

Q1 Define Operating System. What are the goals of the operating system? Explain.

Operating System is a program that controls the execution of application programs. It can be an interface between applications and hardware.

Goals : The different goals of an operating system are :

1. Efficient Use :

• For efficient use of resources it must be monitored by the operating system. Proper scheduling of the operating system is required.

•) Computer contains different types of resources like CPU, memory and I/O devices, etc. Proper monitoring of these is required ~~or~~ to avoid overhead. As per the resource, scheduling is required.

•) Special attention to be given for CPU and memory. If memory is not free, user cannot load any program into the memory. Then CPU will be busy with memory management.

2) User Convenience :

•) User convenience is affected by the computing environment of the computer system. The computing environment is comprised of computer system, its ~~and~~ interface with other systems.

- and nature of computations performed by the user.
-) Computer architecture and use change the computing environment of the system. Following factors are considered while considering user convenience: (I) Good Service (II) Ease of Use (III) New programming models (IV) Evolution (V) User friendly OS

3) Ability of Evolve:

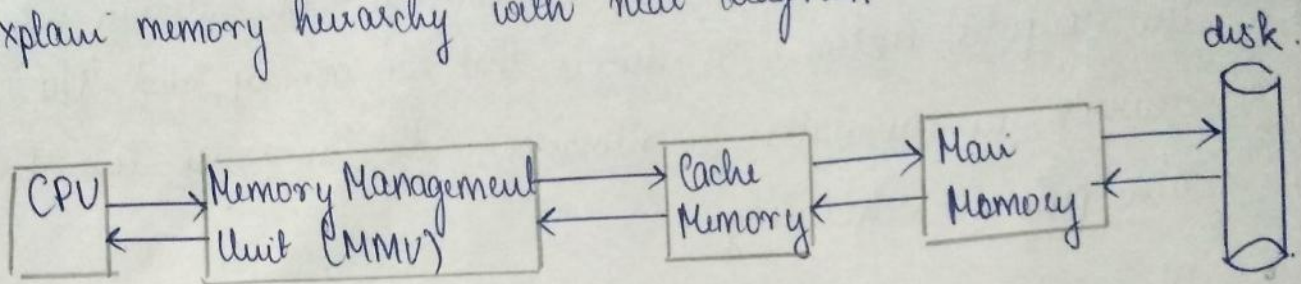
-) An OS should be constructed in such a way as to permit the effective development, testing and introduction of new system features without at the same time interfering with the service.
-) Tasks performed by the OS:
 - i) Maintaining a list of resources in the system
 - ii) Maintain the list of ~~resources~~ authorized users
 - iii) Initiate the execution of programs and process.
 - iv) Maintain ~~us~~ resource usage list.
 - v) Maintain the resource allocated list.
 - vi) Scheduling of resources
 - vii) Also maintain the protection of information.

Q2. Explain Operation of Operating Systems with some examples

- An operating system has 2 functions:
 - (i) Resource Management
 - (ii) Program Management.
- An OS must also provide sufficient CPU attention to a program's execution. This function is called scheduling.

- Concept of scheduling is used to manage the resource in the computer system. OS ensures that the memory and I/O devices are available for allocation. At the same time it also performs scheduling.
- OS performs all the tasks of the user without logic of data and program.
- OS performs various functions, like resource allocation, creation and termination of programs, scheduling and protection.
- Tasks performed by operating systems are:
 - (i) Maintains a list of software and hardware resources in the system.
 - (ii) OS maintains an authorized users list.
 - (iii) Initiate and execution of programs and processes.
 - (iv) Maintain software and hardware resource list.
 - (v) Maintain the resource allocation list.
 - (vi) Scheduling of resources (CPU, Secondary storage, etc)
 - (vii) Also maintain protection information.
 - (viii) Keep track of opened files, append files and deleted files.
 - (ix) Keep record of memory usage.
 - (x) Keep track of secondary storage free space and used space.
- Booting: The operation of bringing OS kernel from secondary storage to the main memory to execute it in the CPU. There is a program bootstrap; which is performing this operation when computer is powered up or rebooted.

