Unit-II

Services and Components of Operating System

* Different Services of operating System:

1) User Interface:
- Every operating system has a unique user interface (UI).
- There are two types of user interfaces:
    1) Command Line Interface (CLI)
    2) Graphical User Interface (GUI).

- CLI deals with text commands entered by user.
- GUI provides a mouse based window and menu system. as an interface.

2) Program Execution:
- The operating system must have the capability to a load a program into memory and execute that program.
- the program must be able to end its execution either normally or abnormally.

3) I/O operations:
- A program which is currently executing may require I/O, which may envolve file or other I/O devices.
- For efficiency and protection, users cannot directly access the devices.
- So, the OS provides access to do I/O operation which means read and write operation with any file.

4) File System Manipulation:
- A file is used to store data.
- These files are stored in computers Secondary ~~main~~ memory.
- Files are organized into the directories for easy navigation.
- While executing a user program, it needs to read a file ~~and~~ or write a file.
- The os gives permission to program for perform operation on file.
- Permission's are of different types:
    1) read-only
    2) read-write
    3) denied.

- OS provides an user interface to the user to create/delete files and director
- OS also provides an interface to creat the backup of file.

5) Communications:
- During execution, the processes running on the same machine or different machines needs to be communicate.
- If the communication is across two different machines, messages transfer through network.
- The operating system manages the exchange of data and programs among different computers connected over a network.

- This communication is established using message passing and shared memory.

6) Error Detection :

- Errors can occur anytime and anywhere
- Errors may occurs within CPU, memory hardware and I/O devices.
- To avoid such malfunctioning system constantly monitors the system for detecting errors.
- If any error identified then OS takes appropriate action on it.
- It helps to run OS smoothly and efficiently.

* System calls :

- Users can get a service from the operating system by invoking system calls.
- System calls are functions which are written in assembly, C & C++ languages.
- System call is a communication made by OS with the processes.
- User should not bothered for writing their required program development environment. This basic functioning is provided by system programs.
- Example, Editors, compilers and shells.
- system programs are bundles of required system calls.
- In kernel mode, operating system

get an access to a privilege instructions and executes required services.
- System call is kind of interface or mediator between operating system & processes.

Types of system calls :

1) Process Control :
- Process control is the system call that is used to direct the processes.
- For example, creating, load, abort, end, execute, process, terminate the process, etc.

2) File Management :
- File Management is a system call that is used to handle files.
- For example, creating files, delete files, open, read, write, etc.

3) Device Management :
- It is a system call used to deal with devices.
- For example, request device, release device, read, write, etc.

4) Information Maintenance :
- It is a system call used to maintain the information.
- For example, set time or date, get

time or date, set system data, etc.

5) Communication:
- It is a system used for communication.
- For example, send and receive messages, etc.

System Calls	Windows	UNIX
Process control	CreateProcess() ExitProcess() WaitForSingleObject()	Fork() Exit() Wait()
File Manipulation	CreateFile() ReadFile() WriteFile() CloseHandle()	Open() Read() Write() Close()
Device Management	SetConsoleMode() ReadConsole() WriteConsole()	Ioctl() Read() Write()
Information Maintenance	GetCurrentProcessID() SetTimer() Sleep()	Getpid() Alarm() Sleep()

System calls Type	Windows	UNIX
Communication	CreatePipe() CreateFileMapping() MapViewOfFile()	Pipe() Shmget() Mmap()
Protection	SetFileSecurity() InitializeSecurityDescriptor() SetSecurity-Descriptorgroup()	chmod() Umask() chown()

* OS components :

1) Process Management :
- A program is nothing unless its instructions are executed by a CPU.
- A program in execution is called a process.
- To complete its tasks, process needs the computer resources.
- There might be exist one or more processes which requires same resource at the same time.
- Therefore, OS has to manage all the processes and the resources in an efficient way.

- Some resources may be required one process at a time to maintain the consistency otherwise, deadlock may occur.
- Following activities involved :

1) Scheduling processes and threads on the CPU's.
2) Creating and deleting both user and system processes.
3) Suspending and resuming processes.
4) Providing mechanisms for process synchronization.
5) Providing mechanisms for process communication.
6) deadlock handling for processes.

2) Main Memory Management :
- Main memory is an important resource of computer system that's the reason we need to managed it by OS.
- To execute any program, user needs to store it in main memory.
- Main memory is volatile and has a limited space. therefore, user needs to store his programs in secondary-storage.
- Every process needs main memory to execute.
- There are many processes present at a time in main memory and each process has different address space.

