

Introduction to operating system

what is OS (or) define OS (or) Goals of OS

- * operating system is nothing but a program
- * program contains a set of related instructions
- * program contains a collection of instructions
- * program means software
- * so operating system ~~called~~ is a software.

- * Two types of softwares
 - 1) system software
 - 2) Application software

Application software: means a if user develop application is called Application software (or) Application program

system software: operating system is a system software.

we can use the system (or) computer in effective manner with the help of system software

- * OS is a system software
- * compiler is a system software
- * Assembler is a system software
- * Text editor are system software
- * NotePad, WordPad are also system softwares, we can utilize the computer in effective manner

Definition of operating system

operating system acts as an interface between user of computer & computer hardware

- * without installing os we can't do anything. so computer is dummy component without installing a ~~computer~~ operating system.
- * we can do several activities only by installing operating system.

Goals of operating system

1. Execute user program
2. Easy to use computer
3. utilize Computer Hardware in effective Manner.

1. Execute user program

operating system provide environment to execute user programs. actually os can not execute a program

* The program are any task executed by 'CPU'; it is nothing but processor.

* Generally if we take any programming language, it may be c or c++ or Java or Python, etc or any program if we after typing the program, saving the program.

The corresponding program is saved in hard disk ~~etc~~ but Secondary memory

* whenever we save the program operating system save the program in hard disk, during compilation also the program will resides hard disk only. but at the time of execution the os transfers program from hard disk

to main memory. because CPU can execute a program when the program resides mainly memory only.

* CPU can not access secondary memory, CPU can not access hard disk. only access at main memory only

* So, saving the program in hard disk, transfer program from hard disk to main memory, after execution is over once again the program transferred ^{from} main memory to hard disk

* In order save ~~the~~ some other program in main memory because the size of main memory is very very small.

* main memory stores limited program only.

* So all those things done by operating system only so OS provides environment to execute programs.

Easy to use computer

* we use computer in effective manner only by OS

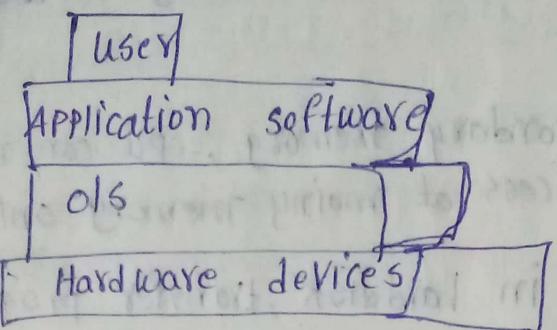
* As a user we assume that given a printout. Now it is the beauty of OS to allocate printer

* As a user we have done some scanning. Now also the responsibility of OS to allocate scanner to our program / file

utilize computer Hardware in effective Manner

* we have various hardware components such as I/O devices Keyboard, mouse, printer, scanner so all those hardware components you will be utilize more effective manner by only operating system.

Computer components



Hardware devices : Physical components present in the computer we utilize all those hardware components use effectively only by OS (or) with help of OS.

Application software : means the programs which are developed by users . so users develop the ^{API's} software for their requirement

operating system

~~operat~~ we ~~at~~ mainly focus on OS
OS from user view , system point of view

user view

Easy to use computer → In goals of OS 2nd part

what is an OS from system point of view :

1. Resource Manager / Allocator

~~control~~ Program

OS Allocates resources to the corresponding program

we have softwares / hardware resources as well as software resources

Key board Mouse Printer responsibility to Allocating os takes programs resources to the program Allocate All

2. Control Program :

OS controls the program , it acts as a control program to that OS controls the execution of program . so that one pro

- can not interfere with another program. so those two programs ~~execute~~ differently will be executed separately.
- * one program never interferes with each other. but os takes responsibility executing those programs concurrently.
 - * so this is about some important points regarding what is operating system.

operating system Services

we know os is an interface b/w user of computer & computer hardware without installing operating system we can't do any activity in the computer.

* services that are provided by os. mainly os provides 8 services

go to Goals of OS for ref

1. Program Execution : os provide environment for execution of programs. it may be any programming language like c, c++, c#

2. I/O operations : when a program is in execution that program may require an I/O device (or) that program may require file. it is responsibility of that operating system to allocate the I/O device or file to the corresponding program. Ex: taking a printout. it is duty to the os to allocate printer to the corresponding file.

Ex: scanning. it is duty to the os to allocate scanner to the corresponding file.

so I/O operations taken by operating system

3. File system manipulation :

if we want to organize a hundreds of files or lakhs of files is called file system.