3 Explain memory hierarchy with neat diagram



- Memory hierarchy is a cost effective method of obtaining a large and fast memory
 - It is an arrangement of several memories with different speeds and sizes.
 - The CPU only accesses the faster memory, i.e., the cache
 - If a required byte is not present in the memory ~~having~~ being accessed, it is loaded there from a slower memory
- Cache Memory is the fastest while disk is the slowest in the hierarchy.
- CPU ~~can~~ ^{only} access cache memory, if required data is not present it is loaded there from memory.
- Cache Memory -
 - (i) Organisation
 - A cache block or cache line is loaded from memory when some byte in it is referenced.
 - A write through arrangement is typically used to update memory.
 - (ii) The cache hit ratio (h) indicates what percentage of accessed bytes were already present in the cache.
 - The cache hit ratio has high values because of

⊙ Temporal locality ⊙ Spatial locality

— Effective memory access time = $h \times$ access time of cache memory
+ $(1-h) \times$ (time to load a cache block + access time of cache memory)

• Main Memory:

- Main memory prevents access to memory by an unauthorized program
- Memory bound registers indicate bounds of the memory allocated to a program.

• Virtual Memory

- The part of memory hierarchy consisting of the main memory and a disk called virtual memory.
- The program and its data are stored in the disk
- Required portion of the program and its data are loaded in memory when accessed.

Q4 Explain key features of batch processing and multiprogramming OS with neat diagram and explain their advantages and disadvantages

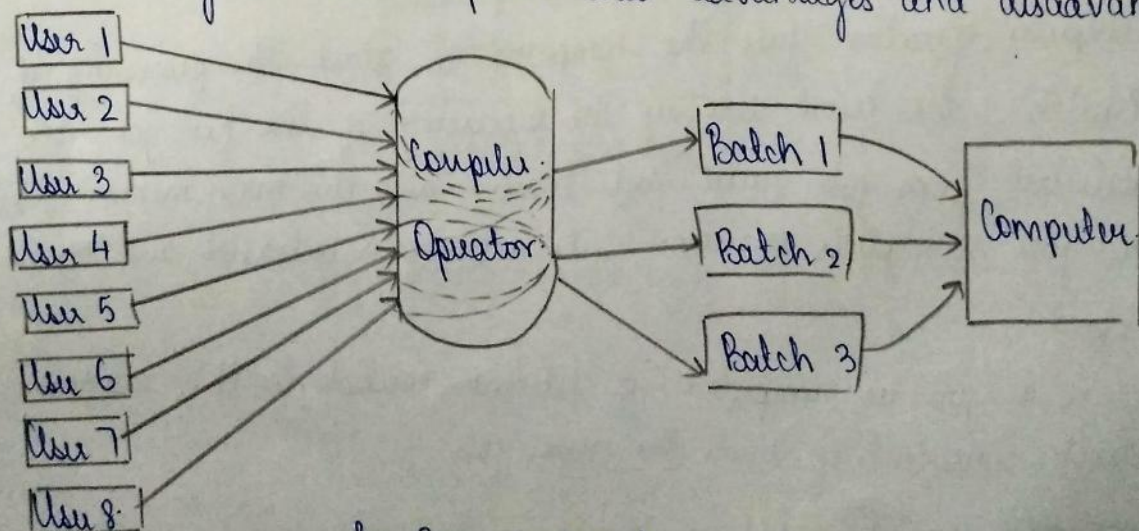


fig: Concept of Batch System

- Batch is a collection of jobs, called a batch. Batch is a sequence of user jobs.
- Job is a predefined sequence of commands programs and data that are combined into a single unit.
- Each job in a batch is independent of other jobs in a batch.
- Jobs with similar needs were batched together to speed up processing.
- Card readers and tape drives are the input devices in batch system. Output devices are tape drives, card punches and line printer.
- Primary function of batch system is to execute the jobs in a batch one after another without requiring the operator's intervention.
- Some computers have a serial system where a list of instructions are carried out one after another.
- Batch monitor is used to implement batch processing system. Batch monitor is also called kernel. Kernel resides in one part of the computer main memory.
- Batch monitor controls the sequence of events. Main memory store the batch monitor and users program and data.
- Computer operator gives the command to start the processing of a batch, the kernel sets up the processing of the first job. Job was selected from job queue and loaded into the main memory. When a job completes execution, its memory is released and it is copied.
- When a job is completed, it returns control to the monitor which immediately reads the next job.
- Spooling uses the disk as a large buffer for outputting data to

printed is and other devices.

ADVANTAGES

1. Move much of the work of the operator to the ~~operator~~ computer.
2. Increased performance since it was possible for job to start as soon as the previous job finished.

