What is operating system? (1)

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

In technical terms, it is a system s/w which manages hardware. An OS controls the allocation of resources and services such as memory, processors, devices and information.

Basic functions of operating system:-

An operating system has 4 main functions.

a) Manage the computer resources, such as central processing unit, memory, disk drivers and printers.

b) Establish a user interface

c) Executes and ~~Service~~ provide services for applications s/w.

d) Security.

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(2)

Resource Abstraction :-

The fundamental operation of the OS is resource abstraction which is a process of hiding the details of how the hardware operates, thereby making computer H/w relatively easy for an application programmer to use. It provides generic interfaces to services provided by underlying H/W.

Without O.S every programmer would need to know the most intimate details of the underlying H/w to get anything to run

Types of operating system :-

a) Batch processing :- It is a technique in which O.S collects programs and data together in a batch before processing starts. O.S does the following activities related to batch processing.

- O.S defines a job which has predefined sequence of commands, program and data as a single unit.

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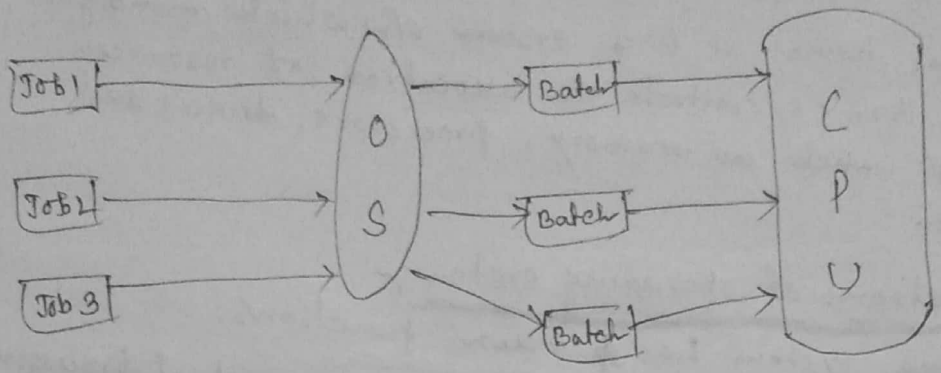
- OS keeps a number of jobs in memory and executes them without any manual information.
- Jobs are processed in the order of submission i.e first come first served fashion.



- When job completes its execution, its memory is released and the o/p for the job gets copied into and output spool for later printing & processing.

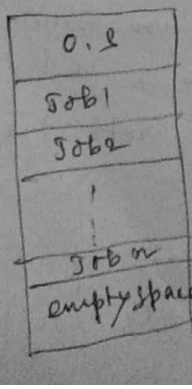
Advantages:- 1) Batch processing takes much of the work of the operator to the computer.

2) Increased performance as a new job get started as the previous job finished without any manual intervention.

Disadvantages:-

1) Defficuilt to debug program.
2) A job could enter an infinite loop.
3) Due to lack of protection scheme, one batch job can effect pending jobs.

b) **Multiprogramming**:- When two or more programs are residing in memory at the same time, then sharing the processor is reffered to as Multiprogramming. It increases CPU utilization by organizing jobs so that the CPU always have one to execute.



- It keeps several jobs in memory at a time
- The O.S picks and begins to execute one of the job in the memory.
- It monitors the state of all active programs and system resources using memory management programs to ensures that the CPU is never idle unless there are no jobs.

Advantages :

1. High and efficient CPU utilization
2. User feels that many programs are allotted to CPU almost simultaneously.

Disadvantages :-

1) CPU scheduling is required.

2) To accommodate many jobs in memory, memory management is required.

3.) Time-sharing operating system :- It enables many people, located at various terminals, to use a particular computer system at the same time. Multitasking or Time sharing systems is a logical extention of multiprogramming. Processor's time is shared among multiple users simultaneously is termed as time-sharing.

In multiprogramming the objective is to maximize the processor use. In case of Time-Sharing the objective is to minimize the response time.

Advantages:

1) Provides the advantage of quick response.

2) Reduces CPU idle time.

Disadvantages:

1.) It has problem of reliability.

2) Problem of data communication occurs.

Real time system :- Real time systems represents are usually dedicated, embedded systems. O.S does the following activities related to real time system activity.

- In such system, O.S read from and react to sensor data.
- The O.S must guarantee response to events within fixed period of time to ensure correct performance.

Spooling: It refers to putting data of various I/O jobs in buffer. This buffer is a special area in memory or hard disk which is accessible to I/O devices.

a) OS handles I/O device data spooling as devices have different data access rates.

b) OS maintains the spooling buffer which provides a waiting station where data can rest while the slower device catches up.

Advantages:

1) The spooling operation uses a disk as very large buffer.

2) Spooling is capable of overlapping I/o operation for one job with processor operations for another job.

O.S for Personal computers and workstations

OS for PC: PC provides a good interface to a single user. PC operating systems are widely used for word processing spread sheets and internet access.

