users' commands, calls programs from memory, and executes them; and
- The tools and applications that offer additional functionality to the operating system

Features of UNIX

- Multitasking capability
- Multiuser capability
- Portability
- UNIX programs
- Library of application software

Difference Between DOS and windows DOS is a single tasking, single user and is CLI based OS whereas Windows is a multitasking, multiuser and GUI based OS.

Sr. No.	Key	DOS	Windows
1	Definition	DOS stands for Disk Operating System.	Windows stands for Windows, no specific form.
2	Tasking Nature	DOS is single tasking OS.	Windows is multi-tasking OS.
3	Power Consumption	DOS consumes quite low power.	Windows consumes high power.
4	Memory consumption	DOS memory requirements are quite low.	Windows memory requirements are quite high as compared to DOS.
5	Networking support	DOS has no support for networking.	Windows supports networking.
6	Usage	DOS is complex in usage. You need to remember commands to use DOS properly.	Windows usages is user-friendly and is quite simple to use.
7	User interface	DOS is command line based OS.	Windows is GUI based OS
8	Multimedia	Multimedia is not supported in DOS.	Windows supports multimedia likes games, videos, audios etc.
9	Speed	DOS command execution is faster than Windows.	Windows operations are slower as compared to DOS.
10	Multiwindow	DOS supports single window at a time.	Windows supports multiple window at a time.

Characteristics of windows XP:

- 1) Built on the new Windows engine** : Windows XP Professional is built on the proven code base of Windows NT and Windows 2000, which features a 32-bit computing architecture and a fully protected memory model.
- 2) Enhanced device driver verifier** : Building on the device driver verifier found in Windows 2000, the Windows XP Professional will provide even greater stress tests for device drivers.
- 3) Dramatically reduced reboot scenarios** :: Eliminates most scenarios that force end users to reboot in Windows NT 4.0 and Windows 95/98/Me. Also, many software installations will not require reboots.
- 4) Windows Installer** :: A system service that helps users install, configure, track, upgrade, and remove software programs correctly.
- 5) IP Security (IPSec)** :: Helps protect data transmitted across a network. IPSec is an important part of providing security for virtual private networks (VPNs), which allow organizations to transmit data securely over the Internet.
- 6) Windows Firewall** : Turned on by default, the built-in Windows Firewall helps increase computer security from startup to shutdown.
- 7) Windows Security Center** :: Easily manage security resources with this single, unified view of key settings, tools, and access to resources.

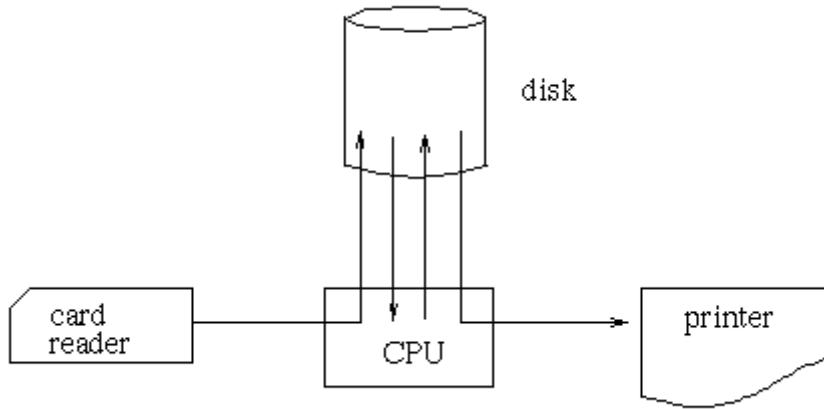
Characteristics of windows 7:

1) Windows 7 aggregates data from multiple sources

Spooling:

1. It is an acronym for **Simultaneous Peripheral Operations On Line**. Spooling refers to putting jobs in a buffer, a special area in memory or on a disk where a device can access them when it is ready.
2. Spooling is useful because devices work at different speeds. The buffer provides a waiting station where data can rest while the slower device catches up.

Below fig. shows the spooling.



3. Computer can perform I/O in parallel with computation. It becomes possible to have the computer read a data from cards, tape, drum or disk and write to a tape printer while it is computing. This process is called spooling.
4. Spooling overlaps the I/O of one job with the computation of other jobs.
5. The most common spooling application is print spooling. In print spooling, documents are loaded into a buffer and then the printer pulls them off the buffer at its own rate.
6. Spooling is also used for processing data at remote sites. The CPU sends the data via communications path to a remote printer.
7. In spooling while one job is printed, other may get inputted at the same time. Thus it increases CPU utilization

Advantage of Spooling

1. Spooling operation uses a disk as a very large buffer.
2. Spooling is capable of overlapping I/O operation of one job with processor operations. Thus CPU never sits idle.

Different types of operating systems :

Differentiate between multiprogramming and multitasking O.S.

