JMS

INDEX

Name: Sudhanshu Ranjan Adarsh Std.: Sec.:

Roll No.: 23-----80 Sub.: Operating S.

DCE

S. No.	Date	Title	Page No	Teacher's Sign / Remarks
1.	2024	Overview of Operating Systems	1-18	
2.	2024	Process Management	19-28	
3.	2024	Deadlocks	29-32	
4.	2024	Memory Mangent functions	33-50	
5.	2024	I/O Managemet functin	51-58	
6.	2024	File Managgement	59-66	
7.	2024	Linus OS	67-78	

Interface * User OS hardware
* Decision Maker

JMS

Unit-I 1. Overview of Operating Systems

Wind - Convinence (PST.)
Unux - Throughput (BAT.)

It is collection of procedures

A collection of programs that governs the control of resources like- processor, main memory, secondry storage, I/O devices and files so that we can use the computer system efficiently and conventionally, is called operating system.

Functions of OS

User
Applica
OS
Hardwa

An Operating System performs many functions to manage a computer's hardware and software:-

- i> File Management:- Managing files and folders, including who can access them and what action can take.
- ii> Memory Management:- Allocating memory to programs and coordinating applications.
- iii> Process Management:- (CPU Sche.) Deciding which process can access the processor and in what order.
- iv> Security:- (deadlock) Protecting data from cyber-attacks and prevent unauthorized access to programs.

window:-
Kerbros security

- Device Management:-

Disk sch. Alg.
→ FCFS
→ SSeek T. P
→ SCAN (Elevator Algo.)

Spooling :- Simultaneous peripheral operation online. It is process of temporary storage of data for use and execution by device.

JMS

Error-
i) Bad Sector
ii) Memory overflow

↳ v> Error Handling :- It detects and reports the error.

↳ vi> System Performance Control :- It controls the performance of system by aborting programs with errors.

Importance of OS

An operating system is important for many reasons :-

↳ i> Resource Management :- It manages the computer resources like CPU, memory, printers etc. (Algorithm)

↳ ii> User Interface :- It provides a user interface that allows user to interact with their computer.

↳ iii> Peripheral Device Control :- It controls the peripheral device like - scanner, printer etc.

↳ iv> Application Execution :- It executes and provides services for application software.

↳ v> Mobile device features :- Mobile operating system supports features like GPS, Wi-fi etc.

i>

entire CPU is dedicated for a job only

ii>

Types of Operating System

The broad categories of operating systems are :-

i> Single User Operating System
ii> Multi User Operating System
iii> Network Operatig system
iv> Distributed Operating System

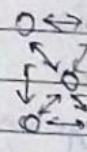
i> Single User Operating System:- An operating system which allow one user at a time on CPU, is called single user operating system. In this OS, only one terminal is active with the CPU. Ex- DOS (Disk Operating System), These OS are very fast, and it is used for personel computers and laptops.

entire CPU is edicated for one job only

less complex

ii> Multi User Operating System:- An operating system which allow two or more user at a time on single CPU, is called multi user operating system. In this OS, two or more terminal are active with the CPU. Ex- Unix, Linux, MacOS. These OS are little bit slow and more complex than single user OS.

iii> Network Operating System:- A special type of distributed operating system which allows to connect many computers in a single channel, is called network operating system. In this OS, two or more OS are wed at a time. One is at more machines and other manages the connection of these systems. Ex-DOS, Windows etc. It is wed for connecting computers and devices into LAN.



Features of NOS:-

Following are the features of NOS:-

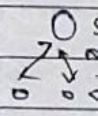
i> It provides base OS feature like- support for processor, protocol etc.

ii> It provides security features like- authentication, access control etc.

iii> Provide proper naming of files.

iv> Provide file, print, back-up services using different server for each.

v> User management and support for logon and log off, remote access etc.



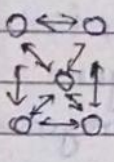
Types of Network OS

There are two major types of network OS:-

i> Peer to Peer

ii> Client - Server

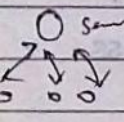
i> Peer to Peer :- In this system, a number of user are allowed to share resources and files located on computer. In this, all computers have same abilities to use resources on network.



Adv. i> Less initial cost
ii> No need for dedicated server.

