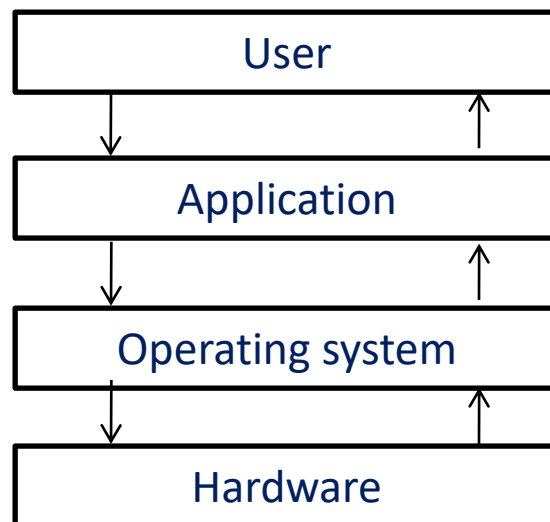


KCA 101 : FUNDAMENTAL OF COMPUTERS & EMERGING
TECHNOLOGIES
for
Master of Computer Application (MCA)

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Operating System(OS)

- An Operating System (OS) is a system software that acts as an interface between computer hardware components and the user. The primary goal of an operating system is to provide an environment in which user can access computer resource in convenient and efficient manner.
- Every computer system must have at least one operating system to run other programs.
- The Operating system is also called resource manager.
- Example of OS are MS-DOS, Windows, Linux, Unix etc.



Historical Detail

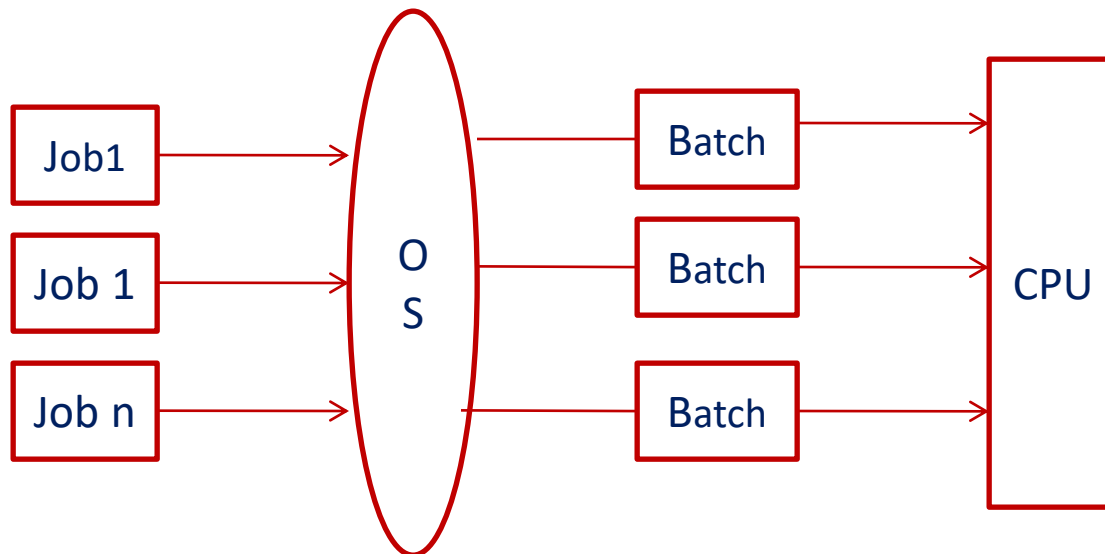
- Operating systems were first developed in the late 1950s to manage tape storage
- The General Motors Research Lab implemented the first OS in the early 1950s for their IBM 701
- In the mid-1960s, operating systems started to use disks
- In the late 1960s, the first version of the Unix OS was developed
- The first OS built by Microsoft was DOS. It was built in 1981 by purchasing the 86-DOS software from a Seattle company
- The present-day popular OS Windows first came to existence in 1985 when a GUI was created and paired with MS-DOS.
- Following are the Operating System examples with the latest Mark

Types of Operating Systems

- Batch Operating Systems.
- Time-Sharing Systems.
- Distributed Systems.
- Network Operating Systems.
- Real-Time Systems.
- Multiprogramming Systems.
- Multitasking Systems.
- Multiprocessing Systems.