Multiprogramming	Multitasking
In Multiprogramming system, the operating system simply switches to and execute another job, among the number of jobs.	In multitasking, the CPU switches from one task to another for reading and processing, but the switches occurs so frequently that the users may interact with each program while it is running.
It keeps several jobs in memory at a time. This set of jobs is kept in job pool.	The more programs are stored into main memory as the main memory gets partitioned.
Programs are executed one by one.	Time sharing is used while multiple programs are executed.

Same program execution takes place in foreground and background by doing resource management.	Multiple applications can be used in foreground and background.
Example of multiprogramming, we open word, excel, access and other applications together but while we type in word other applications such as excel and access are just present in main memory but they are not performing any task or work. Or we can say that are not being used at the same time.	Example of multitasking, we listen to music and do internet browsing at the same time (they execute parallel).

Multiprocessor Systems	Clustered Systems	Distributed Systems	Real Time Systems
Multiprocessor – use of two or more CPU's with a single computer system.	Cluster – is collection of computer in which any member of the cluster is capable of supporting the processing function of any other member.	Processor do not share the memory of the clock.	It is used in an environment where a large number of events, mostly external to the computer system must be accepted & processed in a short time or within some deadline.
Multiprocessing referred as the execution of multiple concurrent s/w processes in a system as opposed to a single process at any one instant. The term multiprogramming is more appropriate term to describe this concept.	A cluster has $n+k$ configuration where n processing nodes are actively processing the application & k processing nodes are in a standby state, serving as spares. In the event of a failure of an active node, the application that was running on the failed node is moved to one of the standby nodes.	Each processor has its own memory.	A RTS may be defined as one which controls an environment by receiving data, processing them & taking action or returning results very quickly to affect the functioning of the environment at that time. This is called a Response time. It is measured in seconds or in milliseconds.

Advantages – 1. It increases throughput: by increasing the no. of processors, more work done in a short period of time.	Other common cluster config. Include Simplex(one active node, no spare), n+1 active node(n active nodes, 1 spare)	Gives the impression that there is a single OS controlling the n/w.	Application- In military, industry & medicine. Ex. Nuclear power plant control Industrial Manufacturing control Medical Monitoring.
2. Can save memory compared to multiple single systems because the processors can share peripherals cabinet & power supplies.	This system is subsystem of a telecommunication switching system, running certain centralized application function. A LAN interconnect hub provides connectivity with each other elements of the switching system.	a) The processor communicates with each other through high speed buses or telephone lines. The two processors in this system may be different ie. May be multiprocessors, workstations, minicomputers.	Weapon Delivering Systems. Space Navigation & Guidance. Advantage : Useful in real time practical industrial applications.
3. It increases reliability : If functions can be distributed properly among several processors, then failure of one processor will not halt the system, but will only slow it down. 4. Minimum h/w reqd.		Speed of computation. Reliability : If any machine or node gets failed, the other machine can work continuously. Communication among the different systems is possible. Adv. – Resource sharing.	

MSBTE Questions

Q. 1 : Describe evolution of operating system. (*Generation of computer 1 ½ Marks each 6 Marks*) (*Note : Mainframe computers like batch, sequential, multiprogramming, time sharing should be given marks*)

Q. 2: Describe evolution of Operating System. (List of evolution of OS 1 mark Description 3 marks)

Q. 3 : Explain Batch processing operating system. (*Explanation – 3 marks, diagram -1 mark*)

Q. 4: Describe first generation of operating system with its advantages and disadvantages. (Explanation: 2 marks, any two Advantages: 1/2 mark each, any two Disadvantages: ½ mark each)

Q. 5: What is multitasking? Explain with suitable example. (*Explanation- 2 Marks, Any relevant example- 2 Marks*)

Q. 6: Differentiate between multiprogramming and multitasking O.S.(4 Marks)

Q. 7: Describe multiprogramming operating system. (Explanation 4 Marks)

Q. 8 : Describe the multiprocessor systems concepts. (*Explanation-4 Marks*)

Q. 9: Explain multiprocessor system and its two types.(4 M)

Q. 10: Describe cluster Operating system.(4 Marks)/ Define clustered systems? List four characteristics of clustered systems

Q. 11: Explain multiprogrammed O.S with suitable diagram. (4 M)

Q. 12: Describe time sharing system with suitable example. (*Explanation- 3 M, Example - 1 M*)

Q. 13: What is real time operating system? (*Explanation- 4 Marks*)

Q. 14: With neat diagram, explain real time system. List its any four application.

Q. 15: List different types of operating systems. Explain advantages of multiprocessor system (any two) (*List any four types – ½ Mark each, any two relevant Advantages - 1 Mark each*)

Q. 16: List and draw a neat labelled diagram of four components of a computer system.

Q. 17: List Advantages and Disadvantages of Batch Monitoring functions. (Four points)