Chapter 1
Overview Of Operating System [08 Marks]

1.1. OS- Concept, Components of OS, Operations of OS, Views of OS

A computer system has many resources (hardware and software), which may be require to complete a task. The commonly required resources are input/output devices, memory, file storage space, CPU etc. The operating system acts as a manager of the above resources and allocates them to specific programs and users as necessary for their task. Therefore operating system is the resource manager i.e. it can manage the resource of a computer system internally. The resources are processor, memory, files, and I/O devices.

An OS is a program that manages the computer hardware. It also provides a basis for application programs and acts as an intermediary between the computer user and the computer hardware.

Operating System (OS) is an interface between computer user and computer hardware

OR

An operating system is software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

Example Operating Systems :- Linux, Windows, OS X, VMS, OS/400, AIX, z/OS, etc.

OR

An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.

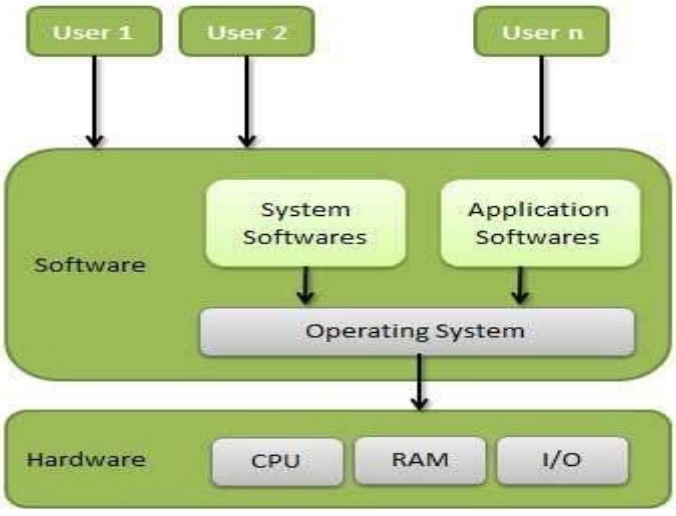


Fig.1: Operating System

OS acts as a control program which controls all activities of computer system. It interacts with hardware of computer system to perform different tasks.

Primary objective of OS is to make computer convenient to use and utilize hardware in efficient manner.

Computer system can be divided into 4 components:

1. Hardware 2.Operating System 3.Application Program 4.Users

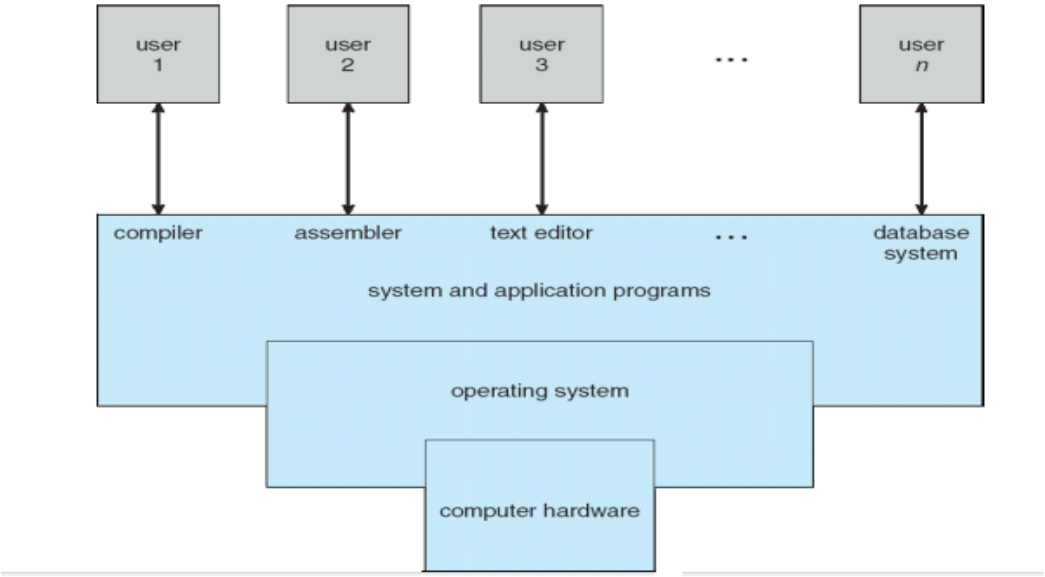


Fig.2 : Components of Computer System

1. **Hardware**: These are physical parts of machine which provides basic computing resources. It includes CPU, memory, I/O devices etc. which provides basic computing resources for system.
2. **Application Program:** It defines the way in which these resources are used to solve user computing problems. e.g. word processor, compiler,browser
3. **Operating System:** It controls & coordinate the use of hardware amongst the various application program for various users.
4. **Users:** Users are human beings, machines and other computers.

An operating system is similar to a government. Like a government, it performs no useful function by itself. It simply provides an environment within which other programs can do useful work. To understand more fully the operating systems role, we next explore operating systems from two view points :-from users point and from system point

- **Program Management**
- **Resource Management**
  - **Memory Management**
  - **File System Management**
  - **I/O subsystem Management**
- **Security And Protection.**

- **Process Management**

  A process is a program in execution. It is a unit of work within the system. Program is a *passive entity;* process is an *active entity*.

  Process needs resources to accomplish its task
  - CPU, memory, I/O, files
  - Initialization data

  Process termination requires reclaim of any reusable resources

  Single-threaded process has one program counter specifying location of next instruction to execute
  - Process executes instructions sequentially, one at a time, until completion

Multi-threaded process has one program counter per thread

Typically system has many processes, some user, some operating system running concurrently on one or more CPUs

- Concurrency by multiplexing the CPUs among the processes / threads

Process Management Activities

The operating system is responsible for the following activities in connection with process management:

- Creating and deleting both user and system processes
- Suspending and resuming processes
- Providing mechanisms for process synchronization
- Providing mechanisms for process communication
- Providing mechanisms for deadlock handling

- **Resource Management**

Memory Management

To execute a program all (or part) of the instructions must be in memory

All (or part) of the data that is needed by the program must be in memory

Memory management determines what is in memory and when

- Optimizing CPU utilization and computer response to users

Memory management activities

- Keeping track of which parts of memory are currently being used and by whom
- Deciding which processes (or parts thereof) and data to move into and out of memory
- Allocating and de allocating memory space as needed