Batch Operating System

- This type of operating system user does not interact with the computer directly.
- There is an operator which takes similar jobs having the same requirement and group them into batches.
- It is the responsibility of the operator to sort jobs with similar needs.
- The batch-system can be shown as below

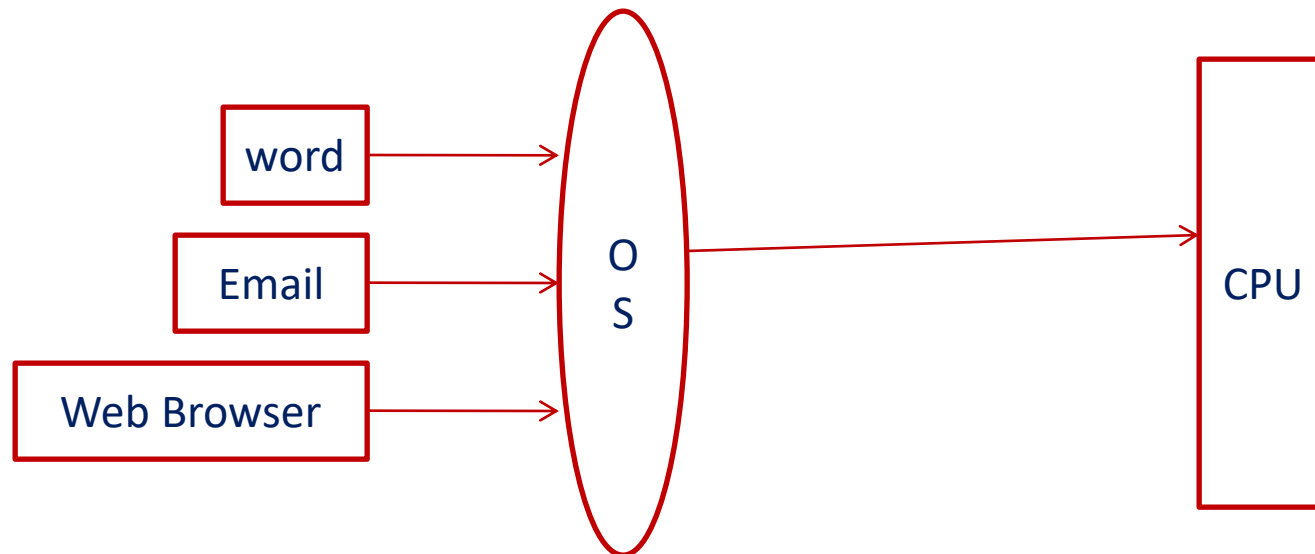


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- Advantages
 - It is very difficult to guess or know the time required for any job to complete.
 - Multiple users can share the batch systems
 - The idle time for the batch system is very less
 - It is easy to manage large work repeatedly in batch systems
- Disadvantages
 - The computer operators should be well known with batch systems
 - Batch systems are hard to debug
 - It is sometimes costly
 - The other jobs will have to wait for an unknown time if any job fails
- Examples of Batch based Operating System: Payroll System, Bank Statements, et

Time-Sharing OS

- 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 systems are also known as Multitasking Systems. The time-sharing is done using multiprogramming and multitasking.
- The task can be from a single user or different users also. The time that each task gets to execute is called quantum time. After this time interval is over OS switches over to the next task.