Disad: i> Data is not centralise for files
ii> Don't provide security.

ii> Client - Server :- It allows the network to centralise functions and application in one or more server. The file server become centralised, provide acess to resources on file server. It allow multiple user to simultaneously share same resources of physical location. Ex - Windows, Novell Nature



Adv :-
i> Centralise :- Resources are controlled through server because information and resources are available.
ii> Scalability :- All elements can be replaced individually as need increase.
iii> Flexibility :- New technology can be easily integrated.
iv> Accessibility :- Servers can be accesed remotely across multiple platform.

iv) Distributed System:- An OS which allows sharing of resources and co-ordination of distributed activities in network, is called distributed OS. It use a layer called middleware to present heterogenous system as single processor.

v) Batch Operating System:- This type of OS does not interact with computer directly. There is an operator which takes similar jobs and group them into batches. It is designed to manage and execute large number of jobs efficiently.

Whenever one job would be completed no other job takes

Adv: i) Multi user can share the batch.
ii) The idle time for batch is less.

Disad: i) It is hard to debug.
ii) The other jobs will have to wait for unknown time.
iii) More CPU idle time

vi) Multi-Programming OS:- It can be simply illustrated as more than one program is present in main memory and any one of them can kept in execution. It is non-preemptive.

Many files transferred from HD to RAM.

Adv: i) It increases the throughput of system
ii) It helps in reducing response time.

vii> Multi Tasking OS :- It is simply a multiprograming os with a facility of Round-Robin Scheduling Algorithm. It can run multiple programs simulateneously. It is preemptive

Advt: i> Multiple programs executed.
ii> It comes with proper memory management.

viii> Real-Time OS :- The time interval required to process and reponed to input is less. It is wed when there are time requirements are very strict like missile system.

Types :- i> Hard Real Time :- In this, time constraints are extremely strict. These system are built for saving life like airbags. Virtual memory is rarely found in these system.

ii> Soft-Real Time :- These are for application where time-constraint is ~~tess~~ high. It is very less restrictive.

Adv:
i> Maximum utilization of device more output from resources
ii> Memory allocation is best managed.
iii> Time assign for shifting task is very less.

iv) Time Sharing OS:- Each task is given some time to execute so that all the tasks work smoothly. Each user gets time of CPU as they use single system. After this time interval is over, OS switches to next task.

Advt:

i) Each task get equal opportunity.
ii) CPU idle time can be reduced.
iii) Fewer chance of software duplication.

v) Embeded OS:- It is specilized OS designed to perform specific task for device. It often works within embeded system. It perform one task in bigger machine like traffic lights, digital camera, Refrigrator etc.

Q. Difference b/w Multiprogramming and Multitasking Os.

	M. Programing	M. Tasking
i)	It include single CPU to execute program.	It wes multiple task for task allocation
ii)	Concept of Context Switching is wed.	Concept of Context switching and time sharing is used.
iii)	It increases CPU utiliziation by organising job.	It increase CPU utilisation and responsiveness.
iv)	To reduce CPU idle time for long. (Used)	To increase CPU utilisation concept by time sharing.

v> The OS switches to and executes another job when current job needs to wait.	It switching happens when allowed time expire or other reason for process needs to wait.
vi> Execution Process takes more time.	Execution process takes less time.

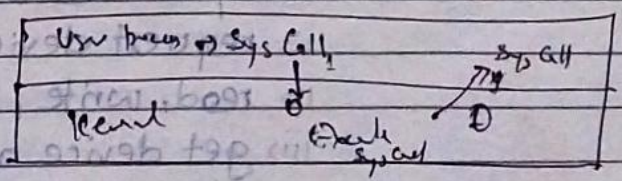
SYSTEM Calls

It is a programmatic way in which a computer program requests a service from kernal of OS it is executed on. It is a way for programs to interact with OS.

A computer program makes a system calls when it make a request to operating systems kernal. It provides the services for OS to wer program via Application Program Interface (API). System calls are only entry point to kernal system.

There are five-categories of system calls:-

i> Process Control
ii> File Manupulation
iii> Device Maripulation
iv> Information Maintainance
v> Communication



i) Process Control :- A running program needs to be able to stop execution either normally or abnormally. Under either normal or abnormal, the OS must transfer control to invoking command interpreter.