* file system is a collection of directories again the directory may contain sub directories and directory may contain collection of files.

* Every file contain some text we can perform several operations on the files such as creating a file, opening a file performing the read operation, write operation, execute operation, appending operation in order to do all things 1st need operating system.

* OS take care of performing all these operations

4. Communication:

one process can communicate with another process with the help of OS only. Here those two process may reside in the same computer or those two processes may reside in different computer.

* In some occasions one process may leads to exchange information so that process ~~will~~ some information with other process that should be done with the interprocess communication.

* Interprocess communication is implemented with message passing and sharing of information that we will see in interprocess communication.

* So (IPC) Inter process communication so that service will also be taken care by the operating system

5. Error detection

Every time OS will detect / will monitors whether there are any errors or not. If there is error in corresponding resource or not.

* It checks any error in the CPU or it checks whether is there any problem with mouse, keyboard, it is the responsibility of the OS to detect errors in hardware devices and software devices if they are any errors.

* OS will take appropriate action

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6. Resource Allocation

* we have several resources such as hardware resources & software resources

* we have CPU, main memory, hard disk, software resource like files

* OS allocates all these resources to the program

* Is that beauty of the OS to manage the memory, to manage the disk, to manage the I/O

* All these resource management done by OS only

7. Accounting

let us assume that we have a network, so we know what is Network means collection of computers, multiple persons can work on the computer with

* multiple persons work in the Network so OS will monitors so which person ~~uses~~ ^{uses} which resources. let us assume that person 1 ~~used~~ ^{used} printer very frequently, person 2 used scanner very frequently

* so OS will calculate ~~those~~ (or) monitors all those data which person used which resources frequently

8. Protection & Security

so OS will also takes care about protection & security

* so that no one can access our data to the outside persons can not access our data

* if we take Unix operating system in order to provide the protection & security. we use CII more commands

* Several commands are there we have to read permission, write permission, execute permission

* Unix OS will provide services very efficiently when compared with windows OS

* It is responsibility of OS to provide protection & security to our data. unauthorised persons can not access or

data so, these are the various services which are provided by the operating system

Types of operating system

OS is an interface b/w user of the computer and computer hardware. without installing OS we can't do any thing in computer.

7 Types of operating systems are there

1. Batch system

The user uses punch cards. The user provide the program or job information in the form of punch card after writing the corresponding program or job details in the punch card all the jobs will be submitted to the computer operator.

* Here the problem with this approach is user can not interact with computer directly in b/w user and computer we have computer operator.

* let us assume the user want to execute 10 jobs or 10 programs so in that form of punch card all that information will be supplied to the computer operator

Ex :- J1 }
J2 } First five jobs executed by → These are grouped into B1
J3 } using cobalt programming lang
J4 }
J5 } Last 5 jobs executed by → so computer group all these into
J6 } fortran lang Batch called B2

Here all the information will be available in the form of punch card. punch card that information will be available

* After that computer operator will do is, computer operator will group all these ^{jobs} into batches, According to the requirement

* 1st computer operator will provides B1 jobs information to the computer. Now it is responsibility to the computer

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to execute B_1 jobs. After producing the output

* The computer operator will supply Batch 2 information,
to the corresponding computer

* so computer will execute and produces the given output
to the user

* The Biggest ^{major} problem of that this Approach is . let us assume
that CPU will execute B_2 jobs and assume
that all these jobs are waiting for some I/O operations

* during I/O operations CPU will set as ID but during that
time it is not possible to allocate that OS to some other
Batch. so when OS allocate CPU to some other batch
only after completing execution of these B_1, B_2 batches. Then
only OS allocate CPU to some other batch. This is the
problem here

* Most of time CPU will sets as ID while doing the I/O operation

* we can overcome this problem with the help of system, ie
multi-programmed System

2) Multi-programmed system

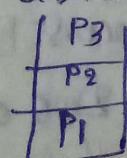
* multi-program means placing multiple programs

* Multi-programmed system → means we can place multiple
programs in the main memory and we can execute all the
programs simultaneously. so it is about what is multi-programming

* Keeping no. of programs in the main memory and executing
all those programs simultaneously

* Major advantage of this Approach is CPU utilization. we can
utilize the CPU in effective manner, if we use multi-programming
operating system

* let us assume that in main memory we have 3 process are there



* assume that OS allocates CPU to process P1. now CPU executing process P1 & after some time P1 needs some I/O operation. during I/O operating there is no need of CPU. CPU will sets ID

* what the CPU will do is. CPU control will be shifted to 2nd program

* now CPU executing the process P2. let us assume P2 also require some I/O operation. so OS will allocates CPU to some other process.

