

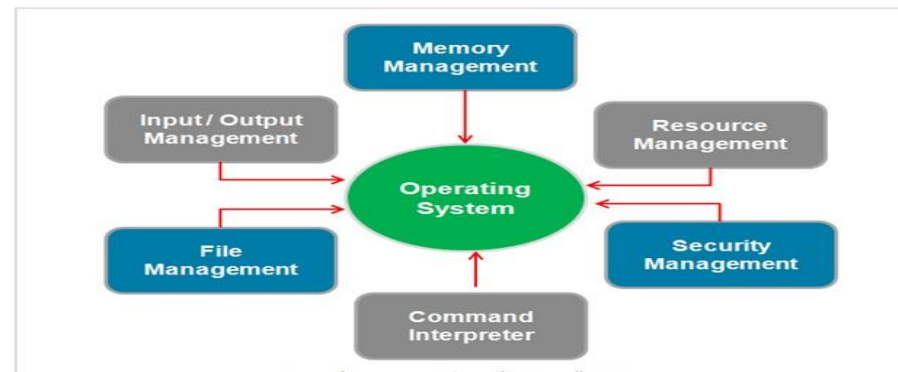
# CHAPTER # 1

OPERATING SYSTEM

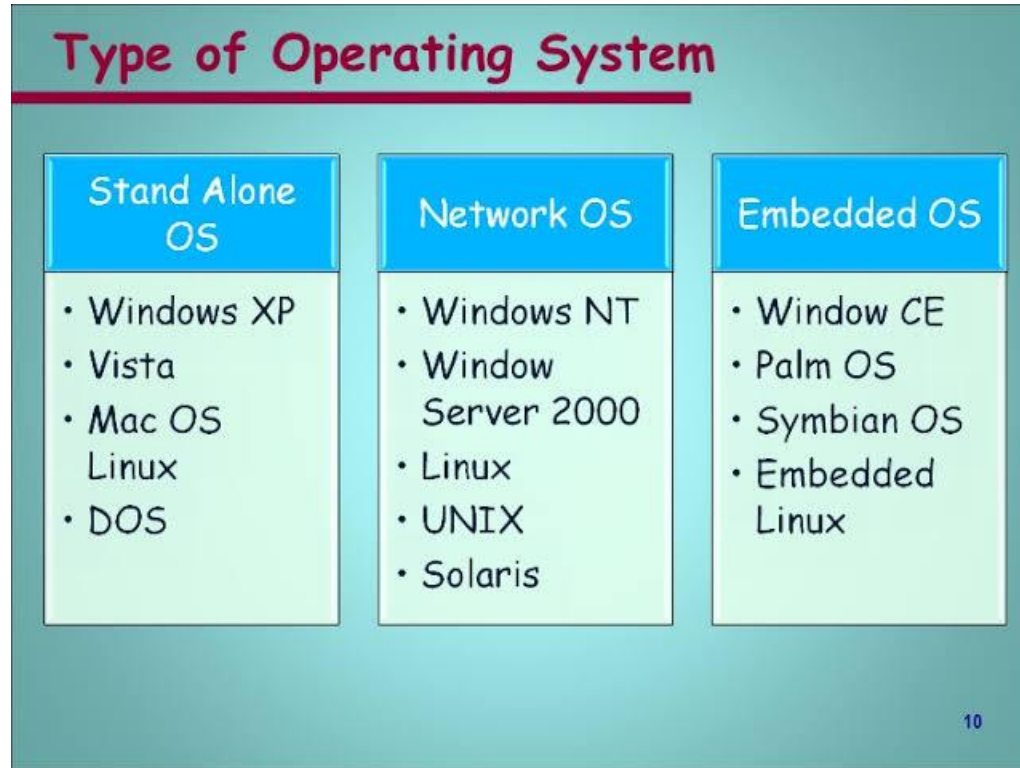
# Operating System

- It is a program that controls and coordinates all the functions of the computer system.
- It acts as an interface between user and hardware.
- It performs the following tasks:
  - Load software into main memory and executes it.
  - Control the operation of main memory.
  - Manage files and folders on storage device.
  - Manage the operations of I/O devices.
  - Allows multitasking to handle several tasks at the same time.
  - Provides security through password and username.
  - Performs network operations.
  - Detect hardware failure.