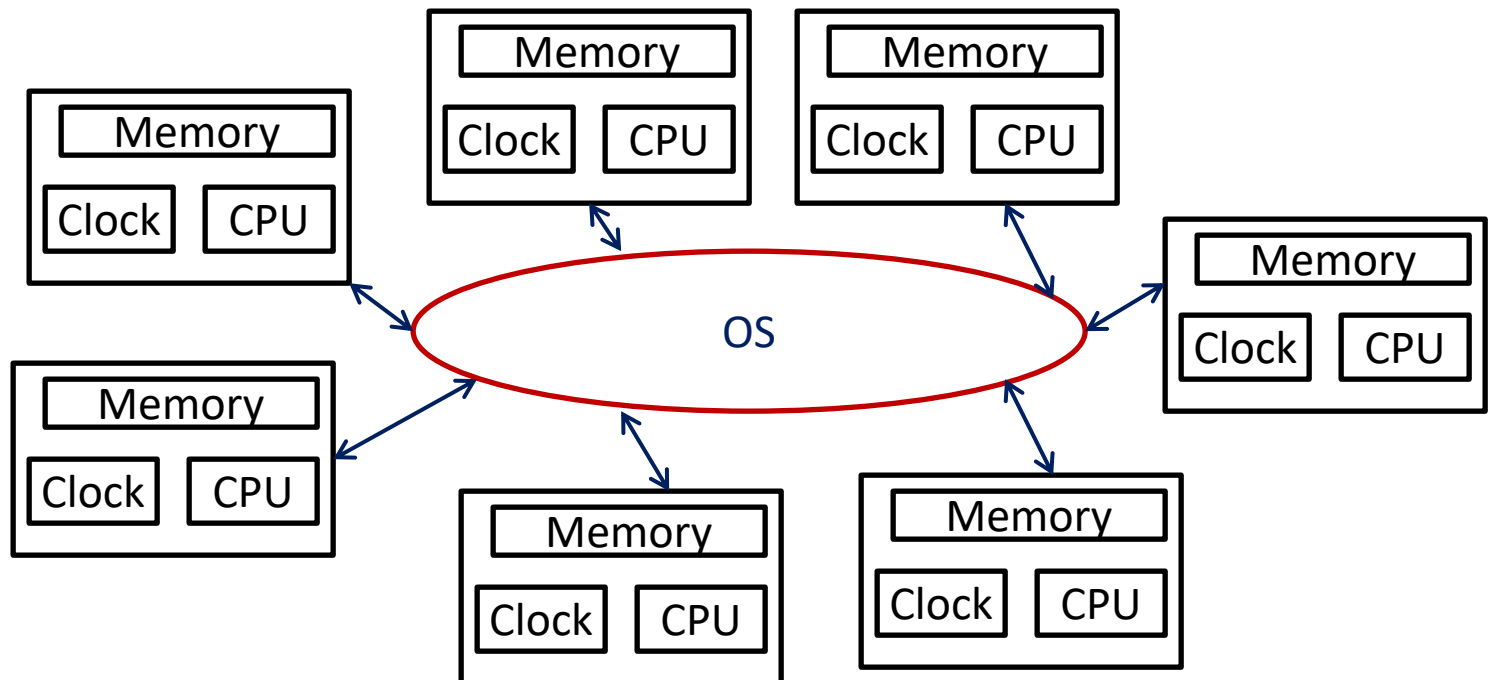
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- Advantages
 - Each task gets an equal opportunity
 - Fewer chances of duplication of software
 - CPU idle time can be reduced
- Disadvantages
 - Reliability problem.
 - One must have to take care of the security and integrity of user programs and data.
 - Data communication problem.

Ex. Multics, Unix

Distributed Operating System

- This type of OS various autonomous interconnected computers communicate with each other using a shared communication network.
- Independent systems possess their own memory unit, clock and CPU.
- These are referred to as loosely coupled systems or distributed systems.
- User can access files and software that are not actually present on own system but at some other computer.



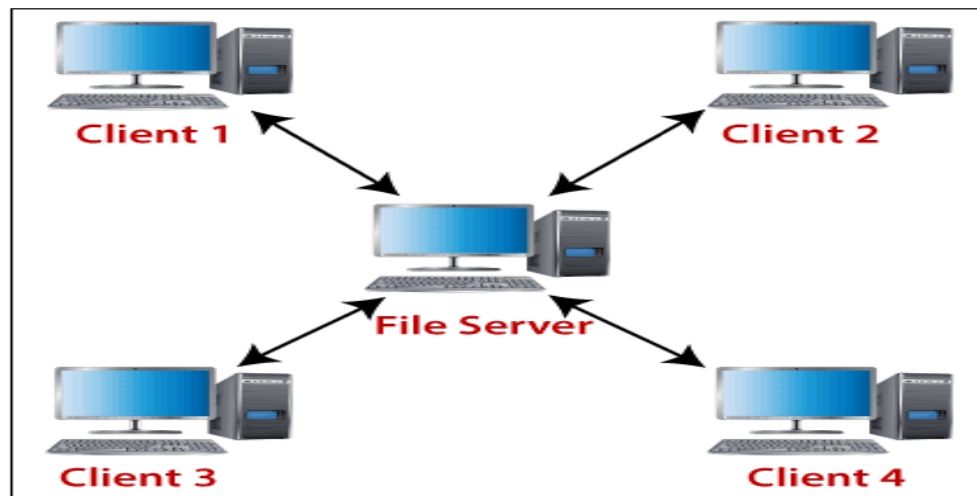
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- Advantages
 - Failure of one will not affect the other network communication, as all systems are independent from each other
 - Electronic mail increases the data exchange speed.
 - Since resources are being shared, computation is highly fast and durable
 - Load on host computer reduces
 - These systems are easily scalable as many systems can be easily added to the network
- Disadvantages of Distributed Operating System:
 - Failure of the main network will stop the entire communication
 - To establish distributed systems the language which is used are not well defined yet
 - These types of systems are not readily available as they are very expensive.