* so this is advantage here, while 1 process is waiting for I/O operation. OS allocates CPU to some other process like wise we use the efficiency of CPU effective manner with the help of multiprogramming system.

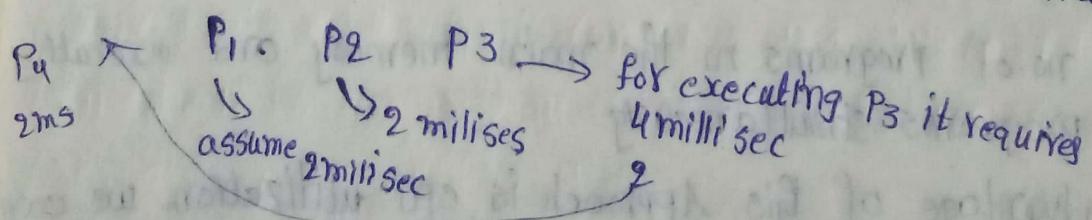
3. Time sharing system (or) Time shared (or) multitasking system

* Time sharing means it is an extension to the multiprogramming system

* so here also main memory may contain multiple programs to all those are to be executed simultaneously.

* Time sharing the name specifies CPU allocate a time to all the processes

* let us assume that 3 process are there in main memory



* let us assume OS allocate 2 millisec to all processes. so CPU allocate each process only for 2 millisec only.

* assume that 1st CPU starts executing process P3 here time is 4 millisec. But CPU can execute upto 2ms only. so P3 executes 2 millisec remaining time is one

will be append to the beginning of the list. so the remaining time is 2ms. so now CPU executes P₂. P₂ requires only 2 milisec there is no problem if it is executed.

then CPU complete P₂ executes after P₁ completes, next complete CPU P₃ i.e 2MS.

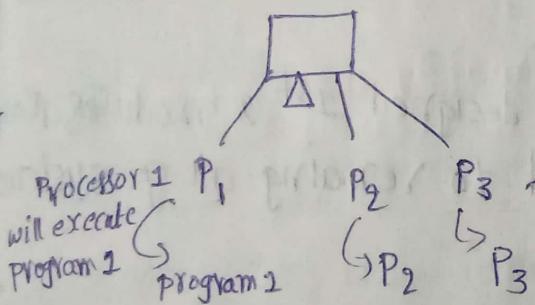
* so we can conclude all the process completed their execution

* so, this is about time sharing system time will be shared among all the processes that are in the system

4. Multi-processor system

The name itself specifies the meaning instead of single processor, multiple - processor are connected to the same computer

* Here we have a single computer let us assume that 3 processors are connected to the corresponding processor



All these 3 programs executed concurrently, so what will happen it increase the output

They are 3 advantages are there are follows

1) It increases throughput → means output

* in less span of time we will get output. when we have only 1 CPU that CPU has execute all these 3 process concurrently

2) Economy

* it is very cheaper process. because 3 processors attached to the single computer only. we are not using 3 different

computers. we are using only a single computer and
processors attached to the single computer

3) Reliability

Suppose due to some problem if one process is failed no problem. the remaining processors will execute the corresponding task

5. Distributed System (or) Networked System

* The name itself specifies the same information will be distributed to all the systems in the corresponding Network

Ex: 10 persons working on a same project. let we have a Network with 10 systems assumes that 10 persons working on that Project

* The project information will be distributed to all the 10 persons.

* let us assume P1 that P1 has designed 1st 2 modules these 2 modules hold will be distributed to remaining all 9 systems also. assumes that P2 d.

* assume that P2 designed module 3 & module 4 so that information is distributed to all the systems also, due to some problem if the first computer and 2nd computer is trashed / failed. it is no problem because their copies available in remaining 9 computers also.

* So the same information is distributed all the system in the network due to any problem if one or multiple system fails. because the same data is replicated in all the systems also, that same data is available in all systems also.

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6. Real time system

- * Real time os is mainly useful in order to implement real time Applications
- * if we want to perform an application in a specific period of a time for specific amount of time. Then we have to use Real time operating System
- * There are 2 types of Real time os are there

- 1) Hard-real time operating System → that Application should be executed within that stipulated amount of time only
- 2) soft-real time operating system otherwise the System will fail best example of hard os

if there is problem, there is no problem
ex: ~~within~~ within stipulated we did not get off
there is NO problem. Best ex is we take aeroplane riding
weather forecasting information sensor is fail unable to drive.
due to some problem if system fail there is NO problem.