Following are the functions :-
- i) end, abort
- ii) load, execute
- iii) create process, terminate process
- iv) get process attribute, set process attribute
- v) wait event, signal event

ii) File Management :- Some of the system calls for file management :-
- i) createfile, delete file
- ii) open, close
- iii) read, write, reposition
- iv) get file attribute, set file attribute

iii) Device Management :- Process usually requires several resources to execute, if these resources are available, they will be granted and control return to user proces.

Some of system calls for device mgmt. are :-
- i) request device, release device
- ii) read, write, reposition
- iii) get device attribute, set device attri.
- iv) logically attach or detach device

iv) Information Maintainance:- Some system calls exist purely for transferring information between user program and OS.
- i) get time or date, set time or date
- ii) get system data, set system data
- iii) get and set processes, file or device attribute

v) Communication :- Communication is OS occur by a process called inter-process communication (IPC)
- i) message passing
- ii) shared memory

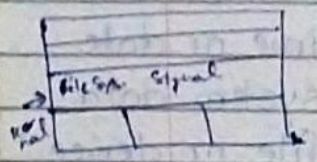
Operating System Structure

The OS can be implemented with the help of various structure. The structure of OS depends on how the various standard component are interconnected and melded into kernal.

Five structures of operating system:-
- i) Monolithic System
- ii) Layered System
- iii) Virtual Machines
- iv) Exo-kernals
- v) Client - Server System

(simple)

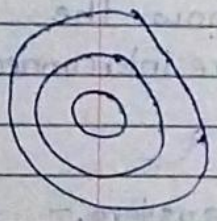
i> Monolithic System:- Such operating system do not have well-defined structure and are small, simple and limited. The interfaces and levels of functionality are not well separate. MS-DOS, is an example of such OS, application programs are able to do basic I/O routines.



Adv:

i> It delivers better application performance
ii> It is easy for kernal developers to develop such OS.

ii> Layered Structure:- In this structure, the OS is broken into a number of layers. The bottom layer is hardware and topmost layer is user interface. Ex- Unix



These layers are so designed that each layer use the functions of lower layer. This simplifies debugging process, if lower layers are debugged and an eror occur during debugging, then error must be on that layer only, as lower layer have already been debuged.

Layer	Function
0	Processor
1.	Memory Management
2.	Operator-Proces Comm.
3.	I/O Management
4.	User Program
5.	Operator

Adv:
i> Layering makes it easier to enhance OS
ii> It is very easy to perform debugging and system verification.

iii> Virtual Machine:- These are time sharing system which provide multiprograming and one or more machines. These are not extended machines, they are the exact copies of bare hardware Including kernal/user mode, input/output and everything else the real machine has.

Iv> Exo-Kernal Machine:- It is a program present at bottom layer running in kernal mode. The works of exokernal is just allocate the resource to virtual machine and check them to make sure that no machine is trying to use some other resource. It is require when interprocess communication is required.

Advant:
i> It improves the performance of application
ii> It is simple to test and create new OS.
iii> Separate management from security.

v) Client-Server Model:- By splitting the OS into parts, each part only handle one factor of system like file service, terminal service etc, each part become small and manageable.

★. User Mode:- When a user-mode program request to run, a process and virtual address space are created for it by OS.
User-mode program are less privileged than kernal mode.

Adv:
i> Stability and Reliability
ii> Simplified debugging

★. Kernal Mode:- The kernal is the ~~end~~ core program on which all other OS components rely. It is used to access the hardware component and schedule which processes should run on computer system.
It is most privileged program, it can directly interact with hardware.

Advt:
i> Direct Hardware Access
ii> Complete Control

Q. Difference between User Mode and Kernal Mode:

	User M.	Kernal M.
i>	The application program don't have direct acess to system resource. 'System Call' needs to access.	The program has direct & unrestricted access to system resource.
ii>	A single process fails if an interupts occur.	The whole OS might go down if interupt occur.
iii>	It is also called unprivileged mode or slave mode.	It is also called privileged mode, master mode or system mode.
iv>	All process get seperate virtual address space.	All process shares a single virtual address space.
v>	Applications have fewer privileges.	The applications have more privilege.
vi>	The mode bit value is 1.	The mode bit value is 0.
vii>	System crash can recovered by simply reuming session.	System crash is servere and make things more complicated.
viii>	User program can access and execute for system.	Only essential functionality is permitted to operate.

command interpreter is called - shell

JMS

User Interface of OS

A user interface (UI) refers to the part of OS, program or device that allow user to enter and recieve information.