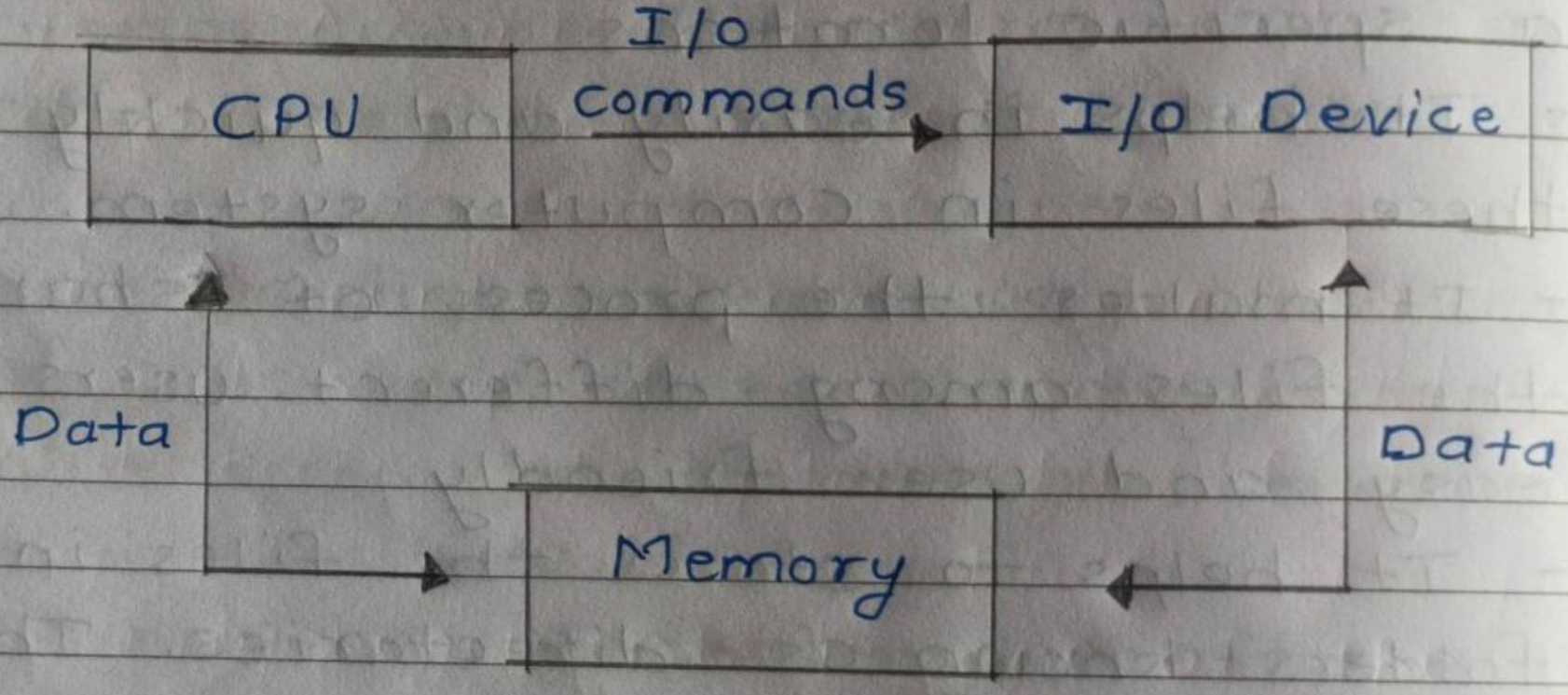
- So, there is a need to manage the main memory. Therefore, we use main memory management.
- After complete execution of program moving out it of main memory and swapped out processes suspended for completion of I/O from secondary storage to free main memory for other processes.
- New processes are required to be loaded in the main memory.
- If the main memory is sufficient to hold all process swapping between main memory and secondary storage is done.
- So, OS needs some strategy to handle the memory or to manage the memory.
- Activities involved:

1) Allocation of memory to the processes.
2) Free the memory ~~after~~ from process after completion of execution.
3) Reallocation of memory to a program after used blocks becomes free.
4) keep track of memory usage by the address.

3) File Management :
- A File is a collection of related information which is stored on secondary storage.
- File management is the process of manipulating files in computer system as well as it is the process of creating, modifying and deleting files.
- It helps to create new files in computer system and placing them at a specific locations.
- It helps in easily and quickly locating these files in computer system.
- It makes the process of sharing of the files among different users very easy and user friendly.
- It helps to stores the files in seperate folders known as directories. These directories help users to search file quickly or to manage the files according to their types or uses.
- It helps the user to modify the data of files or to modify the name of the file in the directories.