File-system Management

OS provides uniform, logical view of information storage

- Abstracts physical properties to logical storage unit - file

File-System management

- Files usually organized into directories
- Access control on most systems to determine who can access what
- OS activities include
  - Creating and deleting files and directories
  - Primitives to manipulate files and directories
  - Mapping files onto secondary storage
  - Backup files onto stable (non-volatile) storage media

I/O Subsystem

One purpose of OS is to hide peculiarities of hardware devices from the user

I/O subsystem responsible for

- Memory management of I/O including buffering (storing data temporarily while it is being transferred), caching (storing parts of data in faster storage for performance), spooling (the overlapping of output of one job with input of other jobs)
- General device-driver interface
- Drivers for specific hardware devices

- **Protection and Security**

Protection – any mechanism for controlling access of processes or users to resources defined by the OS

Security – defense of the system against internal and external attacks

- Huge range, including denial-of-service, worms, viruses, identity theft, theft of service

Systems generally first distinguish among users, to determine who can do what

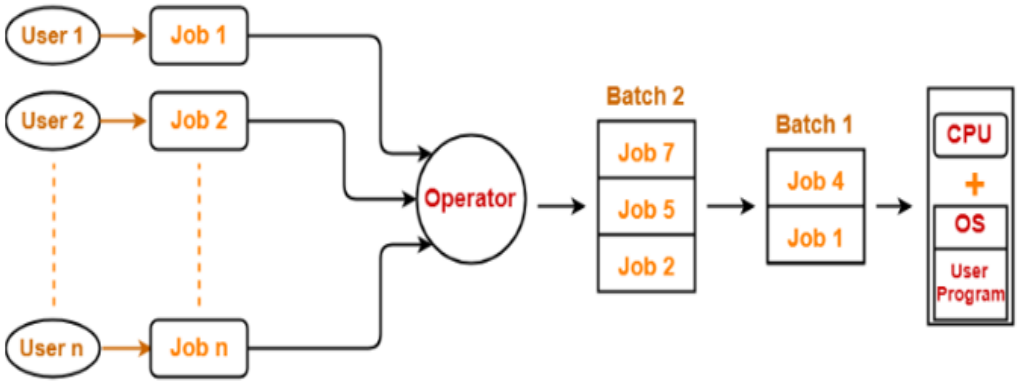
- User identities (**user IDs**, security IDs) include name and associated number, one per user

- User ID then associated with all files, processes of that user to determine access control
- Group identifier (**group ID**) allows set of users to be defined and controls managed, then also associated with each process, file
- **Privilege escalation** allows user to change to effective ID with more rights

1.2 Types of Operating System

1. Batch operating System

- A batch stands for sequence of user job.
- The programmers leave their programs with the operator, operator then sorts the programs with similar requirements into batches & submit it to batch processing system (BPS) & then those jobs were executed automatically without user interaction.
- The users of a batch operating system do not interact with the computer directly.
- The jobs were recognized with the special markers which indicate start & end of jobs.
- Following fig. shows schematic of batch processing system.
- BPS consists of batch monitor or supervisor was the major component which permanently placed in part of memory & other part of memory is used to process user's job.



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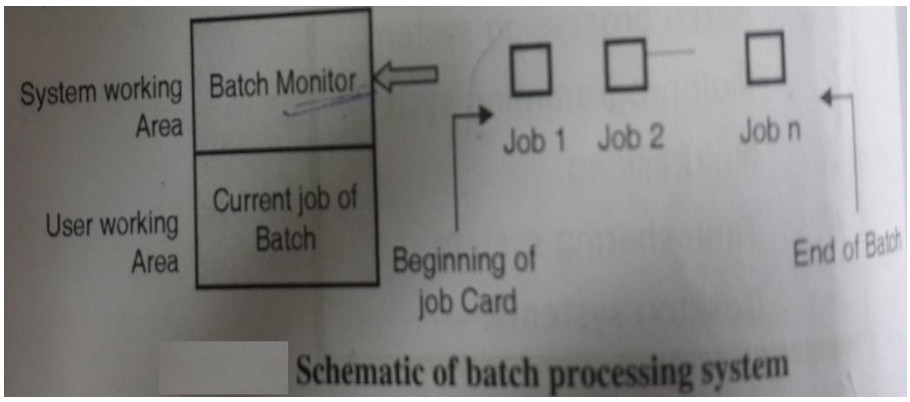


Schematic of batch processing system

- Batch monitor keeps control on processing environment.
- Functions of batch monitor are:
  a. **Scheduling:**

- This activity determines which service request should be handled in next turn.
- BPS uses First Come First Serve (FCFS) algorithm for scheduling.

b. **Memory management:-**

- During BPS operation memory is divided into two parts
  1. System working area 2. User working area.
- Partitioning of memory is done by OS.
- Some part of monitor is permanently stored in memory known as resident area of monitor.

c. Sharing & protection :

- By dividing the memory in two parts protection is very well provided.

Advantages of Batch OS:

- Repeated jobs are done fast in batch systems without user interaction.
- You don't need special hardware and system support to input data in batch systems.
- Best for large organizations
- Sharing of batch system for multiple users.
- The idle time batch system is very less.
- You can assign specific time for the batch jobs so when the computer is idle it starts processing the batch jobs i.e. at night or any free time.
- The batch systems can manage large repeated work easily.
- Programmer attention is reduced.

Disadvantages of Batch OS:

- Monitor remains in memory it results in amount of memory wastage
- It is difficult to debug batch systems.
- Batch systems are sometime costly.
- Lack of protection

2. Multiprogramming

- The process of executing multiple programs simultaneously is known as multiprogramming.
- Uniprogramming cannot keep CPU & I/O devices busy at all time.
- Uniprogramming cannot keep I/O devices as well as CPU busy.
- Using multiprogramming we can increase utilization of CPU & I/O device.
- Multiprogramming OS keeps several jobs in memory at a time. Set of jobs are shown below

