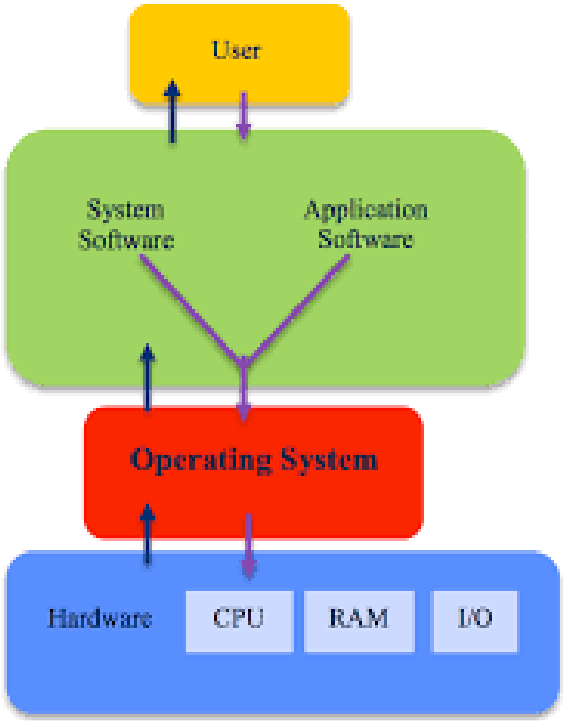
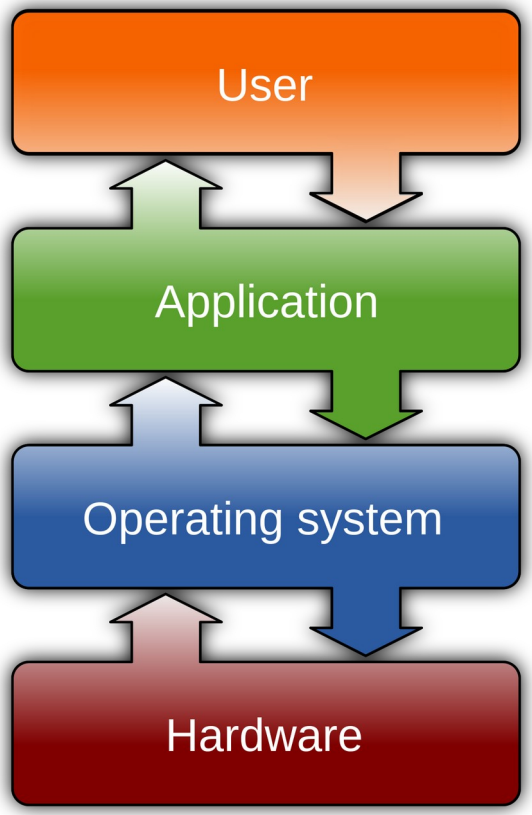
Fundament of Opreating System
Unit 1

What is OS

- It acts as a layer between the user and the hardware and provide friendly environment for the user.
- This software that operates the computer system is known as “Operating System” (Os).

Operating System





What is OS

- OS Supports low-level software of a computer's basic functions, such as scheduling tasks and controllingperipherals”.
- OS work in the back ground without letting us know who is doing the job like Managing Devices, Cotrolling tasks,
- Communication with different devices and computers, storing data etc.
- OS has also been changed from time to time in the past due to advance in technolgoies and computer architecture.

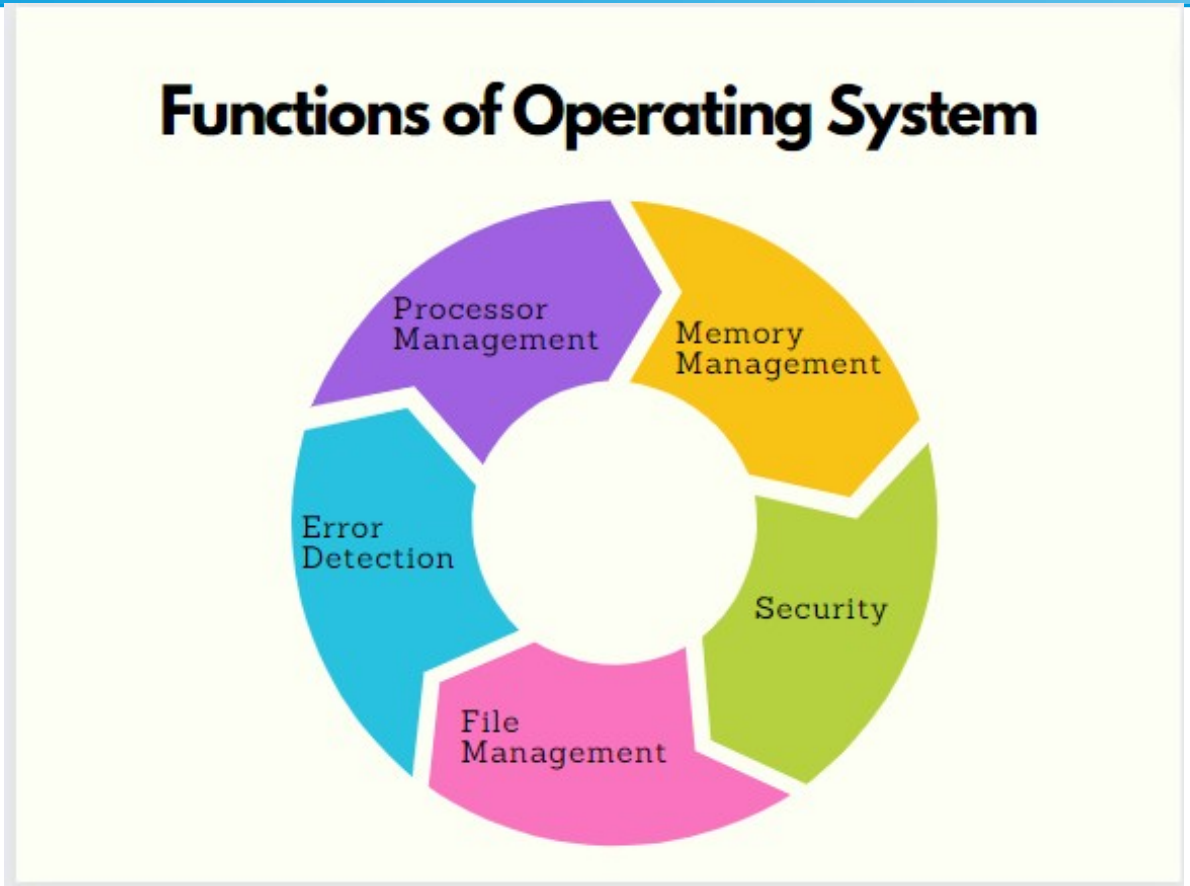
- OS Performs the following Functions
  - Present user friendly environment for the Users.
  - Manages all the resources in an efficient manner.