Examples of Distributed Operating System are- LOCUS

Network Operating Systems

- These systems run on a server and provide the capability to manage data, users, groups, security, applications, and other networking functions.
- These types of operating systems allow shared access of files, printers, security, applications, and other networking functions over a small private network.
- One more important aspect of Network Operating Systems is that all the users are well aware of the underlying configuration, of all other users within the network, their individual connections, etc. and that's why these computers are popularly known as tightly coupled system



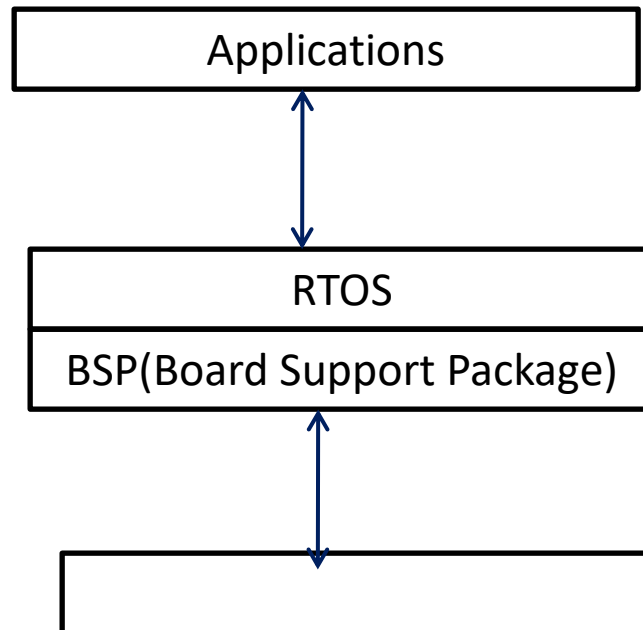
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- Advantages
 - Highly stable centralized servers
 - Security concerns are handled through servers
 - New technologies and hardware up-gradation are easily integrated into the system
 - Server access is possible remotely from different locations and types of systems
- Disadvantages
 - Servers are costly
 - User has to depend on a central location for most operations
 - Maintenance and updates are required regularly

Examples: Microsoft Windows Server 2003, Microsoft Windows Server 2008, etc.

Real-Time Operating Systems(RTOS)

- RTOS are used in real-time applications where processing is very crucial and should be completed within prespecified constraints.
- RTOS response is quick and fast.
- It is used when large number of events are performed in short interval.



Types Of RTOS

- **Hard RTOS**
 - Used for applications where time constraints are very strict and even the shortest possible delay is not acceptable. Used in Satellite launch, Medical systems etc
- **Soft RTOS**
 - These OSs are for applications where for time-constraint is less strict. Used in multimedia transmission.
- **Firm RTOS**
 - Used for application where time constrains are very restrict. After time-constraint result will be incorrect. Used in life shaving like Automatic Parachutes.

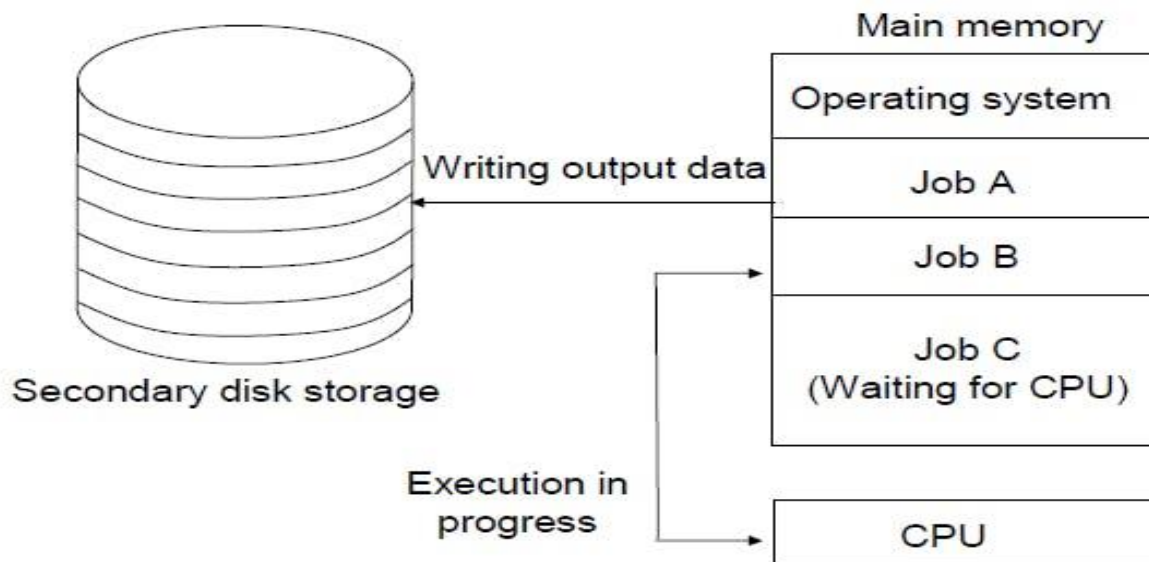
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- Advantages
 - Maximum utilization of devices and system, thus more output from all the resources.
 - The time assigned for shifting tasks in these systems are very less.
 - Focus on running applications and less importance to applications which are in the queue.
 - These types of systems are error-free.
 - Memory allocation is best managed in these types of systems.
- Disadvantages
 - Very few tasks run at the same time.
 - Sometimes the system resources are not so good and they are expensive as well.
 - The algorithms are very complex and difficult for the designer to write on.
 - It needs specific device drivers and interrupts signals to respond earliest to interrupts.
 - It is not good to set thread priority as these systems are very less prone to switching tasks.