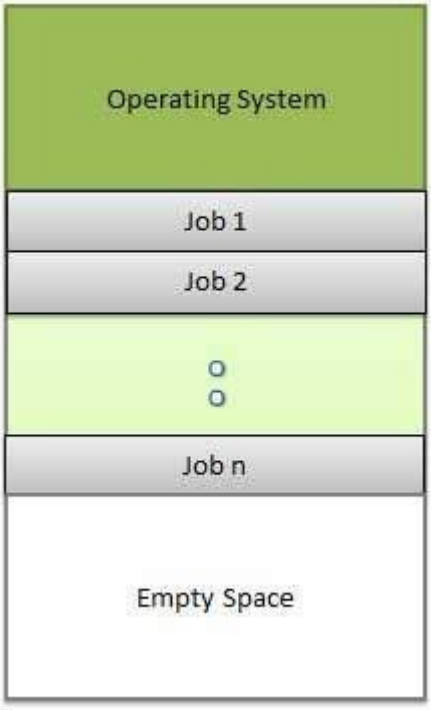
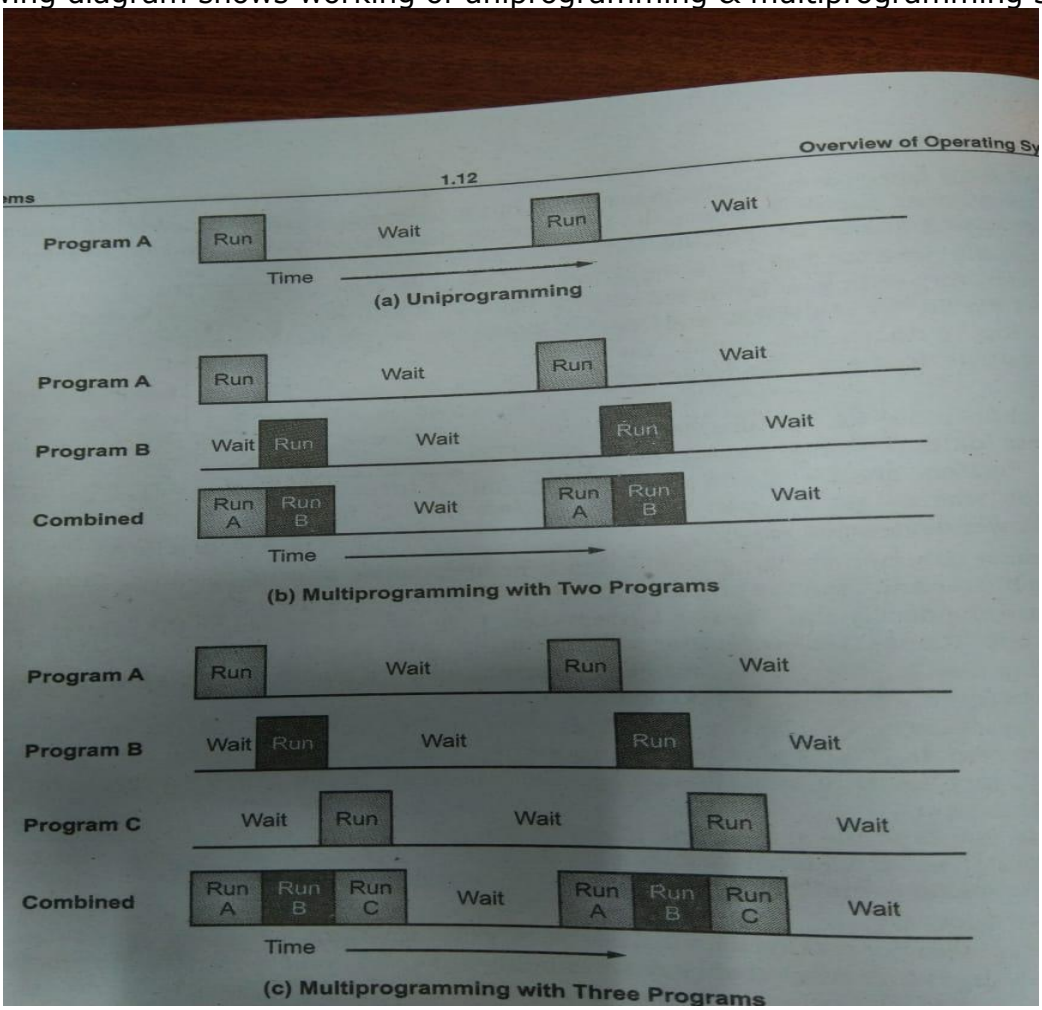


Fig. :- Memory layout of Multiprogramming.

- This set of jobs is kept in job pool.
- Following diagram shows working of uniprogramming & multiprogramming system



- By considering above diagram of multiprogramming system initially, Job A is given for execution .After some time it may require I/O operation So the CPU become

Idle(wait),instead of making CPU idle ,it switches to next job for execution till it require I/O operation, The CPU switched to next job and so on.

- Job may have to wait for some task. When job needs to wait CPU switches to another job, execute it and so on.
- E.g. A computer running excel and firefox browser simultaneously

Advantages :-

- Setup time is reduced.
- Efficiency is improved
- Waiting time is limited for programs.
- CPU utilization increases.

Disadvantages :-

- Proper memory management is required.
- Proper scheduling algorithm is required.
- Maintenance is expensive.

3. Multitasking

- Multitasking is the ability of an operating system to execute more than one task simultaneously on a single processor machine
- Multitasking is logical extension of multiprogramming.
- Though we say so but in reality no two tasks on a single processor machine can be executed at the same time.
- Actually CPU switches from one task to the next task so quickly that appears as if all the tasks are executing at the same time.
- A task is a particular operation like edit, copy, rename, delete, open, close etc.
- Multitasking is possible by executing one job in foreground & many jobs in background.
- Foreground jobs require user interaction where as background jobs does not require user interaction.
- E.g. While editing we can take printouts & listen music.

Multitasking

Advantages :-

- Multiple tasks can be run simultaneously
- Increases sped of execution
- CPU utilization increases.

Disadvantages:-

- These systems are not reliable.
- Problem of data communication.

- It raises question of security of user program & data.

Sr. No.	Multiprogramming	Multitasking
1	Multiple programs are executed simultaneously.	Multiple tasks are executed simultaneously.
2	Collection of different tasks is program.	Task is smaller unit of program.
3	Program may contain multiple task .	Task do not contain program
4	User interaction is not provided	User interaction is provided
5	It utilizes CPU & I/O devices efficiently	It utilizes CPU efficiently
6	There are simply only programs	There are two types of task foreground & background task.

4. Time sharing OS

- 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.
- **Processor's time which is shared among multiple users simultaneously is termed as time-sharing.**
- The main objective of Time-Sharing 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.
- Example OS :Linux

Fig. Time shared OS

- In this there is large central computer system to which number of terminals are connected.
- Central computer provides time slice(in milliseconds) at regular interval to each terminal.
- The time sliced is switched so rapidly that each terminal feels that the whole computer is dedicated to himself or herself.
- CPU does not wait for any operation for every job ,it immediately switched to to other job as the time slice is very less.