Operating System - Functions



# Commonly Used or Types of Operating Systems



# DOS operating system

- Stands for Disk Operating System.
- Developed in 1970 when Microcomputer was introduced.
- It was called Disk Operating System because it was entirely stored on single floppy disk.
- It had text based user interface which is also known as Command line.
- User had to type commands to interact with the computer.
- The user had to learn commands to operate the computer.
- DOS commands were difficult to learn and memorize.
- DOS interface was not user-friendly.

# WINDOWS Operating System

- It was developed in mid 1980s by Microsoft Corporation.
- It provides a Graphical User Interface (GUI) which is user friendly.
- It allows the user to give command to computer through icons, menus, buttons etc.
- It is the most commonly user operating system on PCs and laptop.

# DOS vs WINDOWS

DOS	WINDOWS
<ol style="list-style-type: none"><li>1. DOS provides Command Line Interface.</li><li>2. DOS commands are difficult to learn and memorize.</li><li>3. The user had to type command to interact the computer.</li><li>4. It supports single tasking.</li><li>5. It does not support plug and play facility.</li><li>6. It supports only 16-bit file system.</li><li>7. It requires less memory space.</li><li>8. It supports the use of only keyboard.</li></ol>	<ol style="list-style-type: none"><li>1. WINDOWS provides Graphical Users Interface.</li><li>2. In WINDOWS, user does not have to memorize the commands.</li><li>3. The user interact with computer through icons, menus, buttons etc.</li><li>4. It supports multi tasking.</li><li>5. It provides plug and play facility.</li><li>6. It supports 16,32 and 64 bit file system.</li><li>7. It requires more memory space.</li><li>8. It supports the use of keyboard and mouse.</li></ol>

# Mac OS

- It is a series of operating system developed by Apple.
- Mostly it is installed on Apple Computer like iMac, Macbook Pro and MacBook Air etc.
- It is a more secure operating system compared to Windows.
- Mac computers is of high quality but more expensive than IBM compatible computers.
- The number of application software for Mac OS is less than Windows OS.

# UNIX

- It was developed in early 1970s at Bell Lab. research center by Ken Thompson and Dennis Ritchie in C language.
- It is a multiuser and multi tasking OS.
- It provides greater processing power and better security than Windows OS.
- Computers running UNIX OS rarely have malware attack.
- It is typically not popular for use on microcomputers.
- Mostly used on servers
- It requires high level of technical knowledge to install, maintain and upgrade.
- The latest version of UNIX also provide GUI.



# Types of Operating System

# Batch Processing Operating System

- A Batch Processing OS groups together same type of jobs in batches and automatically executes them one by one.
- A set of similar jobs is known as batch.
- All jobs in a batch are executed one after the other.
- It is very useful for the tasks that require similar processing for example Banks deduct monthly fee etc.
- The batch processing is normally performed using the powerful mainframe computers.

# Multiprogramming Operating System

- It is a software that loads one or more programs in main memory and executes them using a single CPU.
- The CPU executes one program at a time while others are waiting.
- When one program busy with I/O operations, the CPU executes another program.
- It uses CPU time and other resources to improve the performance of computer.

# Multitasking Operating System

- It is a software that performs multiple tasks at the same time on a computer that has a single CPU.
- The CPU executes only one program at a time but it rapidly switches between multiple programs and it appears as if all the users programs are being executed at the same time.
- For Example, the user can edit a text document while a webpage is being loaded in the browser.

# Time Sharing Operating System

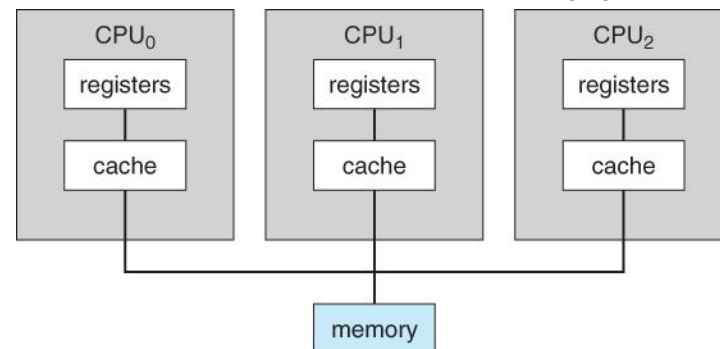
- It is a software that shares the CPU time between multiple programs that are loaded in main memory.
- It gives a very short period of CPU to each program which is called time slice or quantum.
- It is used in mini and mainframe computers that supports large number of users.
- These computers support a large number of users in the big organizations such as Airlines and Banks etc.