4) I/o system management :
- I/o is ~~the~~ one of the main function of os which controls the I/o devices.
- It should have to issue commands, catch interrupts and handle errors.
- It also provides an interface between

the devices and operating system.
- It is simple and easy to use.
- Operating ~~ope~~ system operates with devices through I/o.
- It uses different drivers to interact with OS.
- To handle these operations we need some strategy known as I/o management.
- Diagram:



5) Secondary storage management:
- The most important task of a computer system is to execute programs.
- These programs help you to access the data from the main memory during execution.
- This memory of the computer is very small to store all data and programs permanently.
- The computer system offers secondary storage to back up the main memory.

- Today mordern computer use hard drivers, SSD's as the primary storage of both programs and data.
- The secondary storage management also works with storage devices, such as USB flash drives and CD/DVD drives.
- Programs like assemblers and compilers are stored on the disk until it is loaded into memory.
- then the disk is used as a source and destination for processing.
- Functions:
    1) Storage allocation
    2) Free space management
    3) Disk scheduling.

* Use of operating system tools :

1) User Management :

• UNIX OS has three types of user accounts :

1) Root : This is system administrator and it is also called as superuser. root can run any command.

2) System Accounts : These accounts are used for system related components.

3) User Accounts : These accounts belong to user and group of user. and they have limited access of system files & directories.

- User management is one of the important tools that os has provide.
- Operating system can be Multiuser or single user.
- In case of Multiusers, the level of rights and privileges are different. so, operating system needs to keep record of everything related to the user
- It could be even login and logout times.
- OS provides tools to create users, modify them or delete them from the system.

- Managing users is nothing but managing different user accounts.
- It also ensures that required and limited access to the system.

- Command:

1) To add new user:

Syntax: adduser <username> or
useradd <username>.

Ex. adduser SURYA // invalid
adduser surya // valid.

2) to set password:

Syntax: passwd <username>

Ex. passwd surya

3) to delete user:

Syntax: userdel -r <username>

4) to modify user attribute/properties:

Syntax: usermod -c <newName> <oldName>

Ex. usermod -c 'suraj' surya

2) Security policy:

- Every os has standard security policy.
- Implementation of most of the security policies depend upon the organizations.
- Os security policy helps in protecting systems from various threats to the system like malware, spyware, ransomware viruses, worms and many more.
- Security policies provide all posible preventative measures and techiques to keep os safe.
- Major areas where os security policies used are -

1) System updating or patching system regularly.
2) Software installation or updation of various antiviruses.
3) Firewall installation and management of incoming and outgoing traffic on networks.
4) Provide security to users account.
5) Deciding what kind of data, users and hardware is store in the system.

3) Device Management:
- Device management is needed for smooth functioning of computer system.

1) - In Linux, every device is a file. Like files, it open the device, write data on it and read data from it. and then close it.
- Device drivers are responsible for treating every device as a file.
- When OS kernel writes data to particular device then device driver of that device takes appropriate action for that device.

2) Device files:
- Applications are access these devices by treating it as a file.
- These files are device files.
- They are present in /dev directory.
- The ls command is used to list all the files present in /dev directory.
- Ex. ls -l /dev
- The /dev directory contains files for all possible devices.
- Each device is mapped to a specific device driver through major and minor numbers.

Block devices:
- The first letter b in ~~listing~~ devices file indicates that it is a block device

Character Devices:
- The first letter c in device file indicates that it is a character device.
- It accepts or send data on byte at a time.

- Device management also includes:
1) Keep track of present devices.
2) Resources and device allocation.
3) choose efficient ways to allocate devices to different programs or processes.
- Deallocate the device.

4) Performance Monitor:
- Performance monitor supervises performance of the system.
- It monitors different activities like memory usage and CPU Processing.
- It also monitors performance of the hardware, software and applications.
- It analyses the different problems in the system and can find out by monitoring function.
- Commands:

1) vmstat: Virtual memory statics
The vmstat command reports information about processes, memory, paging, block IO, traps and cpu activity.
$ vmstat 3 6

2) top : Process activity monitoring command.
- top command display Linux processes.
- It provides a dynamic real-time view of a running system.
- By default, it displays the most CPU-intensive tasks running on the server and updates the list every five seconds.
$ top.

5) Task Scheduler:
- Task scheduler can be called as CPU Scheduler.
- Throughout the lifetime of process it migrates or travels to the various scheduling queues.
- An OS should select processes for scheduling purposes from these queues in some manner.
- The selection procedure is done by schedulers.
- In a batch system, there can be many processes which can be executed immediately.
- In batch systems of processes are more than they are spooled to the mass storage device like disks in which they are kept for the later execution.
- The scheduler which picks up job from this spool and loads into main memory for execution is called long-term scheduler.

- There is another scheduler which selects the job or processes which are ready to execute From this pool and allocates the CPU to one of them is called short term scheduler.