DISADVANTAGES

1. Turn around time can be large from user standpoint.
2. Program debugging is difficult.
3. There was possibility of entering jobs in infinite loop.
4. A job could corrupt the monitor, thus affecting pending jobs.

MULTIPROGRAMMING OS

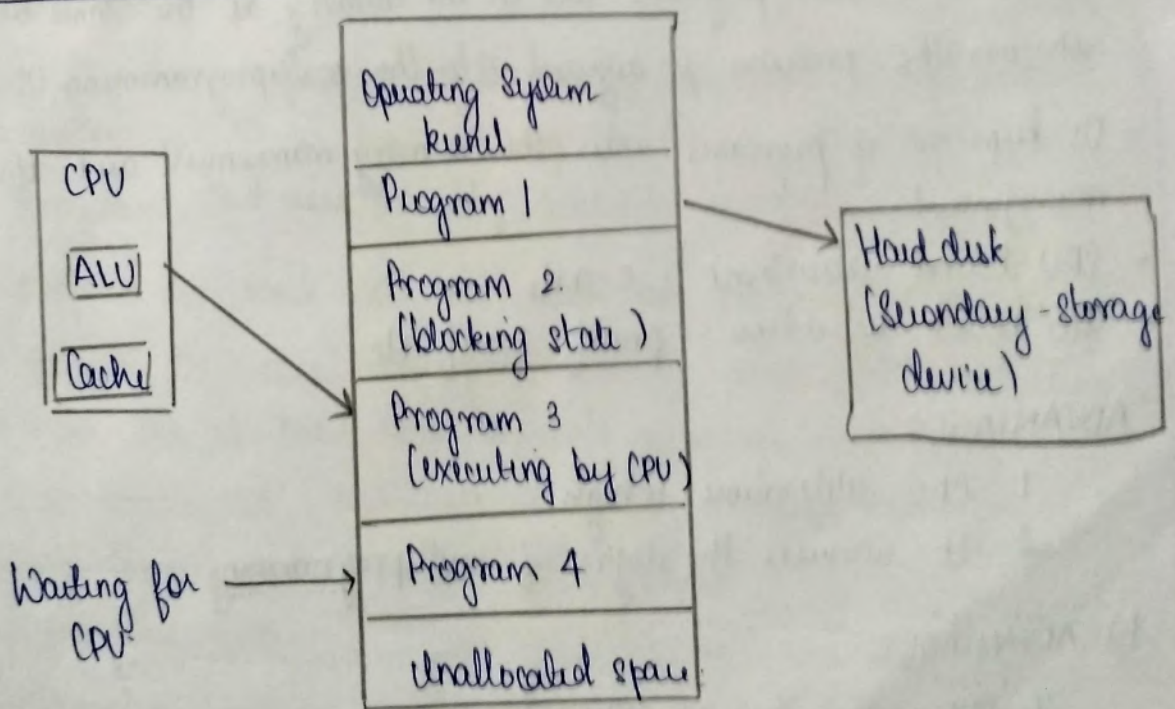


fig. Multiprogramming OS

- At any time either the CPU (or) I/O devices is idle in a batch system. To keep CPU busy, more than one program/job must be loaded for execution. So multiprogramming increases the CPU utilization.
- Resource management is the main aim of multiprogramming OS, File system, command processor, I/O control system and transient area are the essential components of a single user operating system. Multiprogramming OS divides the transient area to store the multiple languages programs and provides resource management to the OS.
- A program in execution is called a 'process', 'job' or a 'task'
- When 2 or more programs are in the memory at the same time, sharing the processor is referred to the multiprogramming OS.
- OS keeps no. of programs into the memory management and I/O management
- CPU bound instructions : $c = a + b$
- I/O bound instructions : printf, scanf, etc.