# Real Time Operating System

- It is a software that runs real time application that must process data as soon as it comes and provides immediate response.
- They are used in the fields where a quick response is critical.
- Some applications of real time operating system are as follows:
- It is commonly used in space research programs
- Real time traffic control and to control industrial processes such as oil refining.
- Automated Car Assembly Plant.
- Air traffic system.
- Heart Pacemaker system.
- Scientific experiments for Nuclear reactors.
- Medical Science application(Magnetic Resonance Imaging (MRI) Scan, Radiation therapy).
- Defense applications(Missile guidance system, anti-missile system, Satellite missile system) etc.

# Multiprocessor Operating System

- It is a software that controls the operations of two or more CPUs within a single computer system.
- All CPUs share the same memory and I/O devices.
- It is used to obtain very high speed to process large amount of data.
- It executes single program using many CPUs at the same time.
- It improves the processing speed.
- The computer need complex architecture to support multiprocessing.



# Parallel Processing Operating System

- It is a software that executes programs developed in a parallel programming language.
- It uses many processors at the same time.
- It divides the task of a program into many smaller tasks and processes them on multiple processors at the same time.
- It is used in Supercomputers that have thousands of processors.

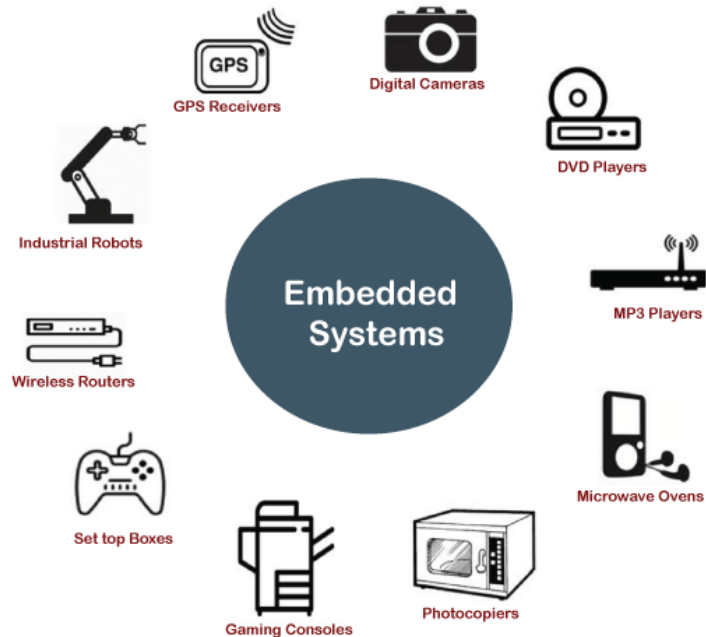


# Distributed Operating System

- It is a software that manages the operation of a distributed systems which allows execution of applications software on different computers in a network.
- In a distributed system, user programs may run on any computer and access data on any other computer in the network and user of a program do not know on which computer their programs are running.

# Embedded Operating System

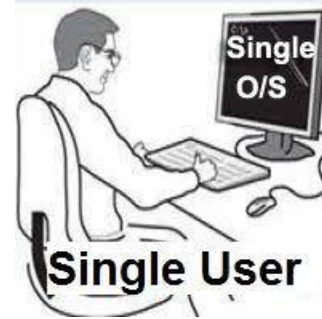
- It is a built-in operating system which is embedded in the hardware of the device that controls the functions of the device such as Microwave oven, TV, ATM, Digital Camera, Washing machines, Games etc.
- It run automatically when the device is turned on and performs specific task.



