(Operating System - 22516)

Unit II : Services and Components of Operating System

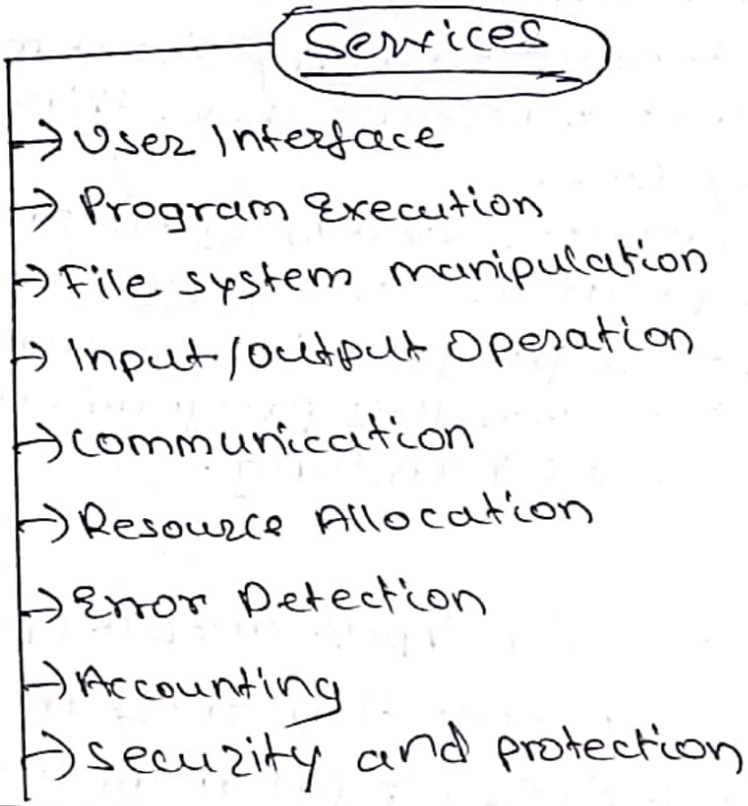
— TRANJAL SAVE (TY-CO)

2.1 : Different Services of Operating System.

An operating Systems provides different kinds of services to both users and to programs as well.

It also provide application programs (that run within an operating system) an environment to execute friendly

It provides users the services to run various programs in a convenient manner.



1) User Interface

User interface is essentical and all operating Systems provide it.

User either interact with operating system through command-line interface or Graphical User interface also Batch based interface.

Command-line interface : You type any command and the computer responds to it

Batch Based : Instead typing one command you make file that contains many command and then

execution.

Graphical User Interface: unlike other, you can interact with the system with graphical component such as windows, icons, buttons & menus.

Program Execution (harddisk → main memory)

* Operating System provide environment for an execution of program.
* C.P.U can't access programs or instruction from secondary memory as size of it is more.
* So, main memory is small memory. O.S brings program to main memory for execution.
* The user does not have to worry about memory allocation or deallocation because these things are taken care of by O.S.
* The purpose of computer system is to allow users to execute programs in efficient manner.
* Major activities: Loads program into memory, Executes the program, Handles program execution mechanism for deadlock handling.

I/O Operations

I/O operations stands for Input/output Operations. When program is in execution they may require some I/O devices or program may require files.

It is a responsibility of Operating System to allocate the I/O device or file to corresponding program.

For example, taking a printout, It an duty of O.S to allocate printer to file

User don't do I/O permission directly

Scanning document, it duty of O.S to allocate scanner to file

File System Manipulation

While working on the computer generally a user is required to manipulate various types of file. It means to perform various operations on file.

File system, is if we want to manage 100 or thousands of file we use File System manipulation.

File system is collection of directories, directory contain sub-directories, directory contains files, file contains some text we can perform several operations on files such as creating an file, opening file, read & write file, append files, deleting the files, Renaming the file etc.....

It maintains details of files or directories with respect their respective details.

Communication

The Operating system manages the communication between processes.

One process can communicate with other process with the help of operating System.

may both process resides in same computer or may resides in other computer

So, one process communicate with another process is known as interprocess communication.

Communication may be implemented by two method either shared memory or message passing.

Communication between processes includes data transfer among them.

Error detection

Error can occur anytime and anywhere.

Error is an sudden or abnormal event that make changes in system.