ADVANTAGES

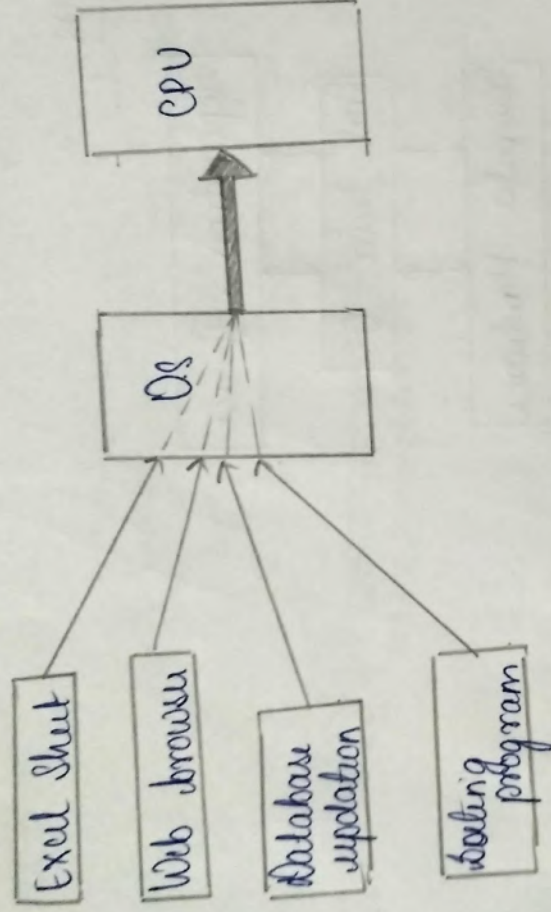
1. CPU utilization is high.
2. It increases the degree of multiprogramming

DISADVANTAGES

1. CPU scheduling is required
2. Memory management is required.

25 Explain time-sharing OS and real-time OS with neat diagram and explain their advantages and disadvantages.

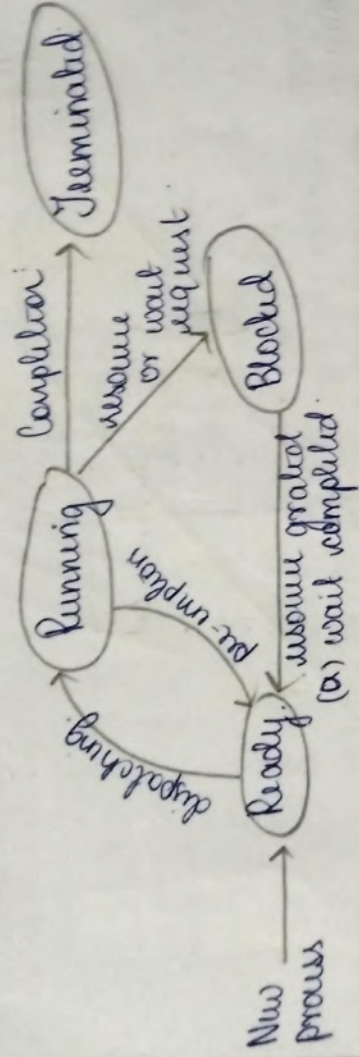
TIME SHARING OS



- It is the logic expression of the MVS. User interaction with program is possible in time sharing OS. During execution of the program, the user directly interacts with the program.
- The computer can work with more than one program at a time.
- Time sharing OS uses multiprogramming and CPU scheduling. Each user has at least one separate program in memory.
- In time sharing OS, each user is given a time slice for executing their job in round robin fashion. Job continues until the time slice ends.
- User interaction with system using virtual machine, user enters the command for virtual machine and result will be returned back to the user.
- It also takes help of file system. File system is stored on the disk so disk management is also required.

Define process state with neat sketch explain the process fundamental state transition diagram or process life cycle

- A process state is an indicator of the current activity of a process



- The fundamental process states are:

- ① Running : A CPU is allocated to the process and is executing its instructions
- ② Blocked : (i) The process is waiting for a resource to be allocated or a specified event to occur.
(ii) The ~~state~~ process should not be scheduled until the awaited event occurs.
- ③ Ready : (i) Process is not blocked but is running.
(ii) It can be considered for scheduling.
- ④ Terminated : Operation of the process has been completed.

State Transitions :

• Operation of a process

(i) a process has a state

(ii) the state of a process changes when the nature of its activity changes. This change of state is called state transition. It is caused by an event

(ii) usual state transitions ~~can~~ can occur before the process terminates.

Q7 Explain event handling mechanism with a neat diagram.