Examples of Real-Time Operating Systems are: Scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, air traffic control systems, etc

Multiprogramming Systems

- Multiprogramming OS is an ability of an operating system that executes more than one program using a single processor machine.
- More than one task or program or jobs are present inside the main memory at one point of time.
- Buffering and spooling can overlap I/O and CPU tasks to improve the system performance but it has some limitations that a single user cannot always keep CPU or I/O busy all the time.
- To increase resource utilization, multiprogramming approaches are used.



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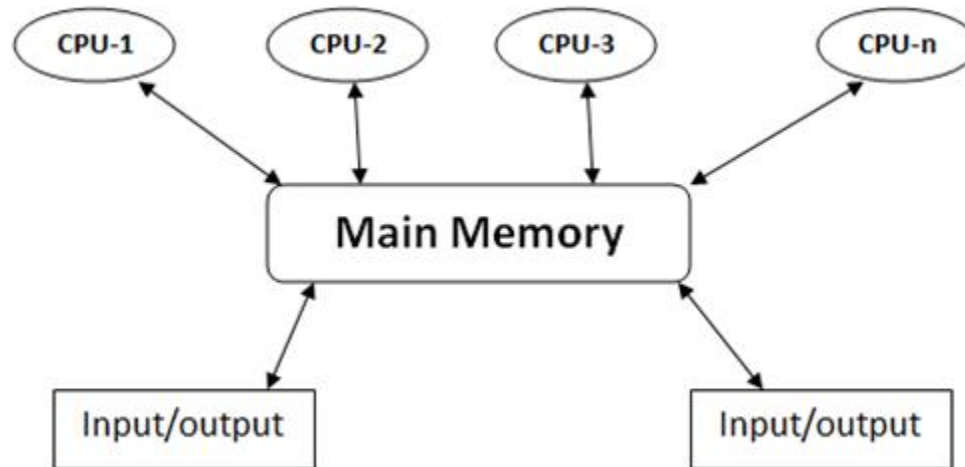
- **Advantages**
 - The advantages of multiprogramming operating system are as follows –
 - CPU utilization is high because the CPU is never goes to idle state.
 - Memory utilization is efficient.
 - CPU throughput is high and also supports multiple interactive user terminals.
- **Disadvantages**
 - The disadvantages of multiprogramming operating system are as follows –
 - CPU scheduling is compulsory because lots of jobs are ready to run on CPU simultaneously.
 - User is not able to interact with jobs when it is executing.
 - Programmers also cannot modify a program that is being executed.

Multitasking Systems

- If operating system performs more than one task at the same time.
- It is accomplished by CPU by shifting each program in and out of memory and one at a time.
- It is a logical extension of a multiprogramming system that enables the execution of **multiple** programs simultaneously.