An Error may occur in CPU, I/O devices or memory hardware.

monitoring the system frequently is an job of operating system and if there is any Error, OS should be correspond to particular error.

Example, mouse not working, error is files etc.....
resource problem.

Resource Allocation

We have several resources such as hardware resources and software resources.

C.P.U, ram, hard disk it is an resource software resources such as files.

The mechanism of to provide all these resources to program is Resource Allocation

Example, if program needs some I/O, memory the providing work of resources is done by ~~Re~~ O.S by Resource Allocation.

It is duty of O.S
providing disk, memory etc... files.

multitasking environment

↳ OS manages all kinds of resources using schedulers

↳ CPU scheduling algorithms are used for better utilization of C.P.U.

counting: Assume we have network, a collection of computers so multiple persons can work with computer.
multiple persons will be in network.
So, which persons will using which resources, will monitored by OS
Example, P1 uses printer frequently
P2 uses scanner frequently

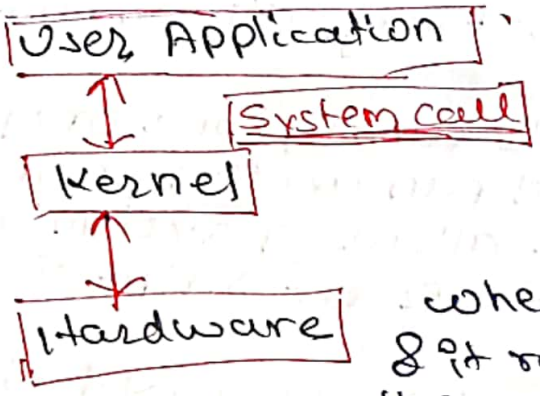
Protection & security: Anyone outside organization cannot access the data.
It is duty of operating that unauthorized user cant access data.

2.2 System Calls - Concept, types of System Calls.

What is System Call?

The system call provides an interface to the Operating System services.

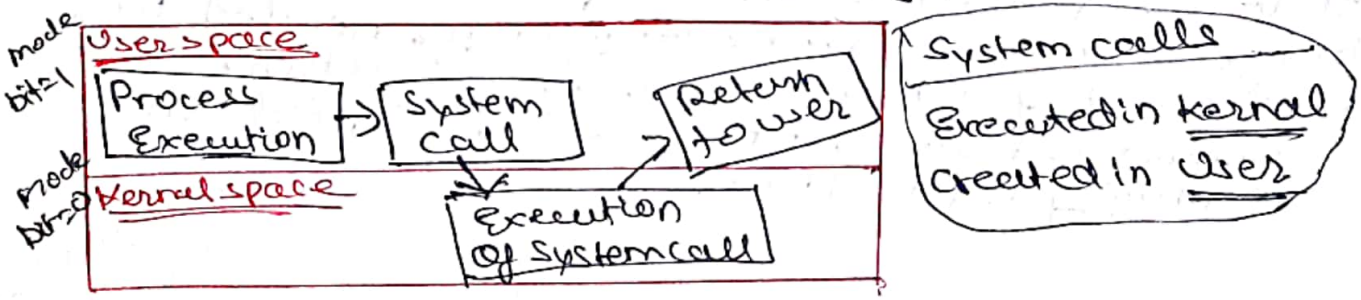
In short, it is an interface between process & Operating system. Also it will act as an interface between application & kernal.



A system call provides the services of OS to the process via API (Application process Interface)

when process is being executed & it requires any resources, the process will create a system call (interuppt) and sends to kernal.

Memory is divided into two categories.



System calls are the only entry points to the kernal space.

For example, user request any operation, to do the in user space system call is generated for resource allocation. and it gets executed in kernal space based on priority and its an interrupt that kernal allocates and return to user in user space.

In kernal space, there is system call table which stores all the system calls such as database management.

Types of System Calls.

① Process & Job control

A running program needs to be able to halts its execution either normally (end) or abnormally (abort).

If program discovers an error in input & wants to terminate abnormally, it may also want to define error level.

When a process or job is running one program, it might need to start and run another program. This is useful because it allows a system to follow instructions from a user or script to run specific tasks.

If we start a process or job we should able to control its execution.

We may also want to terminate a job or process that we created (terminated process). If we find that it is incorrect or no longer needed we need waiting time to finish execution.

Another set of system calls are helpful in debugging a program.

Examples of Process Control System Call

- end, abort
- load, execute
- create process, terminate process
- wait for time, wait event, signal event
- allocate and free memory
- get process attributes, set process attributes.