Defination of OS

"A software that acts as an interface between the users and hardwar of the computer system."

- "A software that provides a working environment for the users's applications."
- "A resource manager that manages the resources needed for all the applications in the background."
- "A software in which all common fuctions required to work on the computer system have been put together."

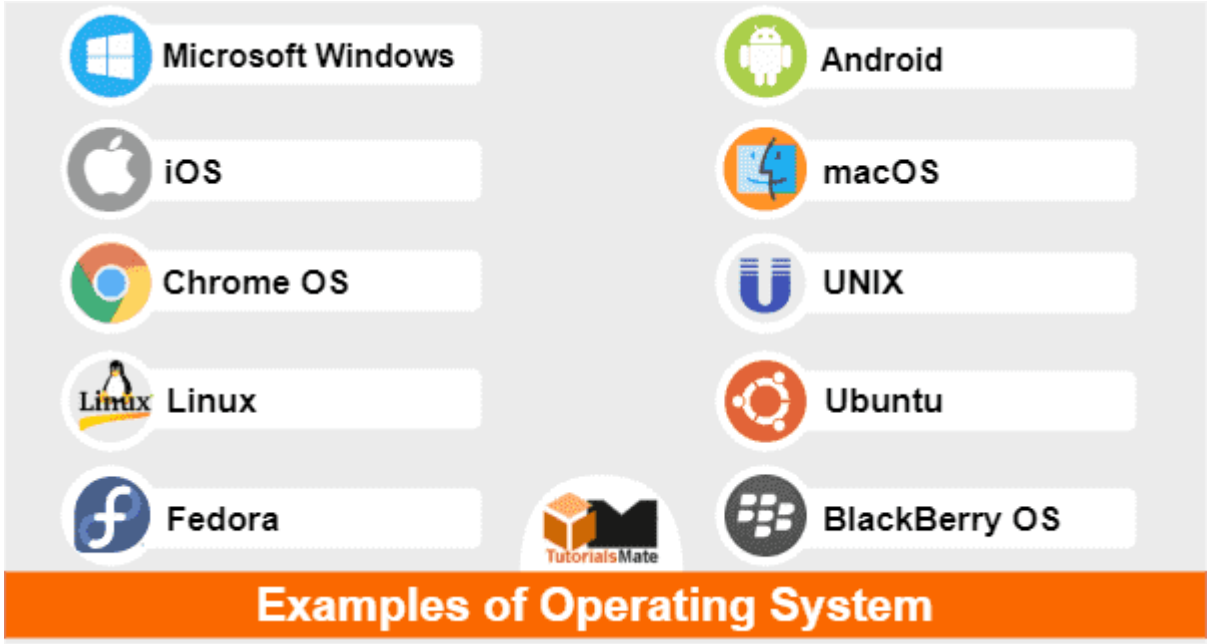
Need of OS


Functions of Operating System
Processor Management
Memory Management
Security
File Management
Error Detection