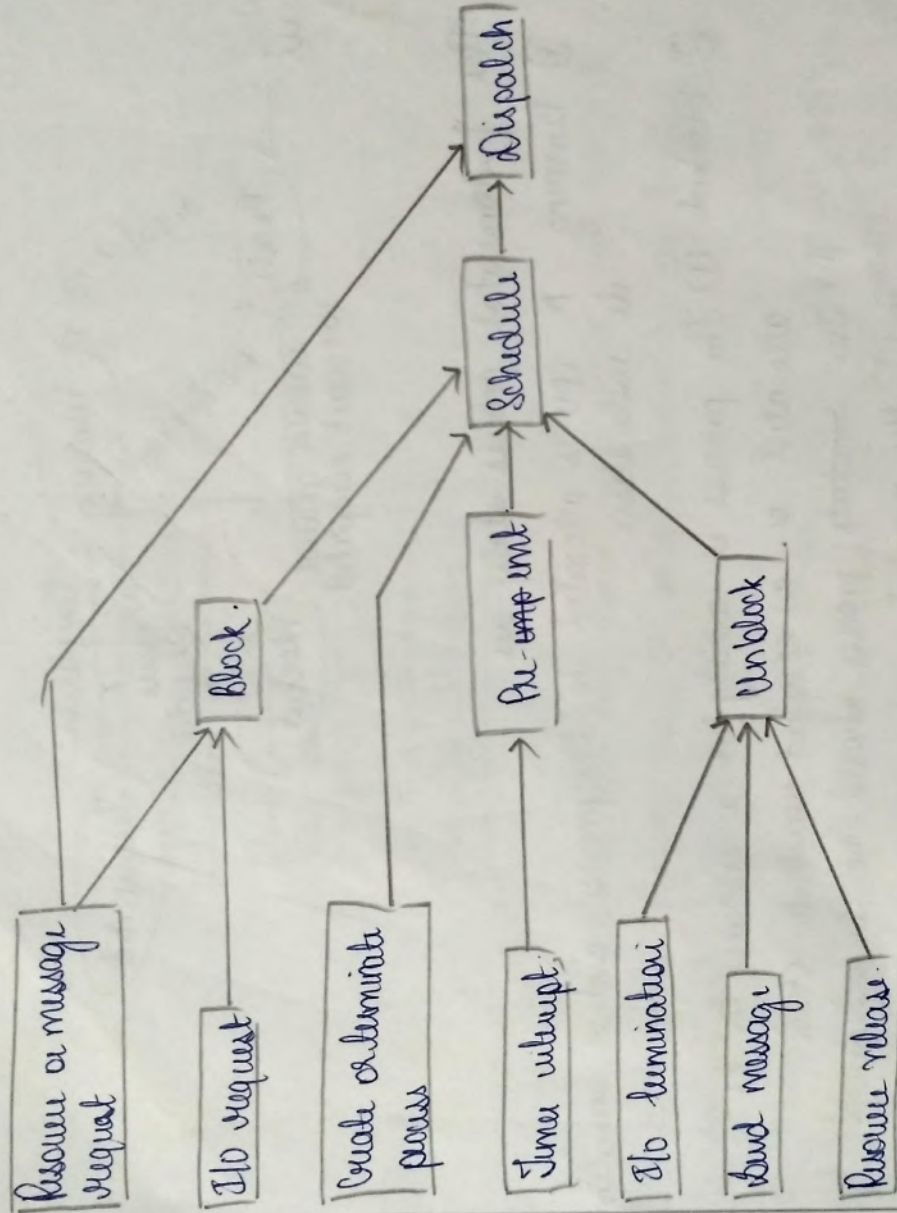


fig: Event handling mechanism.

- The OS performs the following ~~functions~~ actions:

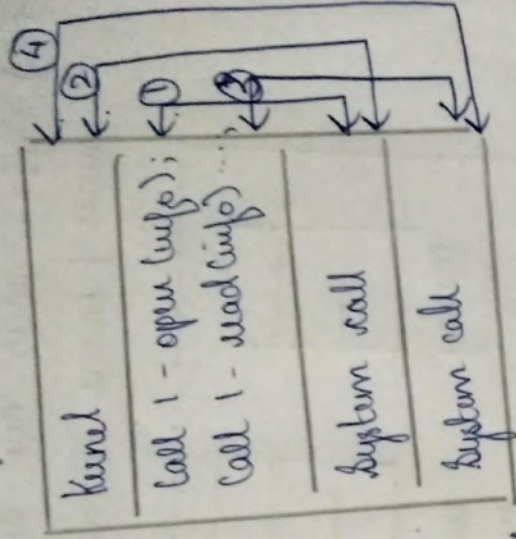
- (i) Create a process
- (ii) Block a process
- (iii) Unblock a process
- (iv) Terminate a process
- (v) Dispatch an I/O operation
- (vi) Grant a resource
- (vii) Intercept an interprocess message.
- (viii) Deliver an interprocess message.