There are two types of UI :-
i> Command Line Interface
ii> Graphical User Interface

i> Command Line Interface :- It deals with using text command and technique for entering those commands. Some OS include command interpreter in kernal.
Ex- Windows, Linux.

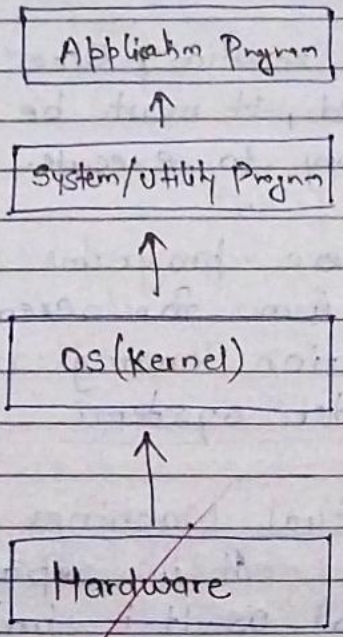
Command Interpreter in Linux is called Shell

ii> Graphical User Interface :- It is a visual interface that allow user to interact with electronic devices through graphical components like icon, button etc. It is used in computers, smartphones, etc.

System Programs

In the logical computer, at the lowest level is hardware. Next is Operating System (Kernel) then the system program and finally application program. System program is also known as system Utility.

JMS



Some of system programs are given:-

i) File Management:- These program create, delete, copy, rename print, dump and generally manipulate files and directories.

ii) Status Information:- Some programs ~~create~~ simply ask for system for date, time, disc space no. of user and status information.

iii) File Modification:- Several text editors may be available to create and modify the content of files stored on storage device.

iv) Programming Language Support:- Compilers, assembler, debugger, and interpreter for programing language are provided to user with OS.

v) Program loading and Execution:- Once a program is compiled, it must be loaded into memory to execute.

vi) Communication:- These programs provide the mechanism for creating virtual connection among user, process and computer system.

Virtual Machines

It is separate OS install on usual OS. It is implimented by software emulation and hardware virtualization.

Two types of virtual machine:-
- i) System virt. mach.
- ii) Process virt. mach.

i) System VM:- A virtual machine that provide a complete system platform and support for execution of OS.

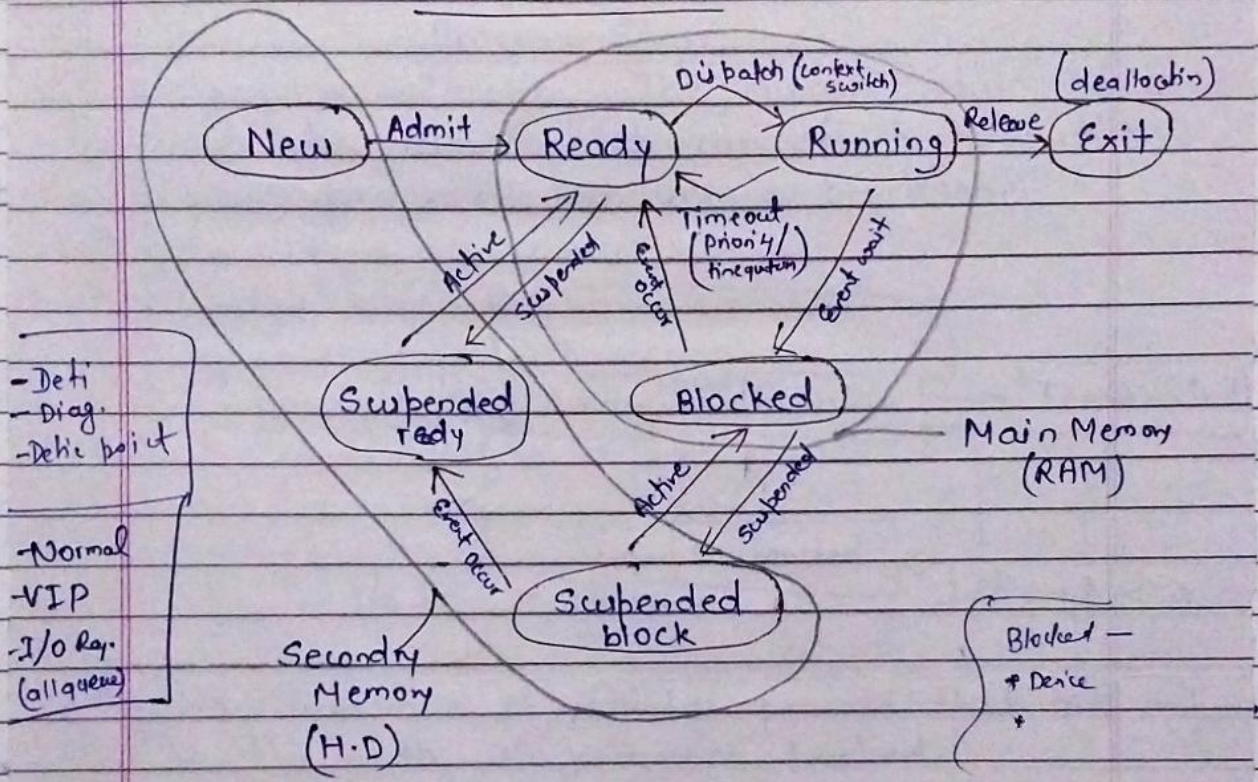
ii) Process VM:- A virtual machine that allows application to run in isolate enviromt