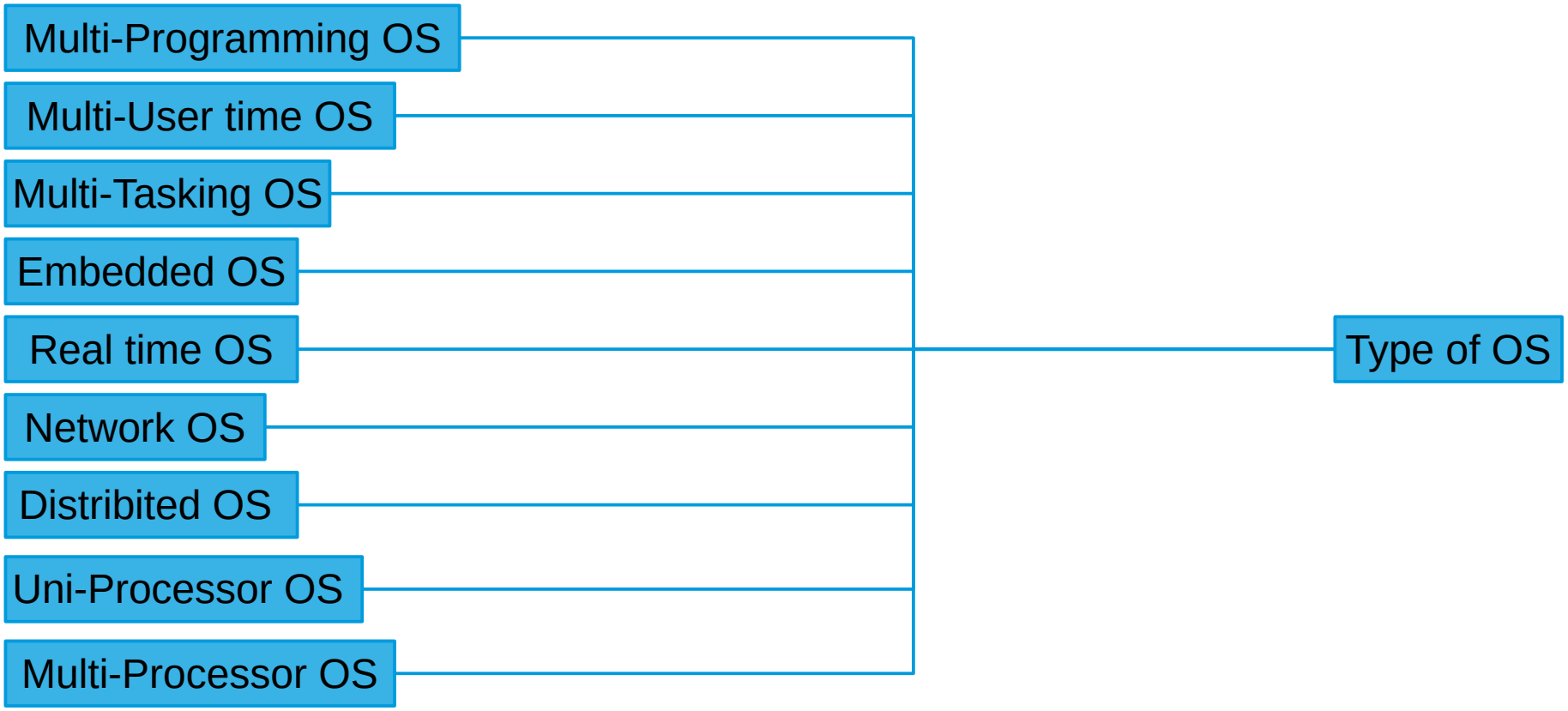
Evolution of different OS

Generation	Period	Computer Architecture
First	1940s - 1950s	Vacuum Tubes based Technology (No Os), Punch Card
Second	1950s – 1960s	Transistors based technology (Delay Problem), Line Printer, COBO, FORTRAN
Third	1960s – 1980s	IC -based technology, Mini Computer (UNIX) Hard Disk, Multi Programming
Fourth	1980s - Present	LSI and VLSI based technology (DOS. WINDOW)

Example of OS



Type of OS

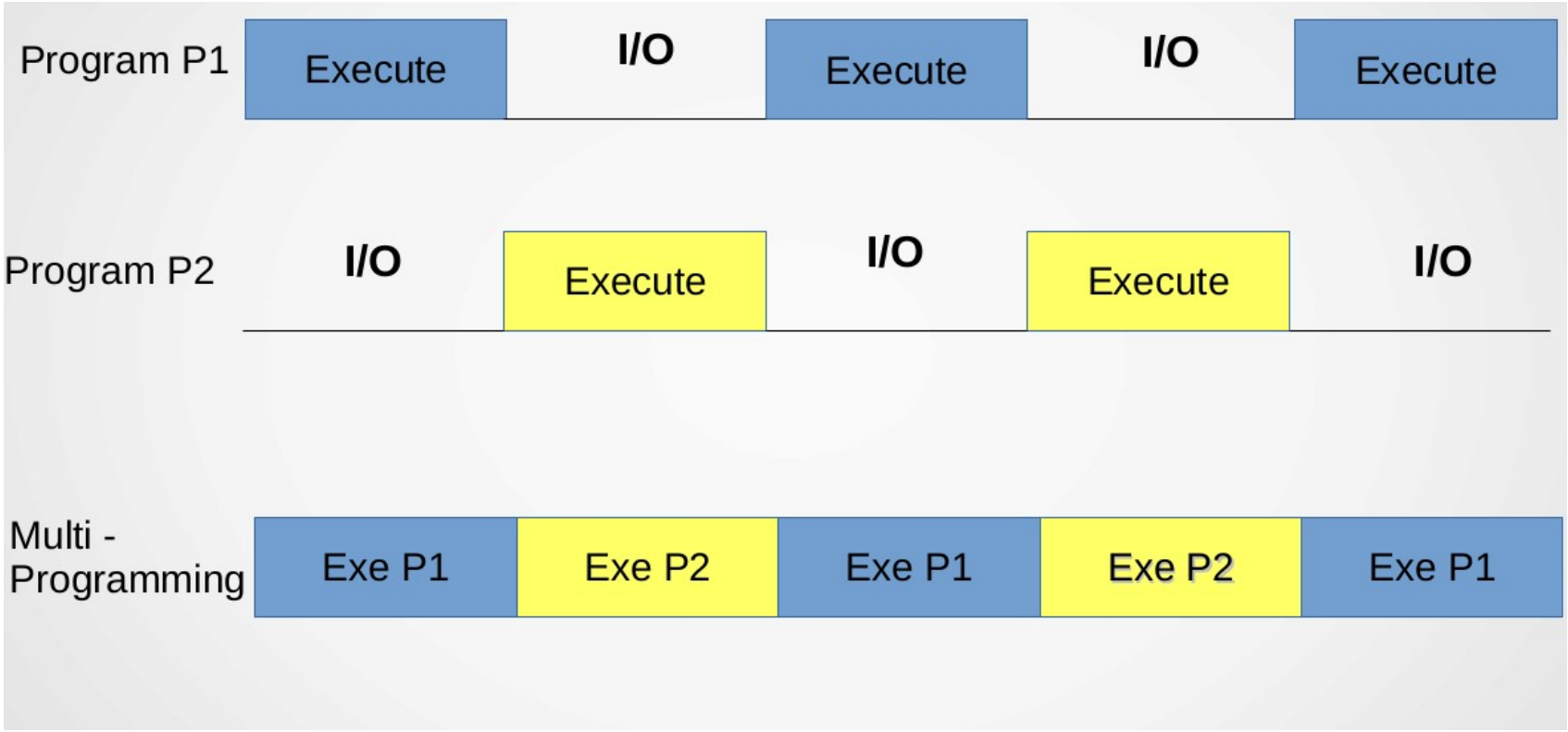

Multi-Programming OS
Multi-User time OS
Multi-Tasking OS
Embedded OS
Real time OS
Network OS
Distribited OS
Uni-Processor OS
Multi-Processor OS
Type of OS

Multi-Programming OS

- When a program is being performed, it is known as a "Task", "Process", and "Job".
- Multi Programming means placing several programs or jobs in the main memory at a time.
- It means that now several jobs are ready to be executed,But CPU can execute only one job at time.
- How Multipal job can execute ?
  - It can be achived with idea of switching between the jobs.