# Single User and Multiuser Operating Systems

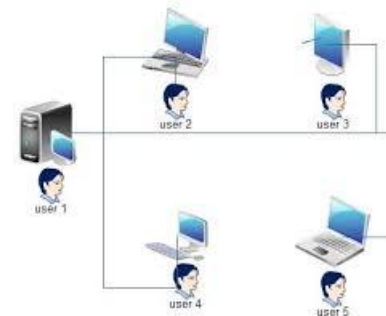
- Single User Operating System:

- The operating system that allows only one person to operate the computer at a time is known as Single user operating system.
- Example: DOS, WINDOWS

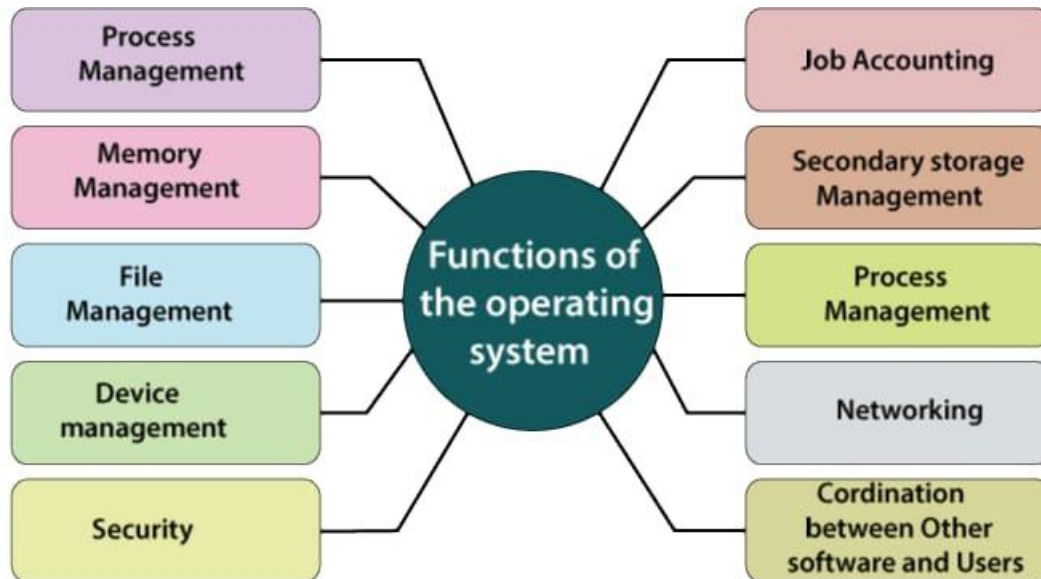


- Multiuser Operating System:

- It allows many users on different microcomputers to use the resources of single central computer (Server) in a network.
- Example: UNIX, LINUX, Windows 2000 onwards etc.

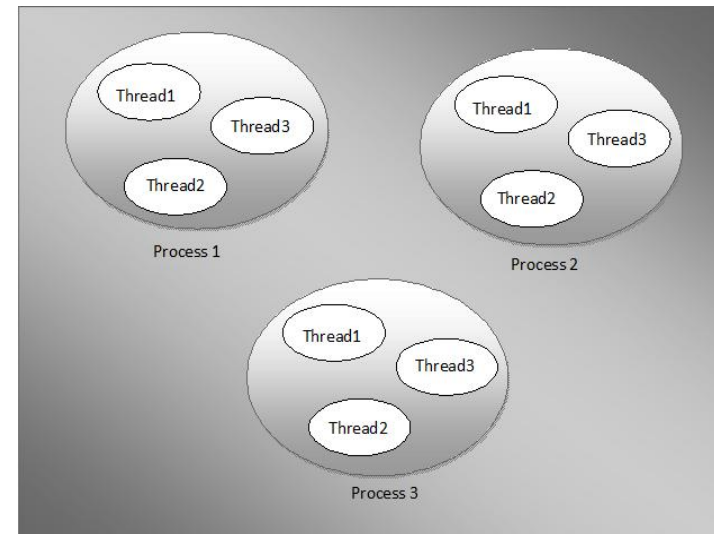


# Operating System Functions



# 1. Process Management

- A process is a program in execution.
- Process management is the part of OS that manages allocation of computer resources like CPU, Main Memory etc.
- Process management describes the state and resource ownership of each process.



## 2. Memory Management

- It is a part of OS that controls and manages the operations of main memory.
- It allocates space to programs that are loaded in main memory for execution.
- It keeps track of freed memory.
- When a process is being loaded, it is called swap-in.
- When a process is being taken out, it is called swap out.