Advt:
- i) Cost saving
- ii) Better Security
- iii) Scalability
- iv) Reliability
- v) Environment friendly

Unit-II 2. Process Management

The process is an instance of program in execution. It is the smallest unit of work that can be individually scheduled by CPU scheduler

Process State



i. New to Ready → LTS (multiprograming process)
ii. Ready to Run → STS (multi tasking process)
iii. All suspension → MTS
iv> Running :- All resources with CPU. On CPU, one process run at a time.

iv> Suspended :- Uncompleted process are comes under this state until the related condition is removed.

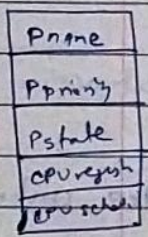
v> Terminated :- Completed process are comes under this state.

Process Control Block

It is also called Process Descriptor

The OS groupes all the information that needs a particular process into data structure, is called Process Control Block (PCB). All the process will be active only when it has active PCB with it.

Various fields of PCB are :-



i> Process Name :- This shows the number of particular process.

ii> Process Priority :- It contains priority of process whether it set by user or OS.

iii> Process State :- It contains the current state of process.

1> Memory Management Information :- It contain information about address where the process store in memory.

1> Accounting Info. :- It contain information about CPU time, I/O disk used, connect time and other.

iv> CPU Register:- These are used to save the state of process into PCB.

v>. CPU Scheduling Information:- It contains information about scheduling algorithm.

Scheduling Queues

In OS, it helps to track the sequence of scheduling by storing process in different queue.

The OS maintains the process scheduling queue:
i> Job Queue:- It keeps all the process in system.
ii> Ready Queue:- It stores process that is ready to execute.
iii> Device Queue:- It stores process that is waiting for I/O device to become available.

Scheduler

It is a software module that choose which jobs to admit to system and which process to run. It is used to optimize system performance.

There are three types of schedular:-
i> Job Schedular (L.T.S)
ii> Process Sched. (M.T.S)
iii> CPU Sched. (S.T.S)

i> Job Schedular:- It is also called long-term scheduler. It works mainly on batch operating system. In this, batch of jobs is submitted for execution. These jobs are stored in batch queue. The main objective is that to provide batch job in such a manner that processor and device remain busy all time. It handles process movement from new to ready.

when current batch executed, then new batch is allowed to execute

ii> Process Schedular:- It is also called medium-term scheduler. It handle swapped out process to make ready for execution. After execution, running process is suspended and removed from memory [store in HD]. Once suspending condition is removed, it allocate required amount of memory and make ready. It handles process movement from suspended to ready state.

iii> CPU Scheduler:- It is also called short-term schedular. The objective is to maximize the system performance. On occurance of any event, the OS calls it to decide which process should be scheduled for execution. Clock ticks, interrupts, I/O completion and operations calls are few events which change the global system state. It handles process movement from ready to running

Operation on Processes

The process in the system can execute concurrently and must be created or deleted dynamically. So, OS provide mechanism for process creation and termination.

i> Process Creation:- A process may create several new process by create process system call. The creating process is called parent process and new process is called children process.