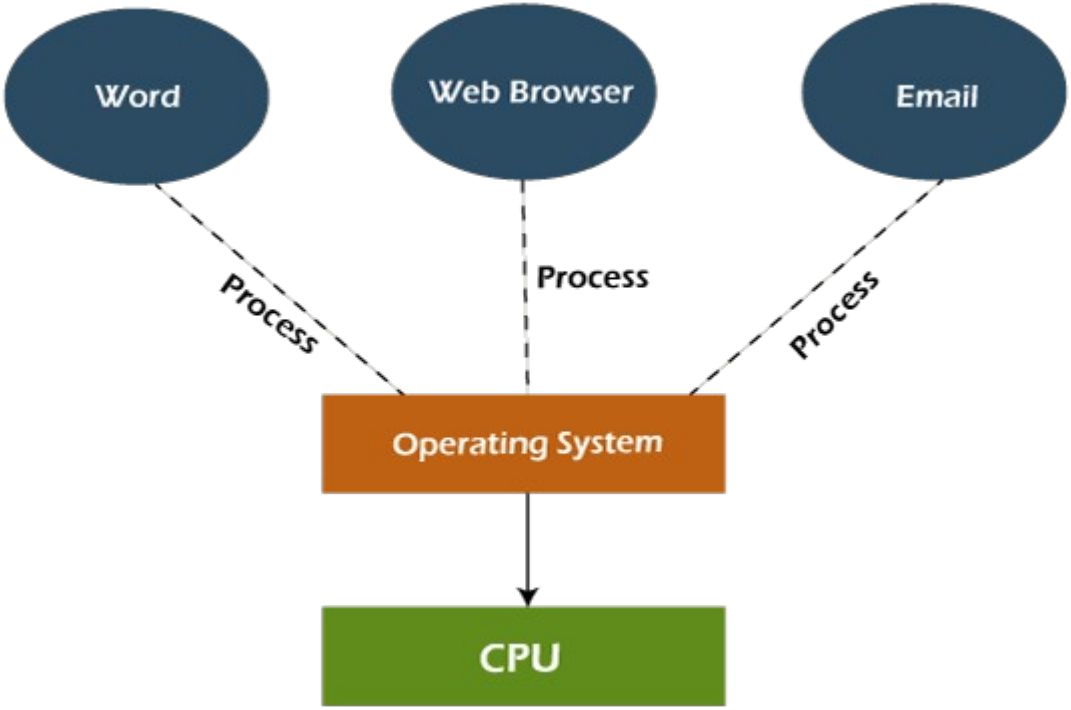
- There can be two type of Instruction in a programm
  - CPU bound
  - I/O boud
- CPU bound instruction means when CPU has an instruction for processing or computation.
- I/o bound instruction means there is a request to an input or output device to read or write.
-

- At the time of I/O instruction, CPU remain Ideal.
- Since due to multi-programming concept there are many jobs ready in the main memory, the CPU can switch to second job while the first is waiting for an I/O.
- If the second job also reaches an I/O bound instruction, then CPU switches to another job and so on.


Program P1
Execute
I/O
Execute
I/O
Execute
Program P2
I/O
Execute
I/O
Execute
I/O
Multi - Programming
Exe P1
Exe P2
Exe P1
Exe P2
Exe P1

- The major benefits of multi programming system are
  - Less execution time
  - Increased utilization of memory
  - Increased throughput
- (Throughput = number of jobs complted per unit time)
- Throughput is increased if degree of multi programming is increase.

Multi Tasking



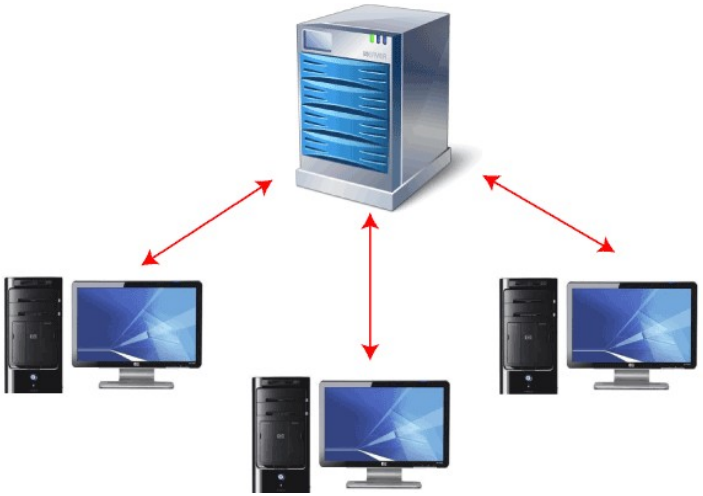
Multitasking

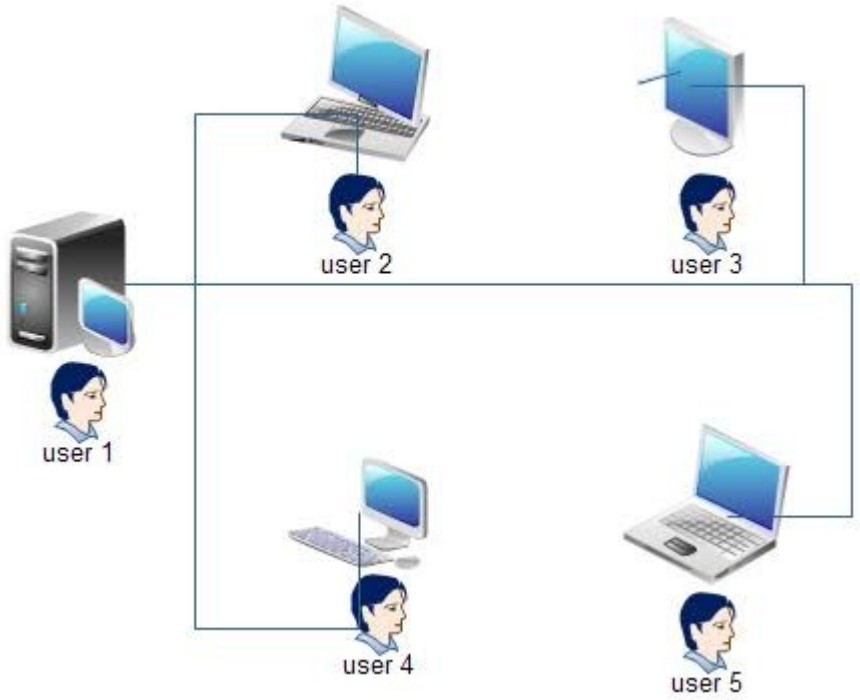
- Window was developed for personal computers such that a single users working on a PC can open multiple windows.
- In this way user is able to open many windows or tasks and work on them. This is known as multi – tasking.
- With the availability of high speed of processor, the user has the illusion of working in parallel on multiple tasks.
- But it is the time – sharing scheduling techique which has made it possible.