# 3. File Management

- It is a part of OS that manages files and folders on storage devices such as hard disk, USB flash drive CD/DVD etc.
- It allow the users to perform operations such as copying, creating, moving, renaming deleting and searching files and folders.
- It also allows the user to perform read, write open and close operation on file folders.

# 4. I/O Management

- It is the part of OS that controls all the I/O operations during program execution.
- It manages all the INPUT/OUTPUT operations of I/O and storage devices.
- User communicate with computer with different I/O devices i.e Keyboard, Mouse, Monitor etc.
- It also detects and handles the errors during data transmission.



# 5. Secondary Storage Management

- It is the part of OS that manages free space and storage allocation of user programs and data on secondary storage devices.
- It also allocates and deallocates the storage space to user programs.

# 6. Network Management

- It is the part of OS that monitors and manages the resources of a network.
- It allows to create user groups and assigns privileges to them.
- It shares the network resources among users and detects and fixes network problems.

# 7. Protection System

- It is the part of OS that ensures that each resource of computer is used according to the privileges given to users by the system administrator.
- It creates account for each user and gives privileges to prevent misuse of the system.
- It provides password to all the users to maintain network security.

# 8. Command Interpreter

- It is the part of OS that provides interface between user and the computer system.
- It is a file in OS that reads and executes user commands entered as text through keyboard.
- For example, WINDOWS OS uses the cmd.exe file as command interpreter.

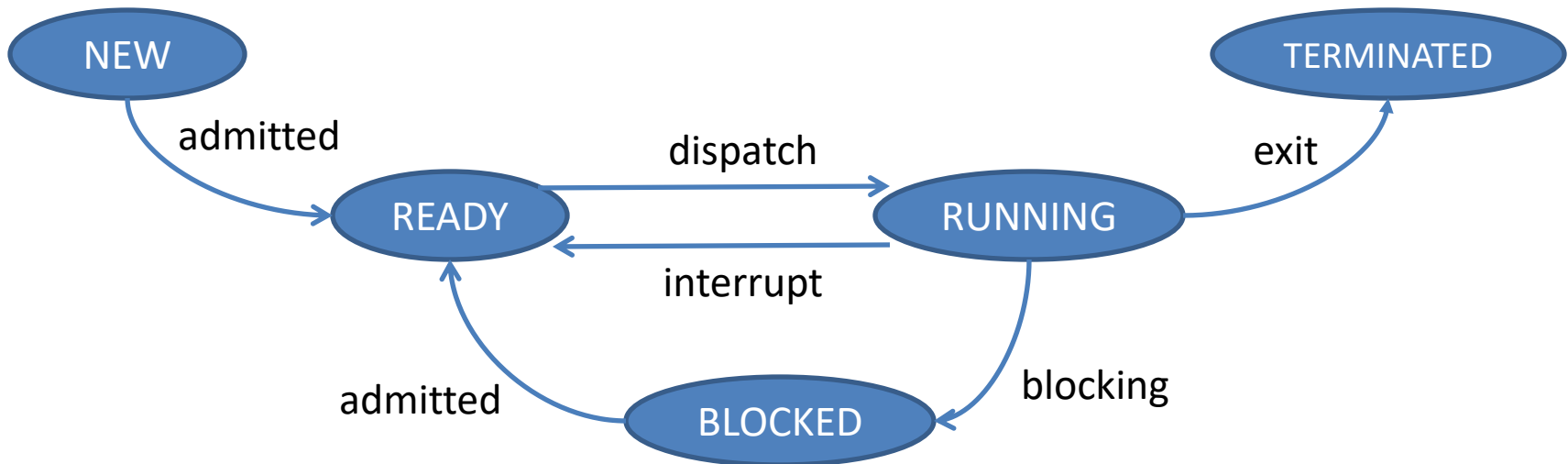
# Process Management

# Process

- A process is a program in execution.
- When a program is loaded in main memory for execution, it becomes a process.
- A program is an executable code that is stored in disk as a text file whereas a process is a dynamic instance of a program during its execution in RAM.
- It represents basic unit of work.
- It uses different resources of computer such as CPU time, I/O devices, memory etc.