We can say that laptops, computer systems, are personal computers and operating system such as windows 7, widows10, android etc. are personal computer operating system.

PC use either intel CPU chips or a derivative of the intel chips The Intel CPU chips are Complex Instruction Set Computer (CISC)

Work stations: It is a computer intended for individual use that is faster and more capable than a personal computer. It includes one or more high resolution displays and a faster processor than a personal computer.

It is used for scientific or technical calculations or purposes These are usually expensive, high-end computers.

It is used by graphics designers any organization, or individual that requires high speed processors, large storage

Ex: MIPS CPU SPARC CPU

Process control block (PCB): It is a datastructure used by computer operating systems to store all the information about a process. It is also known as process descriptor. When a process is created, the operating system creates a corresponding Process control block.

PCB contains many pieces of information associated with a specific process like:

1. Pointer : It points to another process control block. It is used for maintaining the scheduling list.

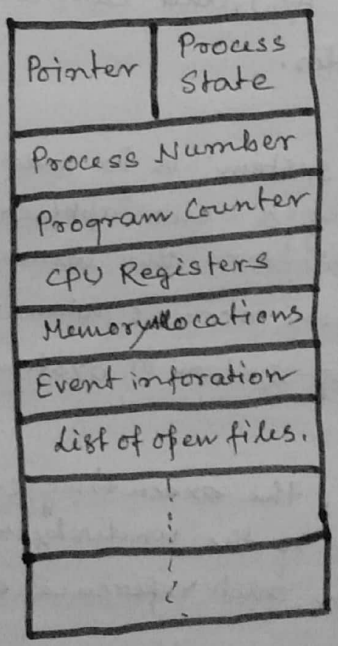
2. Process state :- Process state may be new, ready, Active or waiting and so on.

3. Program counter: It indicates the next instruction to be executed for this process.

4. CPU registers: It include general purpose register, CPU registers, stack pointers, index registers and Accumulator etc.

5. Memory Management information: The information may include the value of base and limit registers, page tables or the segment tables. This information is important for deallocating the memory when the process terminates.

6. Accounting information: It includes the amount of CPU and real time used, time limits, job or process numbers.



(PCB)

Context Switch.: It is the mechanism to store or restore the state or context of a CPU in process control Block, so that a process execution can be resumed for the same point at a later time.

using this technique a context switcher enables multiple processes to share a single CPU. It is essential part of a multitasking operating system features.

When the scheduller switches the CPU from executing one process to execute another process, the context switcher saves the content of all processor registers for the process being removed from the CPU, in its process descriptor.

Processor & User Mode:- A processor in a computer, running windows has 2 different modes: user mode & Kernel mode. It switches between the 2 modes depending on what type of code is running on the processor. Applications run is user mode. Core operating system run is Kernel mode.

Processor Mode (Kernel mode): It provides two modes of operation which enforce this protection. The O.S runs in Kernel mode also known as supervisor mode or privileged mode. In Kernel mode, the S/W has complete access to all the computer's H/W, and can control the switching between the CPU modes.

User mode:- The system is in user mode when the OS is running a user applications such as handling a text editor. The transition from user mode to Kernel mode occurs when the application requests the help of operating system or system call occures.

- In Kernel mode, the executing code has complete and unrestricted access to the underlying H/W. It can execute any CPU instruction and reference any memory address. In user mode, the executing code has no ability to directly access H/W or reference memory.

Kernels: A Kernel is the central part of the O.S. It manages the operations of the computer and H/W

There are five types of Kernels.

- A micro Kernel, which only contains basic functionality.
- A monolithic Kernel, which contains many device drivers
- Hybrid Kernel • Exo Kernel • Nano Kernel.

A computer user never interacts directly with the Kernel. It runs behind the scenes and can not be seen, expect for text logs that it prints.

System calls : It is the programmatic way in which a computer program requests a service from the Kernel of the OS it is executed on. It includes H/W related services, creation & execution of new processes, process scheduling. It provides an interface between a process and operating system.

This calls are generally available as routines written in C & C++

System calls can be grouped in five major categories.

1. Process control :
   - load, • execute • end, abort
   - create process (~~fork~~ - fork() on unix, NtCreateProcess in windows NT), CreateProcess( ) in windows)
   - terminate process • get/set process attributes,
   - allocate, free memory.

2. File management :
   - Create file (CreateFile( ) in windows, open( ) in unix)
   - delete file
   - open, close, read, write, get file attributes, set file attributes

3. Device management :
   - Request Device, Release device
   - read, write, reposition

- get device attributes, set device attributes.
- logically attach or detach devices.

4. Information maintenance:

- get time & date, set time and date
- get system date, set system date.
- get process, file & device attributes.
- set process, file & device attributes.

5. Communications.

- Create, delete communication connection
- Send, receive messages.
- transfer status information.