Advantages :-

- Provides the advantage of quick response
- Avoids duplication of software
- Reduces CPU idle time

Disadvantages :-

- Expensive to build.
- Problem of data communication
- Difficult & complicated.

5. Multiprocessor OS/Tightly couples/Parallel System

- In this more than one processors can be places in single cabinet which shares resources, bus, memory etc.
- **Objective –**is to get maximum work done in less time.
- It is also called as tightly coupled or parallel system.

Fig. Multiprocessor OS

OR

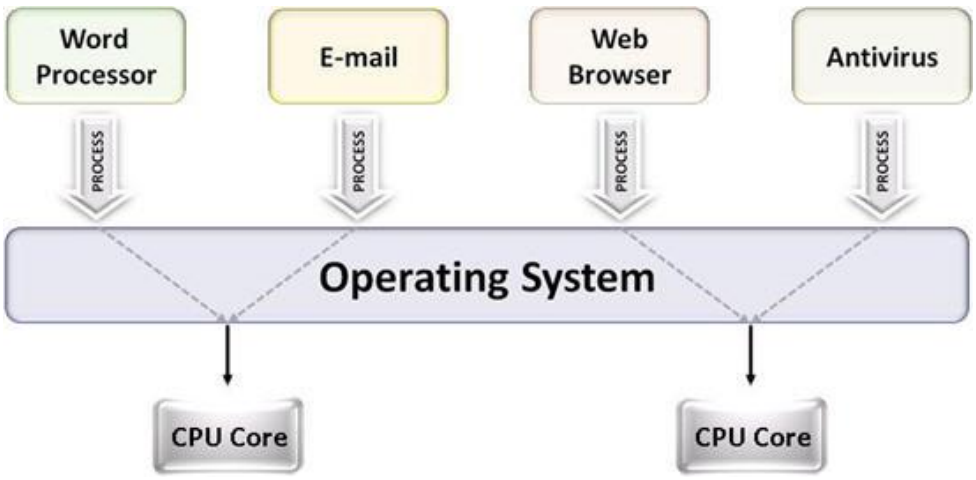


Fig. :-Multiprocessing System

- Types of Multiprocessor System are
    1. **Symmetric Multiprocessing** – In this two or more processors are connected with high bandwidth link & manage by single OS. All processor equally share I/O devices.
    2. **Asymmetric Multiprocessing –**Each processor is assigned specific task.IN this Master-Slave concept is used. Master processors controls slave processors.

Advantages:-

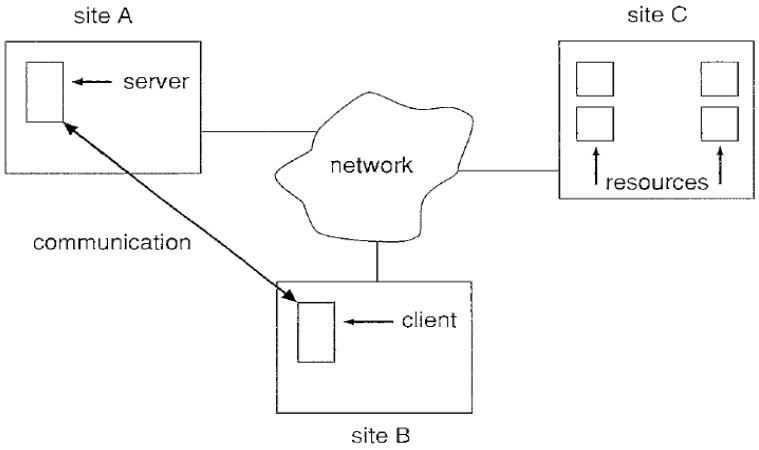
- It increases throughput.
- It increases reliability (if one processor fails, whole system will not fail.)
- More than one processors can be used.
- Maximum work done can be done in less time.

Disadvantages:-

- Expensive to build & maintain.
- More complex in both hardware & software as compare to uniprocessor system.

6. Distributed Operating System/Loosely coupled System

- It is collection of processors interconnected by communication network.
- Also called as **loosely coupled system** and are exactly opposite to multiprocessor system.
- From point of view of specific processor, rest of processor & their respective resources are remote whereas its own are local.
- Data processing jobs are distributed among the processors accordingly.
- The processors communicate with one another through various communication lines (such as high-speed buses or telephone lines).
- Processors in a distributed system may vary in size and function.
- These processors are referred as sites, nodes, computers, and so on.



A distributed system.

Advantages:-

- With resource sharing facility, a user at one site may be able to use the resources available at another.
- Speedup the exchange of data with one another via electronic mail.
- If one site fails in a distributed system, the remaining sites can potentially continue operating.
- Better service to the customers.

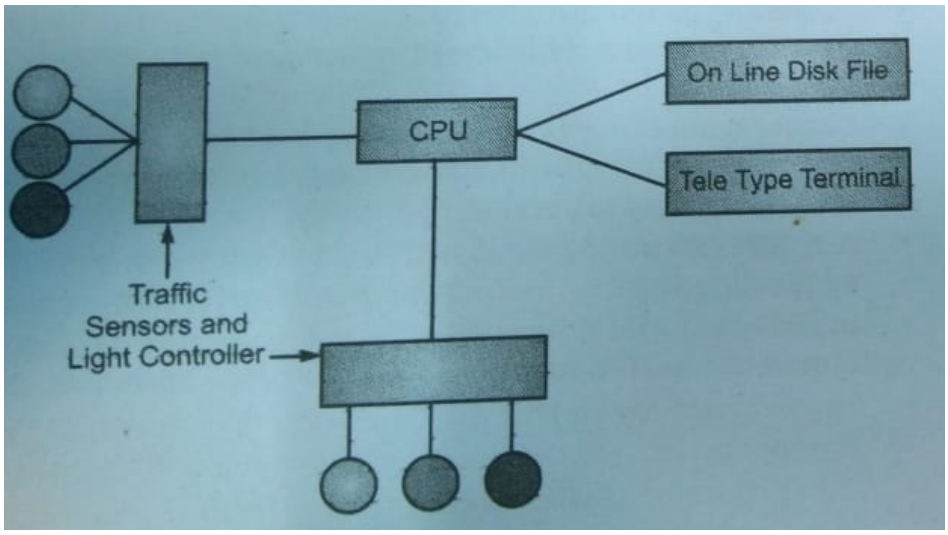
- Reduction of the load on the host computer.
- Reduction of delays in data processing.