(2) File Management

System calls which deal with operations related to files fall under this type.

System allows us to create and delete files. For creating and deleting operating system call requires the name of file and other attribute of file.

File attributes such as file type, file size, protection codes etc.----

System access these attributes for performing operation on file and directories.

Once file is ~~of~~ created, we can open it and use it. System allows performing reading, writing or repositioning operation on file.

Examples → create file, delete file
→ open, close
→ read, write, reposition
→ get file attributes, set file attributes.

(3) Device Management

When process in "running" state, it require several resources to execute. These resources include main memory, disk drivers, files and so on.

So system calls are used for asking permission from kernel. If resource is available, it is assigned to process.

↳ Once the resource is allocated to process, process can read, write and reposition device.

→ Request device, ~~release~~ release device
→ read, write, reposition
→ get device attributes, set device attributes

④ Information Maintence

We need to keep information up to date so th
System calls helps us to do that.
Transferring information between the user prog
and operating system requires system call.
System information includes displaying curren
date and time, the number of current users
the version number of operating system, the amou
of free memory or disk space and so on.
Operating system keeps information about all
its processes that can be accessed with system
call seech as get process attributes and set
process attributes.

→ 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.

⑤ Communication

Process in system, communicate with eeech other.

Communication with each other is done by using two models: message passing & shared memory.

For transferring messages, sender process connects itself to receiving process by specifying receiving process name or identity.

Once the communication is over system close connection between communicating processes.

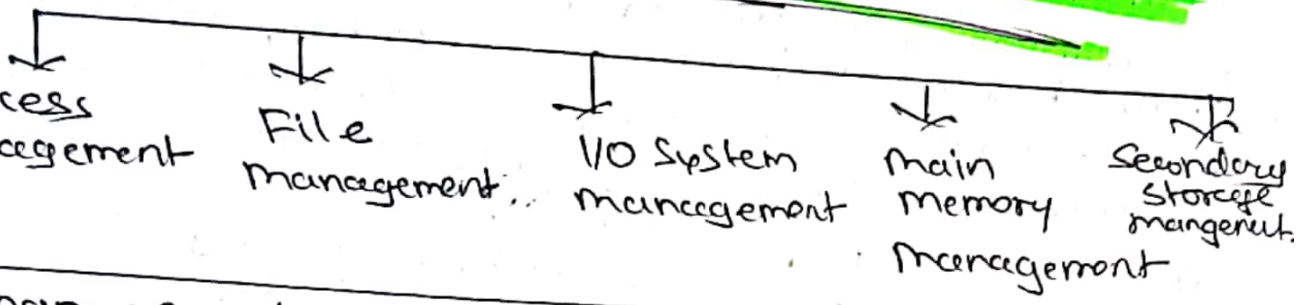
They need to communicate with each other for many reasons like if they need certain resources which is held by another process.

→ create/delete communication connection
→ send, receive messages.
→ transfer status information
→ attach or detach remote devices.

... management

... virtual devices

Components of Operating System



PROCESS management

A program is set of instructions.
When CPU is allocated to program it can start its execution.

A program in execution is process. The process which runs simultaneously are managed by Process management.

Example, word processing system run by user on PC is a process.

A process needs various system resources CPU, time, memory, file and I/O devices to complete job execution.

These resources can be given to the process when it is created or allocated to it while its running.

The process management activity involves :-

1) Creation, execution and deletion of user and system processes.
2) A mechanism for Deadlock handling.
3) A mechanism for process communication.
4) A mechanism for process synchronization.
5) Control the execution of user applications.
6) Suspension and resumption of processes.

Main-memory management

Main memory is an important resource of computer system that needs to be managed by operating system. To execute the program (user needs to keep the program in main memory.

Main memory is volatile.

Every process needs main memory since a process code, stack, heap and data (variables) must all reside in memory.

Main memory is repository of quickly accesible data shared by CPU & I/O devices.

The central processor reads instructions from main memory during the instruction fetch cycle and both reads and write data from main memory during data fetch cycle.

The main memory is one of large storage device that CPU is able to address and access directly.

main memory activities

- Allocation of memory to processes.
- keep track of memory usage by the process.
- Allocating and deallocating memory space as needed.
- Free the memory from processes after completion of execution.

File management

A file is a collected of related information defined by its creator.