Multi-User

- An operating system that allows and grants permission to multiple users to access underlying hardware resources simultaneously is a Multi-user operating system.
- Multi-user operating systems get used in large organizations, e-commerce sectors, government institutions, educational institutions, and large-scale universities.

Multi-User





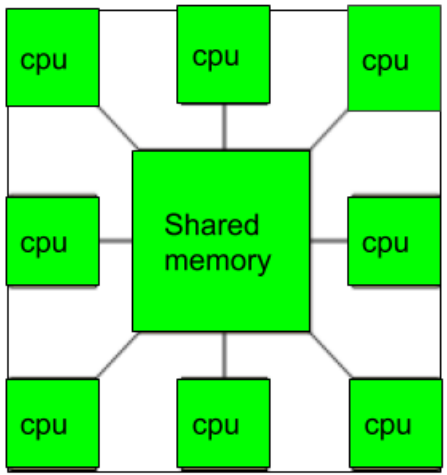
Multi-Processor

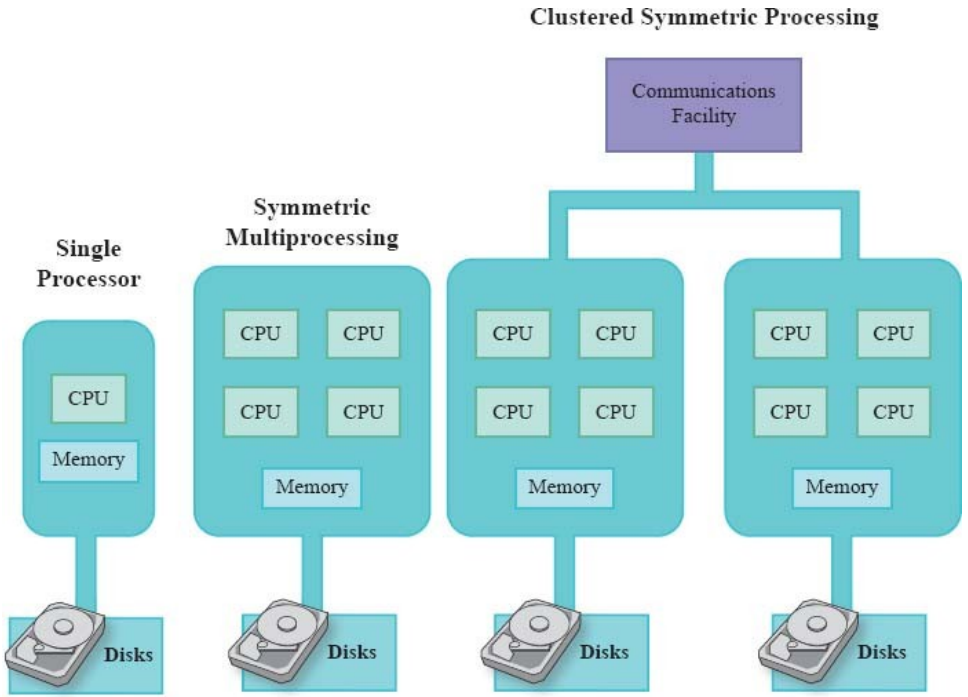
- Multiprocessing helps in performing parallel computing.
- There are several processors in a system, and each of them can run multiple processes simultaneously.
- The system’s throughput will be significantly increased as a result of this. Parallel computing is performed by multiprocessing.
- The presence of more than one processor in the system allows it to run multiple processes at the same time, increasing the system’s throughput.

Multi-Processor

- With the advance in the technology, their was a desire for parallel processing with the help of more than one processor instead of only one.
- Multi processing systems contain more than one processor and share other resourcces.
- The process scheduling is another challenge as it is needed to schedule multiple processes on multiple processors.
- The coordination of various processes should also be taken care of different inter-process communication and synchronization techniques are required.

Multi-Processor





Uni-Processor

A uniprocessor system is defined as a computer system that has a single central processing unit that is used to execute computer tasks.

Each of these systems contains a single CPU and a single I/O channel.

They are most often used as single-user standalone machines; for example, for database development or as client machines in a network.

Some uniprocessor machines are also used as small servers for databases.

Uniprocessor has only one processor but still, it is possible to achieve parallelism by using certain techniques such as multitasking.