Disadvantages:-

- Complex & difficult to build.
- Special security measures are needed to protect the shared resources.

7. Real time System

- Real time systems are used in environment where a large number of events, mostly external to the computer system, must be accepted and processes in short time or within deadline.
- This systems are often used as control device in dedicated application.
- **Objective** -To provide quick event response time & meet scheduled deadline.
- It is used when rigid time requirement have been placed on operation of a process.
- In this sensors are used, sensors bring data to computer, computer then analyses data & adjust controls according to sensors input.
- It has fixed time constraints otherwise system will fail.
- Examples: Nuclear power plant control, Railway & airline reservation system, industrial control system, satellite communication, traffic light control etc.



- There are two types of real-time systems:

a. **Hard real-time systems**
hard real-time systems guarantees that critical tasks complete on given time.
E.g. car engine control system.- delay in particular signal may cause engine failure.[plz illustrate example]

b. Soft real-time systems
Soft real time systems will tolerate delay in time.
E.g. Live audio, live video [plz illustrate example]

Advantages :-

- Direct communication between user & system is possible

- System generated task can be completed within time

Disadvantages :-

- More complex & difficult to maintain

8. Mobile OS

- A mobile OS is one that controls smartphones, PDA's, tablet PC's etc.
- Like different OS such as 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.
- Different Mobile OS are Android OS (Google Inc.), Bada (Samsung Electronics) BlackBerry OS , iPhone OS / iOS (Apple), MeeGo OS (Nokia and Intel), Symbian OS (Nokia), Windows Mobile (Windows Phone)

1. Android OS

- Android is a Linux based operating system it is designed primarily for touch screen mobile devices such as smart phones and tablet computers.
- The operating system have developed a lot in last 15 years starting from black and white phones to recent smart phones or mini computers.
- One of the most widely used mobile OS these days is android.
- The android is a powerful operating system and it supports large number of applications in Smartphones. These applications are more comfortable and advanced for the users.
- The hardware that supports android software is based on ARM architecture platform. The android is an open source operating system means that it's free and any one can use it.
- The android has got millions of apps available that can help you managing your life one or other way and it is available low cost in market at that reasons android is very popular.
- **Advantages**
- Android is Linux based open source operating system , it can be developed by any one
- Easy access to the android apps
- You can replace the battery and mass storage, disk drive
- Its supports all Google services
- It supports Multitasking
- Its free to customize
- Its supports 2D and 3D graphics
- **Disadvantages**

- Usually you need more code on Java than Objective-C.
- Complex layouts and animations are harder to code in Android.
- Applications contains virus also present in Android Market
- A lot of "process" in the background that lead to the battery quickly drains.
- Low security and fake apps can be installed to steal your info from unknown resources

2. iOS

- This OS is developed by Apple.
- It is OS that presently powers many of the companies mobile devices including iPhone, iPad and iPod.
- It is the second most popular OS globally after Android
- Major versions of iOS are released annually.
- The iOS user interface is based upon direct manipulation, using multi-touch gestures. Interface control elements consist of sliders, switches, and buttons.
- Interaction with the OS includes gestures such as swipe, tap, pinch, and reverse pinch, all of which have specific definitions within the context of the iOS operating system and its multi-touch interface.
- **Advantages:-**
  - Provides high customer service
  - Has more security
  - Supports multitasking and performance is awesome
  - Supports vast number of applications
- **Disadvantages**
  - Not flexible, only supports iOS devices
  - Not open source
  - Is costly Apps Developments
  - Not cust**omizab**le.

Parameter	Android	iOS
Source model	Open source	Closed, with open source components.
OS family	Linux	OS X, UNIX
Language Used	C,c++.JAVA	C++, objective -c
Developer	Google, Open Handset Alliance	Apple Inc.
Widgets	Yes, except on lock screen	No, except in Notification Center
File transfer	Easier than iOS.	More difficult.
Internet browsing	Google Chrome	Safari
Security	Low	High
Performance	Low	Excellent
Speed of Development	More time consuming and slow	Fast

1.3 Command Line Based OS:-DOS, Unix, GUI Based OS:-Windows, Linux

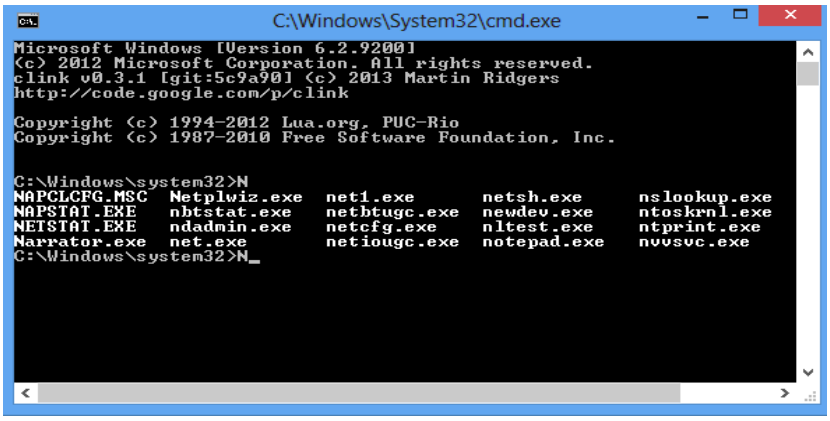
An OS provides an interface through which user interacts with the system. The user interacts with a computer system through its user interface.

Command Line Based OS

- A command line interface (CLI) is a text-based user interface (UI) used to view and manage computer files.
- Command line interfaces are also called command-line user interfaces, console user interfaces and character user interfaces
- It is a type of human-computer interface (i.e., a way for humans to interact with digital computers or personal computer) that relies solely on textual request and response transaction process.
- A Command Line Interface is a powerful way of user interacting with an operating system.
- **Advantages Command Line Interface:-**
    - A CLI does not require Windows to run.
    - If the user knows the correct commands then this type of interface can be much faster than any other type of interface.
    - This type of interface needs much less memory (Random Access Memory) in order to use compared to other types of user interfaces.
- **Disadvantages of Command Line Interface: -**
    - For someone who has never used a CLI, it can be very confusing.
    - Commands have to be typed precisely. If there is a spelling mistake then the command will not respond or fail.
    - If user can mis-type an instruction, it is often necessary to start from scratch again.
    - There are a large number of commands which need to be learned-in the case of Unix it can be more than hundred.