Multiprocessing System

- Multiprocessing operating systems use more than one CPU. They share memory and peripheral devices which provide simultaneous processing of programs. It results in speedup of throughput and cost effectiveness, availability and reliability. They are also called parallel systems



Functions of Operating System

1. Security: The operating system uses password protection to protect user data and similar other techniques. it also prevents unauthorized access to programs and user data.
2. Control over system performance : Monitors overall system health to help improve performance. Records the response time between service requests and system response to having a complete view of the system health.
3. Job accounting – Operating system Keeps track of time and resources used by various tasks and users, this information can be used to track resource usage for a particular user or group of users.
4. Coordination between other software and users – Operating systems also coordinate and assign interpreters, compilers, assemblers, and other software to the various users of the computer systems.

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5. Memory Management –An Operating System performs the following activities for memory management:
- It keeps track of primary memory, i.e., which bytes of memory are used by which user program.
 - The memory addresses that have already been allocated and the memory addresses of the memory that has not yet been used.
 - In multiprogramming, the OS decides the order in which processes are granted access to memory, and for how long.
 - Allocates the memory to a process when the process requests it
 - Deallocates the memory when the process has terminated.

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6. Processor Management – In a multi-programming environment, the OS decides the order in which processes have access to the processor, and how much processing time each process has. This function of OS is called process scheduling. An Operating System performs the following activities for processor management.
 - Keeps track of the status of processes.
 - Allocates the CPU that is a processor to a process.
 - De- allocates processor when a process is no more required.

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7. Device Management—It performs the following activities for device management. Keeps track of all devices connected to the system.
 - Designates a program responsible for every device known as the Input/output controller.
 - Decides which process gets access to a certain device and for how long.
 - Allocates devices in an effective and efficient way.
 - Deallocates devices when they are no longer required.

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8. File Management – A file system is organized into directories for efficient or easy navigation and usage. These directories may contain other directories and other files. An Operating System carries out the following file management activities. It keeps track of where information is stored, user access settings and status of every file, and more. These facilities are collectively known as the file system

Interface

- One of the jobs of the operating system is to provide a 'user interface', so that a human can communicate with the hardware that makes up a computer. A user will give data and instructions to a computer and a computer will give information back to a user.
- The way that a computer and a user communicate is known as the [interface](#) .
- In computers there are different types of interface that can be used for connection with computers to users and their connection is responsible for data transfer.
 1. Command interface
 2. Graphical User Interface

1. Command line interface(CLI)

- It is also called command Line User Interface or Console User Interface or Character User Interface.
- The command-line interface is an interface whenever the user needs to have different commands regarding the input and output and then a task is performed so this is called the command-line argument and it is used to execute the output and create, delete, print, copy, paste, etc.
- The command line interface is necessary because all the basic operations in the computer are performed with the help of the OS and it is responsible for memory management.

1. Command line interface(CLI)

- Advantages –
 - ✓ Controls OS or application
 - ✓ Faster management
 - ✓ Ability to store scripts which helps in automating regular tasks.
 - ✓ Troubleshoot network connection issues.
- Disadvantages –
 - ✓ The steeper learning curve is associated with memorizing commands and a complex syntax.
 - ✓ Different commands are used in different shells

2. Graphical User Interface(GUI)

- The graphical user interface is used for playing games, watching videos, etc.
- These are done with the help of GUI because all these applications require graphics.
- GUI is required computers and this can be done only with the help of an operating system.
- The basic components of GUIs are –
 - Start menu with program groups
 - Taskbar which showing running programs
 - Desktop screen
 - Different icons and shortcuts.

Graphical user Interface

- Advantages
 - A GUI is much easier to use. Users can classify and navigate options since data are represented as symbols, forms, and icons
 - Users may work and view multiple programs at the same time
 - The use of shortcut keys is one of the most important features of a graphical user interface
 - it is much attractive. It is more stylish and elegant in its design in comparison to CLI.
- Disadvantages
 - It is slower than CLI.
 - GUI implementation is not an as easy process as it looks while using it.
 - Even though graphical user interfaces are simple to use, they are not the same when they are created.
 - The design of the graphical user interface makes development more complex and expensive.
 - It usually uses high power and computer memory than other interfaces due to all graphical representations.