Computer can store files on disk (secondary storage) which provide long term storage.

Some examples of storage media are magnetic tape, magnetic tape, magnetic disk and optical disk.

Each of these media has its own properties like speed, capacity, and data transfer rate and access methods. A file system normally organized into the

management

directories ease their use.

These directories may contain file and other directories.

Activities O.S responsible for file management

- Creation and deletion of files.
- Creation and deletion of directions
- mapping of file onto secondary storage.
- Backup of file on stable storage media.
- support primitive for manipulating files and directions.

I/O device management

- As we know that I/O is one of the main functions of an operating system and it is used to control the entire computer's I/O devices.
- I/O device management provides an environment for better interaction between system and I/O devices (such as printers, scanners, tape drivers etc---)
- To interact with I/O devices in effective manner, the O.S uses some special programs known as device drivers.
- Device Driver take data that operating system has defined as file and then translate them into streams of bits or series of laser pulses (in regard with laser printer).
- Subsystem contains of several component.
  - Buffering, Caching and Spooling (memory mangent component)
  - Device driver interface
  - Drivers for specific hardware device.

Secondary storage management

The computer system provides secondary storage to back up main memory.

Secondary storage is required because main memory is too small to accomadate all data and programs, and the data that it holds is lost when power is lost.

Most of programs including Compilers, Assemblers, word processors, editors etc.. are stored on disk until loaded into memory.

Secondary storage consist of tapes, drives disks and other media.

O.S Responsible for following activities.

- Free space management
- Storage Allocation
- Disk scheduling.

Use of Operating System tools:

Tools

1. User managements.
2. Security policy
3. Device management
4. Performance monitor
5. Task scheduler.

ser Management

1) As Administrator, it is your job to create and manage the accounts for all required users.
2) User management includes everything from creating a user to deleting a user on your system.
3) It also assigning the passwords to create users using "passwd" command.
4) User management can be done in three ways on Linux system.
5) Command line tools include commands like useradd, userdel, usermod, passwd etc.... These are mostly use by the server administrators.

Useradd : with this command you can add user.

Syntax: useradd -m -d /home/<userName> -c "<userName>" <userName>

Example: user add -m -d /home/xyz -c "xyz" xyz

useradd -D (Display file)

Userdel : To delete a user account userdel command is used.

Syntax : userdel -r <userName>

Example: userdel -r xyz

Usermod : Modify the properties of existing user

Syntax : usermod -c <newName> <oldName>

Example : usermod -c 'yppoly' john

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passwd : A user can set password. old password has to be type twice before entering new one

Syntax: passwd <userName>
passwd yppoly

② Security policy

1) Install and Update Anti-virus software:
Regularly to protect against malware and other security threats.

2) Keep system patched and updated which ensures OS application has latest security patches.

commands for updates

```
$yum update
$yum check-update
```

3) User management policies.
Protect user accounts by limiting access to essential users and maintain proper user priviliges. Implements policies such as password complexity and account inactivity timeout to strengthen security.

4) Install and configure a Firewall to monitor and control all incoming and outgoing traffic.

5) Account Lock and Unlock
Instead of removing user accounts, you can lock them temporarily as needed.

$ passwd -l accountname | Lock account

6) Disable IPv6 (if necessary), because many applications and policies do not yet required yet.

```
NETWORKING_IPV6=no
IPV6INIT=no
```

7) Implement Strong Password Policy.

Device Management

1) managing all hardware or virtual devices of Computer System.
2) Allow interaction with hardware device through device driver.
3) used to install device and component-level drivers as well as associated software.
4) keeping track of all device's data and location.
5) monitoring device status like printers, storage drivers and other devices
6) Allocate and deallocate devices as per process requirement and prority and either temporarily or permanetenly depending on condition dellocate.

(4) Performance monitor

1) Monitor various activities on computer such as CPU or memory usage.
2) Used to examine how programs running on their computer effect computer's performance.
3) Used to identify performance problems or bottleneck that affect operating system or installed applications.
4) Observe effect of system configuration change

vmstat, top, free, iostat, netstat

(5) Task schedules

1) Assign processor to task ready for execution.
2) Executing predefined actions automatically whenever certain set of condition is met.
3) Schedule task on CPU. which task to run first, which has high priority, which has low latency is decided by schedulers.

4) Schedulers aim to provide fair access to system resources among competing processes or users.

5) Used to select next job to be admitted into the system and the next process to run.