MS-DOS

- MS-DOS is a non-graphical "Disk Operating System".
- That means it is simply: "a System for Operating the Computer from a Disk
- It enabled the user to organize data files, load and execute (run) program files, and control the input and output devices attached to the computer.
- Most current operating systems still use disks (hard disks) but have dropped the D from DOS, and it’s now called just Operating System (OS).
- MS-DOS uses character user Interface(CUI) in which the user interacts with the system with the help of some predefined commands through a command Line Interface.
- In DOS the commands are executed by command line interpreter by translating them into system call.
- Generally this interpreter resides outside the kernel so that is not affected by the user.



Unix

- Unix is an Operating System which is truly the base of all Operating Systems like Linux, Ubuntu, Solaris, POSIX etc.
- It was developed in the 1970s by Ken Thompson, Dennis Ritchie, and others in the AT&T Laboratries.
- Unix is a computer Operating System which is capable of handling activities from multiple users at the same time.
- It was originally meant for programmers developing software rather than non-programmers.
- Main focus that was brought by the developers in this operating system was the Kernel. Unix was considered to be the heart of the operating System.
- System Structure of Unix OS are as follows:

- **Layer-1: Hardware –**
  It consists of all hardware related information.

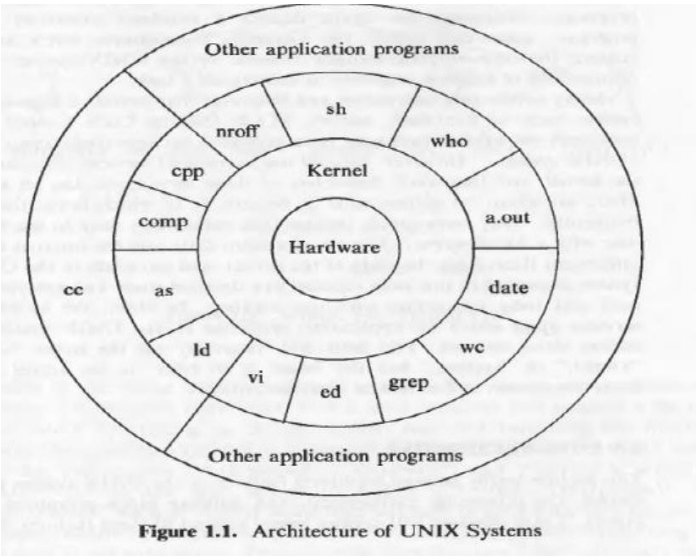


Figure 1.1. Architecture of UNIX Systems

- **Layer-2: Kernel –**
  It interacts with hardware and most of the tasks like memory management, task scheduling and management are done by the kernel.
- **Layer-3: Shell commands –**
  Shell is the utility that processes your requests.When you type in a command at the terminal, shell interprets the command and calls the program that you want.
  There are various commands like cp, mv, cat, grep, id, wc, nroff, a.out and more.
- **Layer-4: Application Layer –**
  It is the outermost layer that executes the given external applications

Graphical User Interface(GUI) Based OS:-

- A Graphical User Interface (GUI for short) allows users to interact with the computer hardware in a user friendly way.
- Windows is the most popular GUI OS.
- GUI uses windows, icons, and menus to carry out commands, such as opening, deleting, and moving files. Although a GUI operating system is primarily navigated using a mouse, the keyboard can also be used to navigate using keyboard shortcuts or the arrow keys.
- Different GUI based OS Microsoft Windows,Apple system, Linux variants like Ubuntu .
- **Advantages**
    - Programmer or user need not have to understand working of the computer system.
    - It looks very attractive and multi-coloured.
    - It is much better than command driven interface which has many drawbacks.
    - User can switch quickly between tasks on the GUI interface.
    - Full screen interaction is also possible with quick and wholesome access to anywhere on the screen
- **Disadvantages**
    - It uses more computer memory as the aim is to make it for user friendly and not resource optimized. As a result, it can be slow on older machines.
    - GUI becomes more complex if user needs to communicate with the computer directly.
    - Certain tasks may take long due to many menus to select the desired choice.
    - Hidden commands need to be searched using Help file.
    - GUI based applications require more RAM in order to run.
    - It uses more processing power compare to other interface types.

Windows

- Microsoft Windows is a group of several graphical operating system families, all of which are developed, marketed and sold by Microsoft.
- Windows is a series of OS developed by Microsoft
- Each version includes a GUI with a desktop that allows users to view files and folders in windows.
- The current version Windows 10 was released on 29 July 2015

Linux

- Linux is a Unix like OS created by Linus Torvalds.
- Linux is an operating system or a kernel.
- It is distributed under an open source license and available in several distributions.
- Its functionality list is quite like UNIX
- Most Linux system provide either the K-Desktop Environment or the Gnome Interface both of which are built on top of X-Windows and resemble the windows Interface.

Difference between MS DOS and Windows

Sr. No.	MS DOS	Windows OS
1.	DOS only supports for single tasking.	Windows OS is multitasking.
2.	DOS uses CLI (command line interface)	Windows supports GUI (graphical user interface).
3.	It is a single user OS.	It is a multi user OS.
4.	It is a single threading OS.	It is a multithreading OS.
5.	It doesn't supports the networking.	It supports the networking.
6.	Less user friendly with compare to Windows.	More user friendly with compare to DOS.
7.	DOS uses FAT 16 file system	Windows uses FAT 32 file system
8.	DOS supports 2 GB of maximum partition size.	Windows supports 2 TB or more partition size.

Difference between GUI and CUI

Sr. No.	GUI	CUI
1.	GUI refers to Graphical User Interface.	CUI stands for Character User Interface
2.	User interacts with computer using mouse.	keyboard is needed to type commands in order to interact with the computer.
3.	Navigation is easy.	Navigation is not easy
4.	We deal with graphics and other visual clues.	We deal with text only.
5.	It is more user friendly.	It is less user friendly.
6.	Modern operating systems are GUI base.	Modern OS does not use CUI.
7.	Example of GUI is Widows OS.	DOS is the example of CUI.