Q8. Explain the system call with neat diagram of how it works.

Open (info)
read (info)

sample code
of program

library fn
to open file
library fn
to read file



(b)

Fig. A schematic of system calls

(a) a program

(b) an execution time arrangement.

A computer has a special instruction called a 'software interruption'.

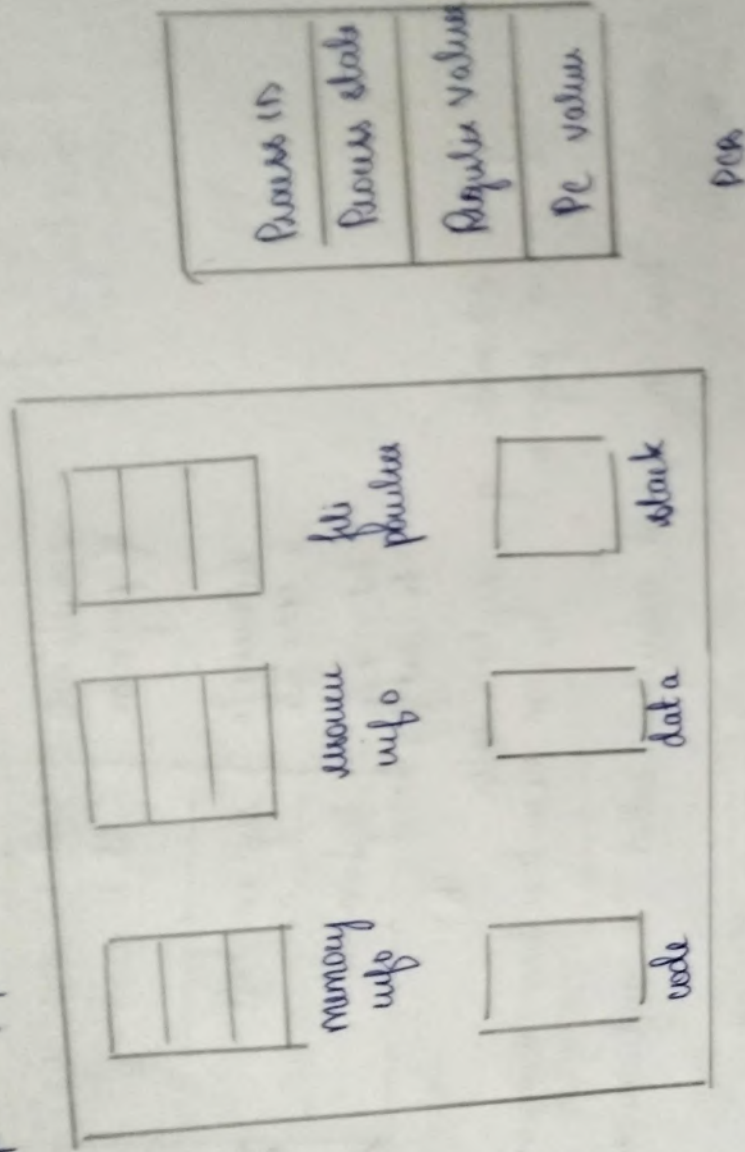
instruction

- Its role power is to cause a program interrupt.
- It's operand becomes the interrupt code.
- A program uses the software interrupt instruction to make a request is being made
- Association of interrupt code and kind of OS is small is OS specific.
- This method of making a request is OS specific called system call.

Types of system calls: system calls are used to make diverse kind of requests.

- Program related request or relax, checking the resource availability
- Program related: create or terminate program, exit or await some interrupt
- File related: Open or close a file, read or write record.
- Information related: get time and date, get resource information
- Communication related: Send or receive message, setup or terminate connection

29) Explain with neat diagram the view of OS on process / process environment.



- The OS views a process as an entity to which resources are allocated and a unit of work to be performed.
- The OS performs scheduling to organize
- A process is a tuple with the following process components
 - The process ID is used by the OS to uniquely identify the process
 - Code, data and stack form the address base of the process
 - Resources are allocated to the process by the OS
 - The CPU status comprised of the values in the CPU registers and in fields of PCB.
- Access environment
 - The process environment consists of all information needed for accessing and controlling resources allocated to the process
 - Address space of the process, i.e. code, data and stack
 - Memory allocation information

- Status of the file processing activities eg: file pointers.
- Process utilization information
- Resource information
- Miscellaneous information