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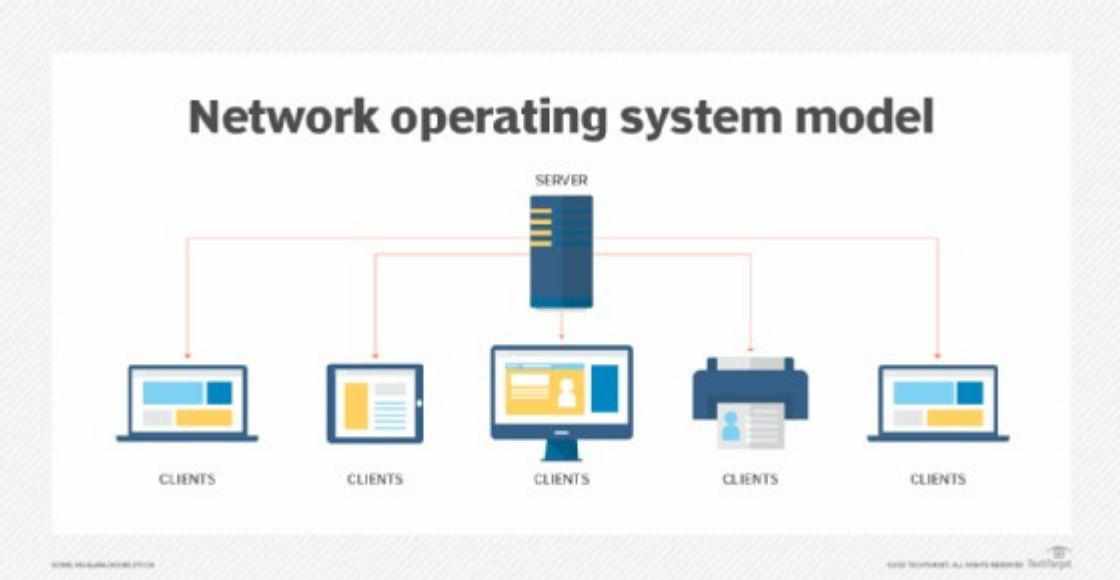
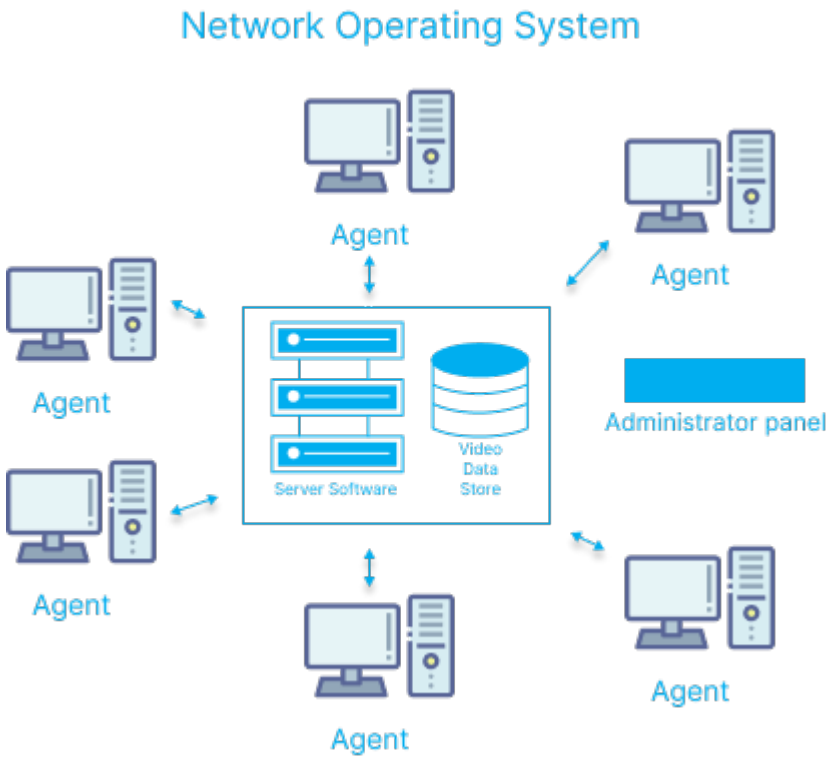
Network Opreating System





Network Opreating System

A network operating system(NOS) is software that connects multiple devices and computers on the network and allows them to share resources on the network.

Network Opreating System

Functions of the NOS :

- Creating and managing user accounts on the network.
- Controlling access to resources on the network.
- Provide communication services between the devices on the network.
- Monitor and troubleshoot the network.
- Configuring and Managing the resources on the network.

Network Opreating System

Continuing Features of the NOS :

- Printers and application sharing on the network.
- File systems and database sharing.
- Provide good security by using functionality like user authentication and access control.
- Create backups of data.
- Inter-networking.

Network Opreating System

Advantages of Network operating systems :

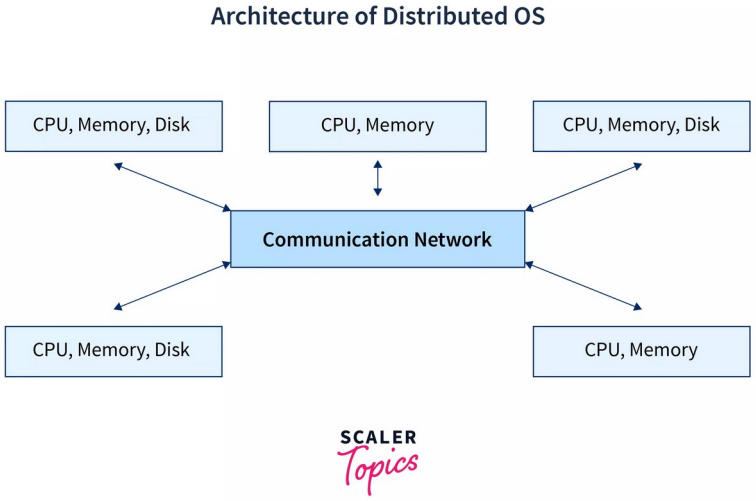
- Highly stable due to central server.
- Provide good security.
- Upgradation of new technology and hardware can be easily implemented in the network.
- Provide remote access to servers from different locations.

Network Opreating System

Disadvantages of Network operating systems :

- Depend on the central location to perform the operations.
- High cost to buying server.
- Regular updating and maintenance are required.

Distributed Opreating System



Distributed Opreating System

- Distributed system works in Wide Area Network (WAN)
- Each node in a distributed system is a complete computer having full set of peripherals including OS.
- The users of a distributed system have an impression that they are working on a single machine.
- Resource sharing is the main motive behind distributed systems.
- This OS providing distributed computing facility employ almost same communication method and protocols as in network OS.

Distributed Opreating System

- The following are some important tasks to be met by Distributed OS.
  - Since distributed system need to access any resource or transfer any task on any node. There are three types of migration provided by the OS.
    - –Data Migration
    - –Computation Migration
    - –Process migration

Distributed Opreating System

- Distributed OS must provide the means for inter-process communication
  - Remote Procedure Call

    A process on one node may invoke a function or procedure in a process executing on another node.
  - Remote Method Invocation

    Allow a Java process to invoke a method of an object on a remote machine.

Distributed Opreating System

- CORBA (Common Object Request Broker Architecture)
  - It is a standardized language that supports different programming languages and different Os for distributed communication.
- DCOM (Distributed Component Object Model)
- Another standard developed by Microsoft included in Window operating system.

Real Time Operating System

- A **RTOS response to a user request has to be immediate or within a fixed time frame** otherwise the application will fail. This is known as real-time OS.
- This type of processing is largely **useful in defence application which are mission specific.**
- It there is no timely response, there might be loss of equipment and even life.
- Many defence applicaions like guded missile system, air traffic control sytems etc.