CLI vs GUI

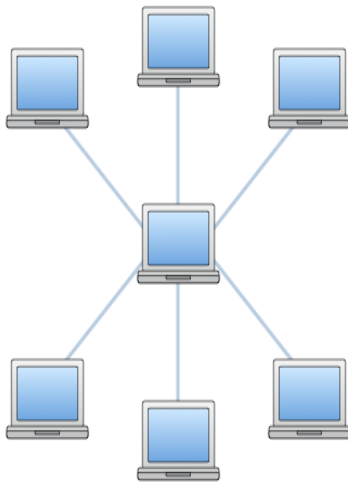
Feature	CLI	GUI
Memory Requirement.	Less memory requirement	More memory requirement due to graphics
Ease of use	It is not easy to use.	It is easy to use.
Speed	It is faster than the GUI.	Speed It is slower than the CLI.
Flexibility	It is less flexible than GUI.	It is more flexible than CLI.
Device	Used It needs the only keyboard.	It needs both a keyboard and a mouse.
Appearance	Appearance Its appearance may not be modified or changed.	Its appearance may be modified or changed.
Precision Data	High compared to GUI	Its precision is low'
Presentation	The information can be viewed to the user in plain text and files in the CLI. In a GUI,	information can be in several ways, including simple text, videos, graphics, etc.
Error	Errors Spelling mistakes and typing errors are not avoided.	mistakes and typing errors are avoided.
Graphics	No graphics are used in the CLI	Graphics are used in the GUI

Network Topologies

- Topology defines the structure of the network of how all the components are interconnected to each other. Topologies can be classified as
 1. Star Topology
 2. Ring Topology
 3. Mesh Topology
 4. Tree Topology
 5. Bus topology
 6. Hybrid Topology

Star Topologies

- In this type of topology all the computers are connected to a single hub through a cable.
- This hub is the central node and all others nodes are connected to the central node



Advantages

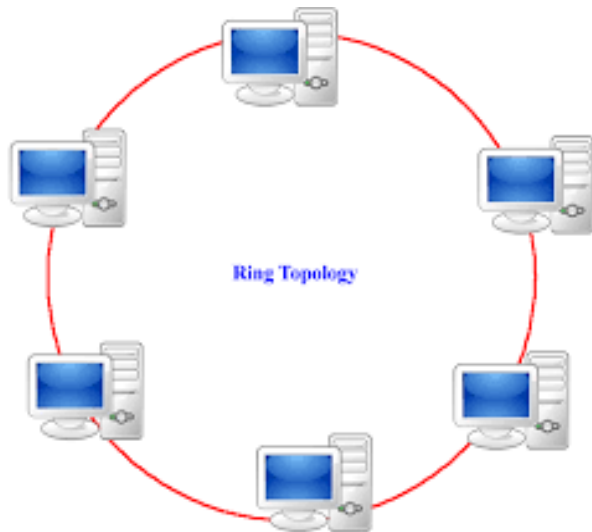
1. Fast performance with few nodes and low network traffic.
2. Hub can be upgraded easily.
3. Easy to troubleshoot.
4. Easy to setup and modify.
5. Only that node is affected which has failed, rest of the nodes can work smoothly.

Disadvantages

1. Cost of installation is high.
2. Communication will stop on central node failure.
3. Expensive to use

Ring Topologies

- It is called ring topology because it forms a ring as each computer is connected to another computer, with the last one connected to the first. Exactly two neighbors for device.



Advantages

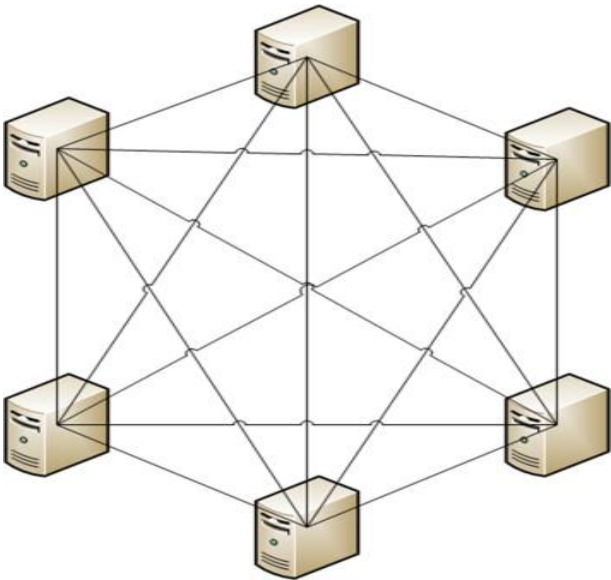
1. Transmitting network is not affected by high traffic or by adding more nodes, as only the nodes having tokens can transmit data.
2. Cheap to install and expand.

Disadvantages

1. Troubleshooting is difficult in ring topology.
2. Adding or deleting the computers disturbs the network activity.
3. Failure of one computer disturbs whole structure.

Mesh Topologies

- It is a point-to-point connection to other nodes or devices. All the network nodes are connected to each other. Mesh has $n(n-1)/2$ physical channels to link n devices. There are two techniques to transmit data over the Mesh topology, they are : 1. Routing 2. Flooding.