2.2 System Call

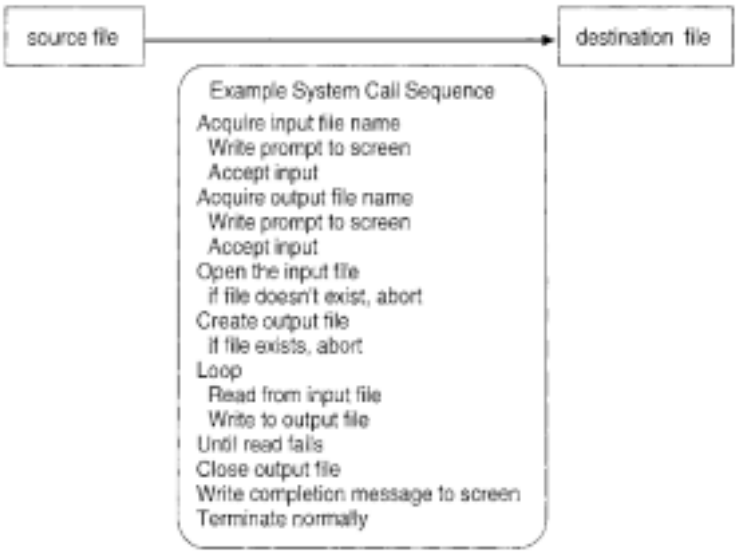
2.2.1 Concept of system call

- System calls provide an interface to the services made available by an operating system.

- These calls are generally available as routines written in C and C++, although certain low-level tasks may need to be written using assembly-language instructions. - System calls allow user-level processes to request some services from the operating system which process itself is not allowed to do.

- System call provides basic functionality to user to operate operating system. - System calls are programming interface to the services provided by the Operating system.

- **Example of how system calls are used:**
    - Writing a simple program to read data from one file and copy them to another file Sequence of system calls are used .



Example of how system calls are used.

- **System call implementation**
    - A number is associated with each system call.
    - For executing system call OS switch its mode from user mode to kernel mode.
    - When user starts the system, the system is in user mode.
    - System call interface maintains the table index according to the system call numbers.
    - The system call interface invokes intended system call in OS and executes intended system call and returns the status or any value of system call. ○ Caller needs to know nothing about how system call is implemented how what it does during execution.
    - Rather it need only obey the API and understand what the operating system will do as a result of the execution of that system call .Thus, most of the details of the operating-system interface are hidden from the programmer by the API . Following Fig. shows implementation of open() system call

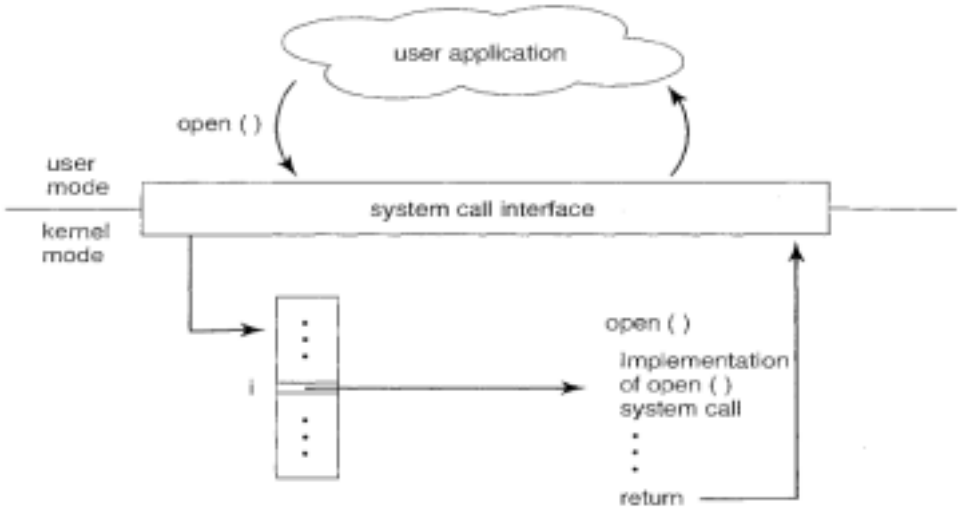
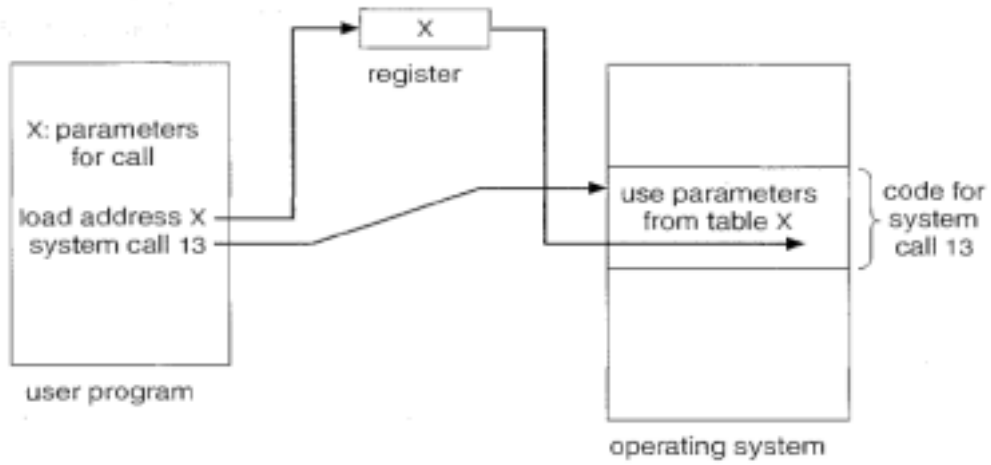


Fig. :- Implementation of system call open()

- **System call Parameter passing**
  - Three general methods are used to pass parameters to the operating system.
    1. Using Register

    2. **Using Table or Block** -When there may be more parameters than registers. In these cases, the parameters are generally stored in a block, or table, in memory, and the address of the block is passed as a parameter in a register.

    3. **Using Stack** -Parameters also can be placed, or pushed, onto the stack by the program and popped off the stack by OS.



Passing of parameters as a table.