Real Time Operating System

- Real time systems are two types:
  - **Hard Real-Time**
  - **Soft Real – Time**
- The system that **have hard deadlines** and must be met are called Hard Real-Time system.
  - All Defence applications are of the this type.
- There is another type known as soft real-time system **where missing of some deadline is acceptable.**
  - In a video conferenceing system

Real Time Operating System

- **Characteristic of RTOS**
  - The RTOS **schedules all tasks** according to the deadline information and ensure that all deadline are met.
  - It must **have Fault tolerance**. In case of failure of any software/hardware system should need to work continue.

Embedded Operating System

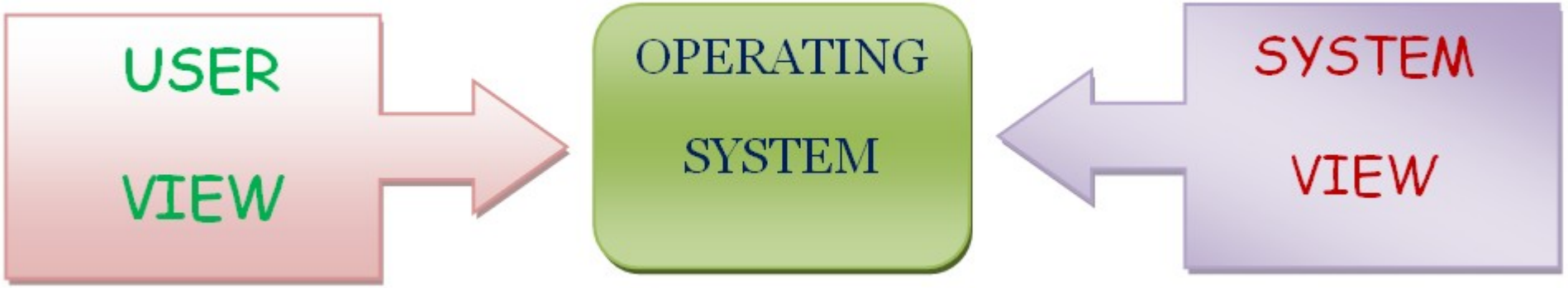
- **Embedded system are specialized systems that tend to have very specific tasks.**
- **Embedded system also have operating systems but they are not generalized ones.**

Embedded Operating System

- **Challenges for the designers of the OS for Mobile Devices are -**
  - **All the mobile devices have a very small memery. So the memory must be managed efficiently.**
  - **All the devices have a slow power CPU as faster CPU will require more power and there by a larger bettery.**
  - **Devices like mobile phones and smartphones have a small screen area. So the conents should be mapped to the available size of the display screen.**

Embedded Operating System

Function of Operating System



Function of Operating System

The **user view** is a top-down view of functions performed by an operating system.
The **System view** is bottom – up view of functions performed by an operating sytem.

Function of Operating System

- The user view is to execute the user's task on the computer system.
- But a user does not want to be over whelemed with the complex hardware details of the system. He simply wants an interface between his application and the hardware.
- He is not concerned how the application will get resources from the system and get executed.
- All these jobs will be done by the Operating System.
- In other words, operating system acts as a mediator between the application and the computer system that makes easy use of hardware and other resources without even knowning.

Function of Operating System

- User view
  - User interface
  - Program development & Execution
  - Accessing I/O operations
  - Accessing File System
  - Error Detection