Advantages

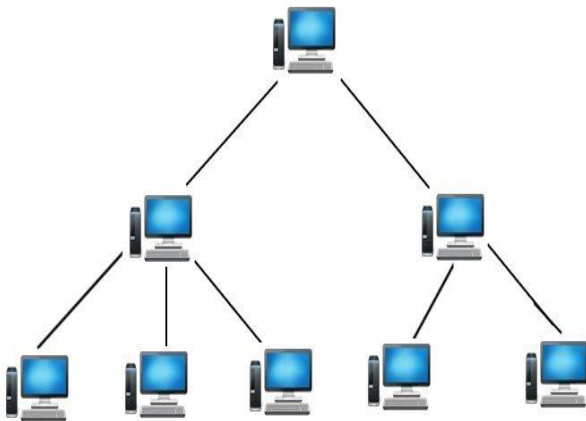
1. Each connection can carry its own data load.
2. It is robust.
3. Fault is diagnosed.
4. Provides security and privacy

Disadvantages

1. Installation and configuration is difficult.
2. Cabling cost is more.
3. Bulk wiring is required.

Tree Topologies

- It has a root node and all other nodes are connected to it forming a hierarchy. It is also called hierarchical topology. It should at least have three levels to the hierarchy.



Advantages

1. Extension of bus and star topologies.
2. Expansion of nodes is possible and easy.
3. Easily managed and maintained.
4. Error detection is easily done.

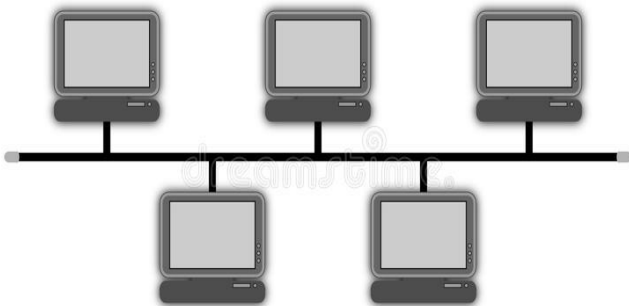
Disadvantages

1. Heavily cabled.
2. Costly.
3. If more nodes are added maintenance is difficult.
4. Central hub.

Bus Topologies

- Bus topology is a network type in which every computer and network device is connected to single cable. When it has exactly two endpoints, then it is called Linear Bus topology.

Bus Topology



Advantages

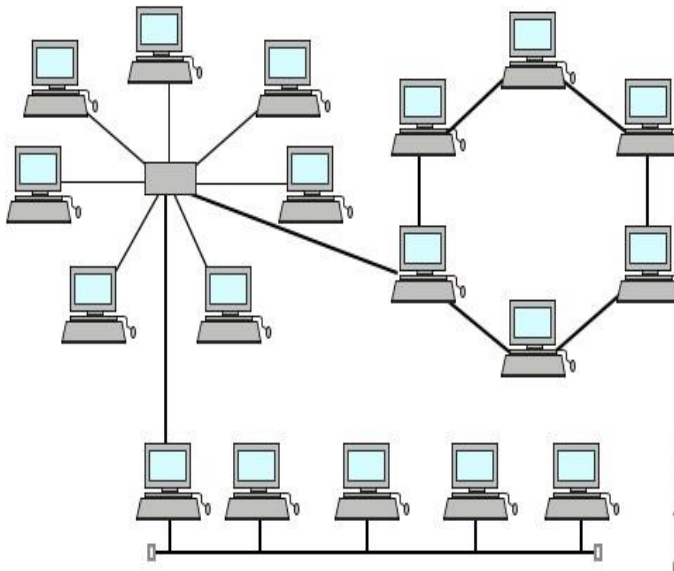
1. . It is cost effective.
2. Cable required is least compared to other network topology.
3. Used in small networks.
4. It is easy to understand.
5. Easy to expand joining two cables together.

Disadvantages

1. Cables fails then whole network fails.
2. If network traffic is heavy or nodes are more the performance of the network decreases.
3. Cable has a limited length.

Hybrid Topologies

- It is two different types of topologies which is a mixture of two or more topologies. For example if in an office in one department ring topology is used and in another star topology is used, connecting these topologies will result in Hybrid Topology (ring topology and star topology).



Advantages

1. Reliable as Error detecting and trouble shooting is easy.
2. Effective.
3. Scalable as size can be increased easily.
4. Flexible

Disadvantages

1. Complex in design.
2. Costly