Functions of OS (or) operating system components

1. Process Management

→ goals of os

- * process can be defined as a program in execution
- * in connection with process management os will do several activities
 1. Create a process
 2. Suspend a process
 3. Resume a process
 4. Handle inter process communication
 5. Process synchronization will also handle by os in connection with process management.
 6. Deadlocks are also handled in connection of process management.

2. main - memory management

- * when OS loads program from hard disk to main memory
- * at the execution time OS loads program from hard disk to main memory because CPU has to execute the program/process. Will the CPU can access Main Memory only, CPU can not access Hard Disk, Secondary Memory.
- * so that is the first task, in connection with main-memory management OS will perform some activities
 - 1) OS loads the program into ^{main} memory from the hard disk during the execution
 - 2) once all those operations are over it de allocates the memory (i.e.) OS transfers program from main memory to secondary because the size of main memory is very very small whereas the size of hard disk is very larger once the execution is over OS has to transfer the program/process from main memory to secondary. So that OS ~~in order to store~~ may use that space in order to store some other programs

* In order to Allocate ~~process~~ from management memory for the corresponding process

* OS mainly uses 2 Approaches

1. Contiguous Memory Allocation

a. MFT (Multiprogramming with fixed tasks)

b. MVT (Multiprogramming with variable Tasks)

* whereas olden days OS uses these approaches

* But nowadays

2. Non contiguous Allocation

a. Paging

b. Segmentation

* In OS we have a chapter about this topic

3. Secondary Storage

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3. Secondary memory management

- * contents of the main memory is lost when we switch off the computer. When the computer is turned on the computer contents also
 - * we need a device our information stored permanently for that purpose we are using secondary memory
 - * The best example of secondary memory is hard disk
 - * hard disk is non-volatile memory (i.e. our data is stored in computer permanently)
 - * In order to manage secondary memory we have 3 approaches

1. contiguous allocation

2. linked list allocation → OS can stores the corresponding program in the hard disk.

3. Indexed allocation

In this ~~new~~ way of managing secondary chapter. ~~This~~

- * In OS we have chapter disk Management

4. File management

* file means a collection of related information. if we take employee file it contains employee related information.

* file means a collection of ^{lines,} words, characters, byte, bit.

* in connection with file management os will do separate tasks

Creating a file

deleting a file

creating a directory → directory means collection of files

deleting a directory

Opening a file → open operation, read op, write op, copy, append, merge op

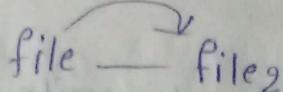
I/O Management

- * I/O stands for input output devices
- * Input device is useful in order to provide information
- * Output device is useful in order to display information on computer
- * The commonly used input device are keyboard, Mouse
- * The commonly used output device are printer, scanner
- * Here every input output device contain a device driver file
it is a software, it is a program
- * Keyboard contain some driver file, printer contain some driver file, scanner contain some device driver file like that
- * Let us assume that we given a printout. It is a responsibility of the OS to allocate the printer. For that purpose 1st operating system sends a signal to the device driver of printer driver file. With the help of printer driver file we give the instruction to the printer so that will perform so printer will perform the print
- * So we can work with the corresponding component only with help of driver file only
- * So in b/w the OS and I/O device we have a driver file
- * The driver file acts as a mediator b/w these two.

System calls in operating system

* System call is an interface b/w process & os

* let take example reading data from file and data from file2



we have to use several system calls

1. we open file1 in read mode because read the content of file1

2. * we have to open 2 system call open & read system call

* so Read a character from file1 check whether not end of the file character or not. if it is not the end of file character

→ The last character of file

then we to copy that file1 to file2. it means we have write char to file2

* We must use write system call.

- open system → Read System call → write system call → close System call

once all the
open over
to close f1
& file2
use

* system call are mainly classified into 5 Types.

1. Process control System call

2. File management System call

3. Device management System call

4. Information Maintenance System call

5. Communication System call

i) Process control System call

process means a program during execution

create a process → loading a program from Secondary memory to main memory

→ load a process

Execute open, wait, signal, allocate & free memory. all the open over we have to → terminate a process.