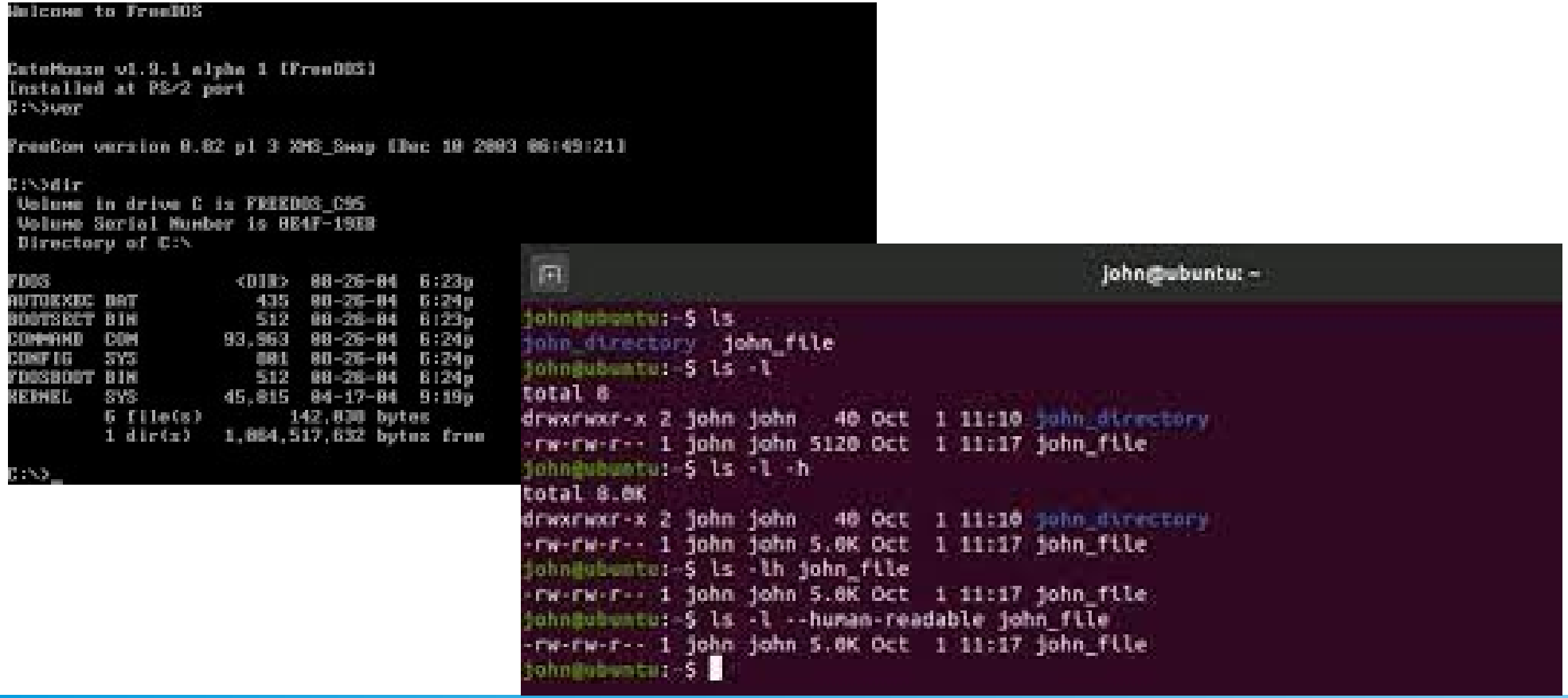
Function of Operating System

- User Interface

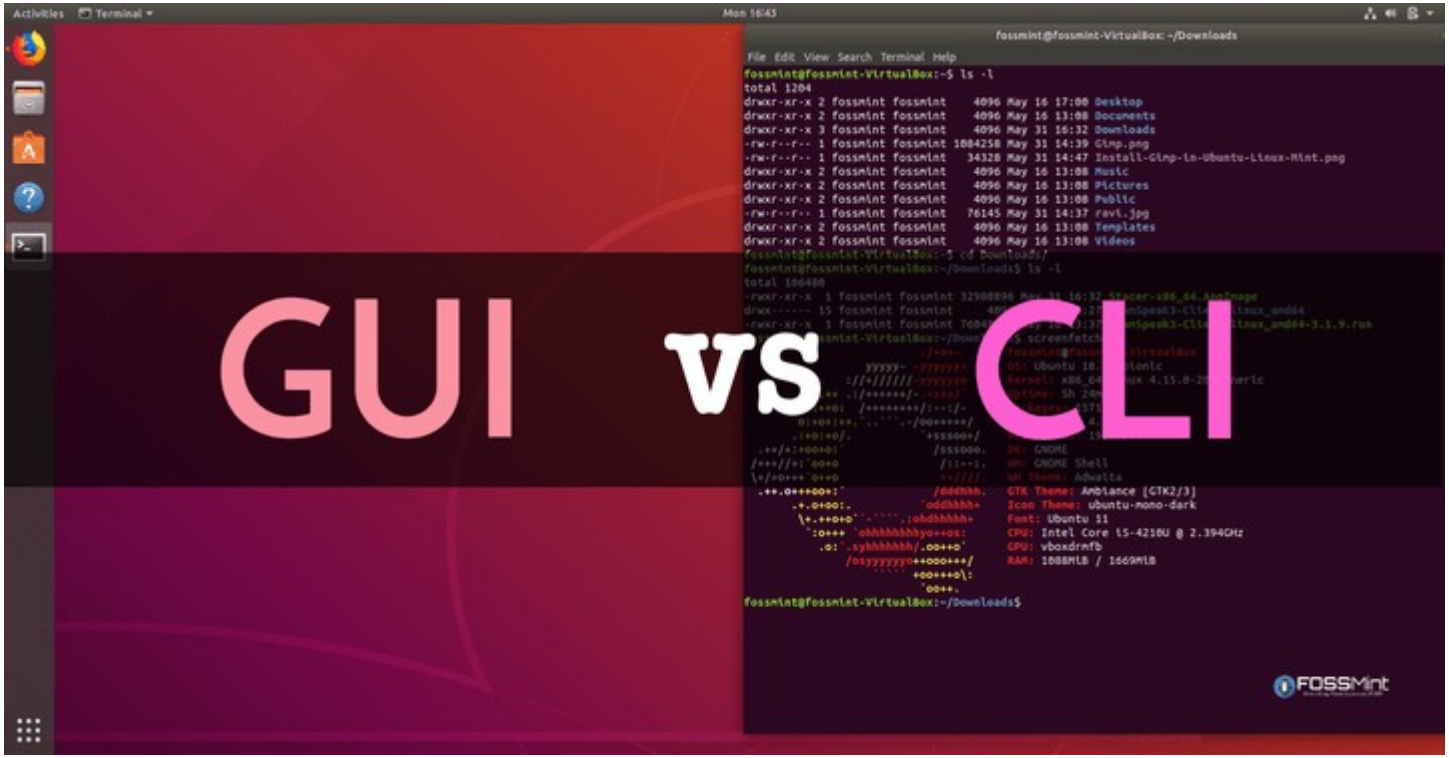
  The operating system provides the interface to use the computer system. There are two types of interface:

- Command – driven Interface
- Graphical user Interface

Command Driven interface



Graphical User Interface


GUI
vs
CLI

Program Development and Execution

- For executing a program, there are certain tasks like loading the program in main memory, initializing and accessing I/O devices and files, scheduling various resources etc.
- All these program executions are performed by the operating system without the knowledge of the user.

Accessing I/O Operations

- If you have written some programs in high level language, then you write some standard input output instructions according to the language being used.
- You donot care for the type of input/output devices and use only standard instructions for any type of devices. The operating system relieves the user from details of input/output devices and accesses them on behalf of the user.

Accessing Files

- A file is a logical concept to store the user's data or program. A User creates the file using some editor and saves and retrieves the files conveniently through the Os interface.

Error Detection

- Whie working on a computer system, one may encounter different types of errors. Either it is a hardware error or error in some user program.
- All these errors must be identified by the operating system and an appropriate action must be taken and the usere should be notified through a message on the screen.

Function of Operating System

- System View
  - Resource Manager
  - Control Program
  - Virtual Machine Manager

System View

- Beyond the user's convenience, most of the functioalities are performed in background by the operating system.
- These activities are to manages or utilize the hardware and other resources of the computer system.
  - Resource Manager

  The operating system is a program that controls the allocations of all the resources in the system.

  Operating System schedules and manages the allocation of all resources in the computer system.

  It is best called as a resource allocator and resource manager

Resource Manger

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System View

- **Control Program**

  The OS acts as a control program in the sense that it protects one user's program from another.

  It is necessary in multi-programming because a user may try to enter other user's memory and even in operating system's region.

  It does not allow the users to access any I/O devices directly as the user may misuse them.

System View

Virtual Machine Manage

A very different view to see the operating system is as a virtual machine manager.

Operating system provides a layer on the actual hardware on which it performs the tasks of the user.

It seem that all the work done is by the hardware.

In other word, there is an illusion created by the operating system that there is a virtual machine that is performing all the work.