2.2.2 Types of system call

System calls can be grouped roughly into six major categories: **1. process control**

2. file manipulation

3. device manipulation

4. information maintenance

5. Communication

6. Protection

- Process control
  - end, abort
  - load, execute
  - create process, terminate process
  - get process attributes, set process attributes
  - wait for time
  - wait event, signal event
  - allocate and free memory
- File management
  - create file, delete file
  - open, close
  - read, write, reposition
  - get file attributes, set file attributes
- Device management
  - request device, release device
  - read, write, reposition
  - get device attributes, set device attributes
  - logically attach or detach devices
- Information maintenance
  - get time or date, set time or date
  - get system data, set system data
  - get process, file, or device attributes
  - set process, file, or device attributes
- Communications
  - create, delete communication connection
  - send, receive messages
  - transfer status information
  - attach or detach remote devices

1. Process Control:

a) **End**- stop execution of process normally.

b) **Abort**- stop execution of process abnormally.

c) **Load**- loads the process or program

d) **Execute**- to execute the process.

e) **Create**- to create new process.

f) **Terminate**- to terminate the process.

g) **Get process attribute**- process has certain attributes like process id, state, priority, etc. With the help of this system call user can access the attributes of process.

h) **Set process attribute**- used to set the process attributes.

i) **Wait for time**- When new process is created, we may need to wait for them to finish their execution.

j) **Wait for event**- when we want to wait for a specific event to occur at that time this system call is executed.

k) **Signal event**- when event is occurred then process will give this system call. l) **Allocate and free memory**- it is used to allocate and free the memory assigned.

2. File Management:

a) **Create**- Used to create a file.

b) **Delete** - Used to delete a file

c) **Open**– Used to open a file which is already created

d) **Close** - Used to close a file which is already open

e) **Read** –Used to read open file

f) **Write** – Used to Write to the file

g) **Reposition**- rewinding or skipping to the end of file.

h) **Get file attribute** -File has certain attributes like file name, type, accounting information etc. With the help of this system call user can access the attributes of file.

i) **Set file attribute** - used to set the file attributes.

3. Device Management

a) **request device** -system with multiple user may require to first request the device.

b) **release device** -after use of particular device is over than we must release it. c) **Read, write,reposition** –ones the device has been requested. We can read, write and reposition the device same as files.

d) **Get device attribute and set device attribute**

e) **Logically attach** –when it is required to access data from remote device which is connected in network.

f) **Logically detach** –after use of remote device then they can be logically detached.

4. Information Maintenance:

a) **Get time/date**- Used to get current system date and time.

b) **Set time/date**- Used to set system time and date.

c) **Get system data**- User may need system data like amount of disc space, memory, number of users login, etc.

d) Set system data

e) **Get process/file/device attributes**- It is used to access different attributes of process, files, devices. Also used to maintain the information of same. **f) Set process/file/device attributes**

5. Communication

a) **Create and delete** –used to create and delete communication between two process of same system or different system.

b) **Send and receive** – Used to send & receive a message in communication.

c) **Transfer status information** –it provides status of system/process whether it is ideal/busy.

d) **Attach or detach -** when it is required to access data from remote device which is connected in network we use attach system call & after use of remote device is over then they can be detached from network.

6. **Protection**

a) **Get,set permission** –used to manipulate the permission setting of resources such as files and disc.

b) **Allow and deny user** –it indicates whether particular user can or cannot be allowed to access certain resources.

2.3 Components of OS

Due to the complex nature of the modern operating system, it is partitioned into smaller components. Each component performs a well-defined function with well-defined input and outputs. Many modern operating systems have the following components activities

1. Process Management.
2. Main Memory Management.
3. File Management.
4. I/O system management.
5. Secondary Storage Management.

1) Process Management

○ A process is the unit of work in a system. Such system consists of a collection process, some of which are operating system process and the rest of which are user processes. ○ A process needs certain resources to accomplish its task such as CPU Time, Memory, and File and I/O devices. These resources are either given to the process when it is created or allocated to it while it is running.

○ All such processes can execute concurrently, e.g. by multiplexing on a single CPU. ○ The operating system is responsible for the following activities in connection with process management:-

1. Scheduling process and threads on the CPUs
2. Creating & deleting both user & system processes
3. Suspending & resuming processes
4. Providing mechanisms for process synchronization

5. Providing mechanisms for process communication

2) Main Memory Management:

○ Main memory is central to the operation of a modern computer system. Main memory is a large array of words or bytes, ranging in size from hundreds of thousands to billions.

○ Main memory is a repository of quickly accessible data shared by the CPU & I/O devices.

○ The central processor reads instructions from main memory during the instruction fetch cycle& both reads and writes data from main memory during the data fetch cycle. ○ While selecting a memory management scheme for a specific system many factors must take into account such as hardware design of the system. Each algorithm requires its own hardware support.

○ The operating system is responsible for the following activities in connection with memory management:-

1. Keeping track of which parts of memory are currently being used &by whom.
2. Deciding which processes & data to move into and out of memory.
3. Allocating & de-allocating memory space as needed.

3) File System management:

○ A file is a collection of related information defined by its creator. ○ Files represent programs and data. Data files may be numeric, alphabetic, alphanumeric or binary. Some files may be free from any specific format or some may be formatted rigidly.

○ File management is one of the most visible components of an operating system. Computers can store information on different types of physical media such as magnetic disk, optical disk etc. Each of these media has its own characteristics. These characteristics include access speed, capacity, data transfer rate, & access method.

○ The operating system implements the abstract concept of a file by managing mass storage media & the devices that control them.

○ Files are normally organized into directories to make them easier to use. Finally when multiple users have access to files it may be desirable to control by whom & in what ways files may be accessed.

○ The operating system is responsible for the following activities in connection with file management:-

1. Creating & deleting files.
2. Creating & deleting directories to organize files.
3. Supporting primitives for manipulating files & directories.
4. Mapping files onto secondary storage.
5. Backing up files on stable storage media.

4) I/O System Managment

- One of the purposes of an operating system is to hide the peculiarities of specific hardware devices from the user.
- For example, in Unix, the peculiarities of I/O devices are hidden from the bulk of the operating system itself by the I/O system.
- The I/O system consists of:
    1. A buffer caching system
    2. A general device driver code
    3. Drivers for specific hardware devices.
    4. Only the device driver knows the peculiarities of a specific device

5) Secondary Storage Management

- The main purpose of a computer system is to execute programs. These programs, together with the data they access, must be in main memory during execution.
- Since the main memory is too small to permanently accommodate all data and program, the computer system must provide secondary storage to backup main memory.
- Most modem computer systems use disks as the primary on-line storage of information, of both programs and data. Most programs, like compilers, assemblers, sort routines, editors, formatters, and so on, are stored on the disk until loaded into memory, and then use the disk as both the source and destination of their processing.
- Hence the proper management of disk storage is of central importance to a computer system.
- There are few alternatives. Magnetic tape systems are generally too slow.
- In addition, they are limited to sequential access.

○ Thus tapes are more suited for storing infrequently used files, where speed is not a primary concern.

○ The operating system is responsible for the following activities in connection with disk management

1. Free space management
2. Storage allocation
3. Disk scheduling.