2. File management System calls

create a file, delete, open, read, write, close system call

3. Device Management

Device mean I/O Devices

request device, release device, read, write system call

to one file
at a time

it release

4. Information maintenance

It is mainly useful for in order to get information about computer

inf about process, inf about file
get time or date, set time or date, get system data, set
System data, get process file, device attributes, set process
attributes, file attribute are device attributes also these System
calls are used for information

5. Communication

one process can communicate with another process with the
help of IPC (Inter process communication)

during those two processes may ~~be~~ resides in the same
system (or) one process system may reside another system
In that occasion these System calls are used

create, delete communication send, receiver.

Application
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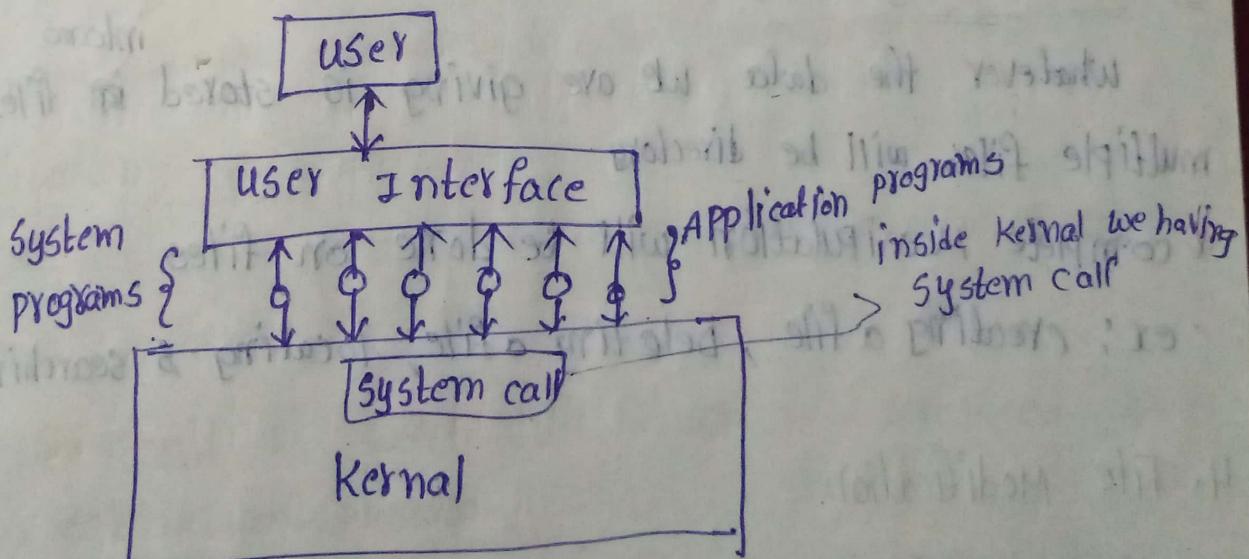
System Programs

Application software: Provides services for the user
System software: Provides services for another software
ex: OS

System program

it provides environment to develop & execute the program.

- * This particular system ^{program} will live in b/w the user interface and the system call.
- * users can't access the system call directly. So with the help of system program user can interact with the System call.
- * That's why the system program will live in b/w the user interface and system call.



- * The system program are classified into different types.

Types of system program

1. Status Information

These types of programs provide the information regarding the status.

ex: according to System date, time, Available memory, How many users loged in.

* All the information will be given by these system call.

2. Communication

Here a virtual communication done ~~between~~ among processors and ~~with~~ users.

~~Ex:~~ virtual connections will be provided among processors & users.

Ex: Remote login, Email, Web browser

3. File Management

whatever the data we are giving is stored ^{in terms} in files. multiple files will be directory

* complete manipulation will be done on files

Ex: creating a file, Deleting a file, locating & searching

4. File Modification.

file modification means the data on files will be get modified.

* The data will be Modified with the help of Text editors and commands

Ex: Text editors, commands

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⑤ Program Loaded and executing

one program will be written. that can be executed by program
→ First the program should be loaded into Main memory
→ The program will be executed

ex: Linkers & Loader

This take care about loading the program into main memory & linking all the header files & object files to combine a single object

6) programming language support

We have more number of languages so if we want to execute any program Compulsory language support will be done.

* we can achieve with the help of

ex: compiler, Interpreter, Assembler, Debugger

→ with the help of these any programming language will be executed.

→ provides additional features to the programming language.

Application programs

This is some more different from system programs

1) provides service for user

* if we want to write document we need some processor i.e word processor

ex: word processor, spreadsheets, video player, audio player

* will come under this Application programs

These are different types of System programs used in operating system