# Various States of a Process

- There are five states of a process which are shown in the figure:

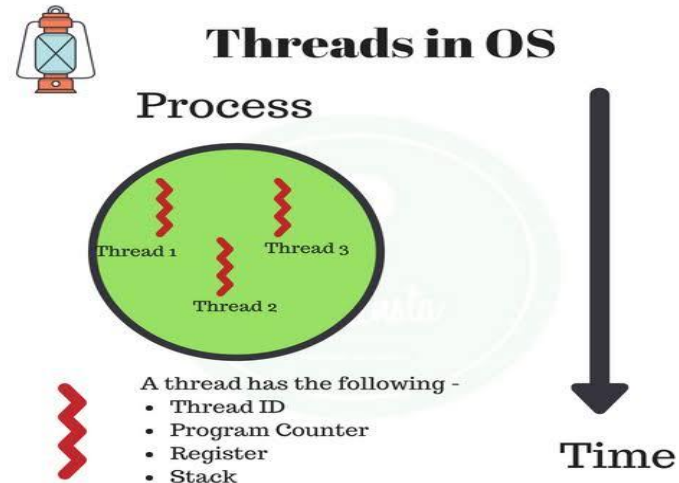


1. **NEW state:**
  - This is the first state of a process when it is created.
  - Any new operation or service that is requested by a program for execution is known as new state of process.
2. **READY state:**
  - A process is said to be in ready state when it is ready for execution but waiting to be assigned to the CPU by OS.
3. **RUNNING state:**
  - A process is said to be in running state when it is being executed by the processor.
4. **BLOCKED state:**
  - A process is in blocked or waiting state when it is not under execution and waiting for a resource to become available.
5. **TERMINATED state:**
  - A process is in terminated state when it completes its execution.



# Thread and Process

- Process:
  - A process is an executable instance of program
- Thread:
  - A thread is a sequence of instruction within a process that executes independently.
  - Threads are created and exited within a process.



Process	Thread
<ol style="list-style-type: none"><li>1. An executable instance of a program is called a process.</li><li>2. It has its own copy of data segment.</li><li>3. Any changes in the process does not effect other processes.</li><li>4. Process run in separate memory space.</li><li>5. Process is controlled by the operating system.</li><li>6. Process are independent.</li><li>7. Every process has its own memory space.</li><li>8. Processes don't share the memory with other processes.</li><li>9. If one process is blocked, then no other process can execute until the first process is unblocked.</li></ol>	<ol style="list-style-type: none"><li>1. A thread is a subset of a process.</li><li>2. It has direct access to the data segment of its process.</li><li>3. Any change in the thread may affect the behavior of the other thread of the process.</li><li>4. Thread run in shared memory spaces.</li><li>5. Threads are controlled by programmer in a program.</li><li>6. Threads are dependent.</li><li>7. Threads use the memory of the process they belong to.</li><li>8. Threads share the memory with other threads of the same process.</li><li>9. While one thread is blocked and waiting, a second thread in the same task can run.</li></ol>

- **Multithreading:**
  - The process of executing multiple thread simultaneously is know as Multithreading.
  - It is an execution method of a program that allows a single process to run multiple thread at the same time.
  - The main purpose of multithreading is to provide simultaneous execution of two or more parts of a program to maximum utilize the CPU time.
- **Multitasking:**
  - Multitasking is the function of operating system that loads multiple tasks in main memory and executes them at the same time by rapidly switching the CPU among them.
- **Multiprogramming:**
  - Many programs are loaded in memory but the CPU only executes one program at a time.
  - The advantage of multiprogramming is that it saves user's time in loading the program to main memory and runs the program quickly.
  - The only drawback is, the system requires more memory as it is occupied by many programs.
  - Some bigger programs cannot load fully in memory and thus programs run slowly.
- **Multiprocessing:**
  - It is the ability of an OS to execute more than one process on a multi processor machine at the same time.

## Multiprogramming

1. In a Multiprogramming system, one or more programs are loaded in the main Memory which is ready to execute simultaneously.
2. The multiprogramming objective is to improve the utilization of the CPU.
3. The multitasking objective is to improve the timing of the response.

## Multitasking

1. Multitasking refers to execute multiple programs, tasks, threads running at the same time.
2. The multitasking objective is to improve the timing of the response.
3. Multitasking takes less time to execute any task or program process.