When a process create a subprocess, that subprocess may able to obtain its resource directly.

ii> Process Termination:- A process terminate when it finishes its final statement and ask to delete. At that point, it returns output to parent process by wait system call. All resource are then deallocated by OS.

Inter Process Communication

It is a mechanism which allows to communicate each other. The communication between these process can be seen.

Two ways of communication:-

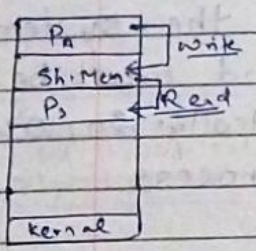
i> Shared Memory

ii> Message Passing

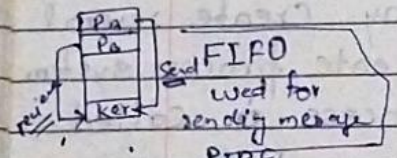
WT & RT is same in Non-Preem.

JMS

i> Shared Memory :- Communication between process by shared memory require process to share some variable. Process can use it for extracting information from other process. Write & Read Imp.



ii> Message Passing :- In this, process communicate with each other without using any kind of shared memory. It uses common mailbox for messaging.



Scheduling Criteria

The performance of different type of shedular :-

i> CPU Utilization :- It is the average fraction of time during CPU is busy.

ii> Through-Put :- It refers to amount of work completed in unit time.

iii> Turnaround Time :- The time between the job is submitted and completed by system.
(CT - AT)

iv> Waiting Time :- It is the time that a job spend in waiting for resource allocation.
(TAT - BT)

CPU bond
I/O bond

v> Response Time :- It is used in time sharing and real time OS.
(Get CPU first - AT)

vi> Arrival Time, Brust Time, Complete Time

Premptive Scheduling

It is one which can be done in circumstances when a process switches from running state to ready state or from waiting state to ready state.

Non-Premptive Scheduling

It is one which can be done in circumstances when a process terminates or switches from running to ready state.

Premptive	Non-Preemptive
i> Resources are allocated to process for limited time.	Once resource are allocated it holds till it complete.
ii> Process can be interrupted in between.	Process can't be interrupted untill it terminates
iii> It has overhead of scheduliy	It doesn't have overhead.
iv> It is flexible	It is rigid
v> CPU utilization is high.	CPU utilization is low.
vi> Waiting time is less	Waiting time is high
vii> Response time is less.	Response time is high
viii> Round Robin, Shortest remaing time first are example.	First come first serve, Shortest job first are example.

Scheduling Algorithm

Concept of preemption

A set of rules that determi which task to execute at a specific moment is called scheduling algorithm.

There are five types of scheduling algorithm :-

i> First Come First Serve
ii> Shortest Job first
iii> Round Robin
iv> Multiprocessor Scheduling
v> Real Time Scheduling

i> First Come First Serve :- It considered to be the simplest of all OS algorithm scheduling. It states that the process that request the CPU first is allocated the CPU first and is implementing.

Characteristics :

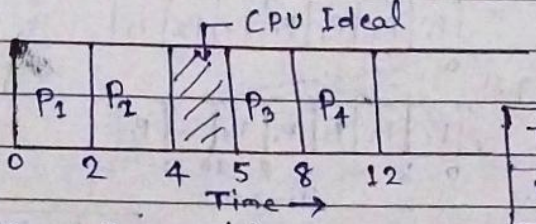
i> It supports both CPU scheduling algorith
ii> It is easy to impliment and use.
iii> It is not efficient and having high waiting time.

ii> Shortest Job First :- It is a process that selects the waiting process with less execution time. It may or may not be preemptive. If the running process has less execution time then it continue.

i) First Come First Serve

Process	AT	BT	CT	TAT	WT	RT
P_1	0	2	2	2	0	0
P_2	1	2	4	3	1	1
P_3	5	3	8	3	0	0
P_4	6	4	12	6	2	2

Gantt Cht:



$T_{AT} = CT - AT$

$W_T = T_{AT} - B_T$

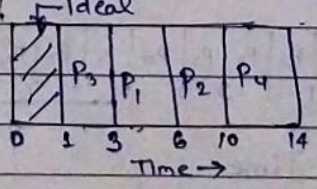
$R_T = CPUTime - AT$

* Mode- Non- Pre-emptive
* Criteria- Arrival Time

ii) Shortest Job First

Proces	AT	BT	CT	TAT	W_T	R_T
P_1	1	3	6	5	2	2
P_2	2	4	10	6	4	4
P_3	1	2	3	2	0	0
P_4	4	4	14	10	6	6

Gantt Cht:



* Mode:- Non - Pre-emptive
* Criteria - Brust Time

AT > BT > Pr.ID

WT & RT same in Non-Pr.

TQ-2

iii> Round Robin

Pro. ID	AT	BT	CT	TAT	WT	RT
P_1	0	5	12	12	7	0
P_2	1	4	11	10	6	1
P_3	2	2	6	4	2	2
P_4	4	1	9	5	4	4

Ready Q.:

P_1	P_2	P_3	P_1	P_4	P_2	P_1

Gnatt Cht:

Context Switch

P_1	P_2	P_3	P_1	P_4	P_2	P_1

0 2 4 6 8 9 11 12

Time →

सबसे पहले Repeat
1) नया Process
2) जिसका काम बचा, वो बचा नहीं

∴ Context Switch = 6

* Criteria – Time Quantum
* Mode – Pre-emptive

iv Shortest Remaing Time First

Pro ID	AT	BT	CT	TAT	W_T	R_T
P_1	0	5	9	9	4	0
P_2	1	3	4	3	0	0
P_3	2	4	13	11	7	7
P_4	4	1	5	1	0	0

Gnatt Cht:

AT > BT > Pid

P_1	P_2	P_2	P_2	P_4	P_1	P_1	P_1	P_1	P_3

0 1 2 3 4 5 6 7 8 9 13

* Criteria:- Brust Time
* Mode:- Pre-emption

TAT = CT – AT
WT = TAT – BT
RT = CPU – AT

SJF with Prem. is called SRTF

Charact: i> It has minimum waiting time.
ii> It is associated with each task as unit of time.
iii> If shorter process keeps coming, cause starvation.

iii> Round Robin :- It is a CPU scheduling algorithm where each process is assigned a fixed time slot. It is preemptive and mainly focus on Time Sharing technique(time quantum).

Charact :- i> It is simple, easy to use and starvation free.
ii> It is widely used as core.

iv> Multiprocessor Scheduling :- It addresses task allocations to multiple CPU. It involves higher throughput and several task can be processed in separate processor.

v> Real Time Scheduling :- It is prefered in real-time OS. In this, process are completed in a critical manner.

Two types of real time system are :-
i> Hard Real time
ii> Soft Real time

i) Hard Real time:- The execution of process must be completed in specific time. So, when a process is submitted, we have to specify amount of time.

ii) Soft real time:- The process are assigned a certain priority and the process having higher priority must be executed before lower priority process. The main aim is to assign priority.

Process Synchronization

When several processes fulfill the work together, then all process ~~much~~ must be synchronised properly. OS not provide synchronization operation. These are cooperative proces who carry proper synchronization

Long Term sch.	Short Term sch.
i) It takes process from job pool.	It takes process from ready queue
ii) It is also called Job Scheduler	It is also called CPU scheduler
iii) It regulates more degree of multi programing.	It regulates less degree of multi programing
iv) It is faster than short term.	It is slower than long term.
v) It changes process state from new to ready.	It changes process state from ready to running.
vi) It select good process for a CPU.	It select new process for a CPU.
vii) It controls multi-Programing.	It controls multi-tasking.

Unit-II 3. Deadlocks

Deadlock is a situation where a group of processes is permanently blocked by each other. It can occur due to improper interaction and communication between process.

Condition for a Deadlock

In 1971 Coffman, Elphick and Shoshani have shown that, there are four condition that cause deadlock in system:-

i> Mutual Exclusion:- If there is sharable resource then only one process can use that resource and other needs to wait.

ii> Hold and Wait:- If a process hold some resource and wait for some resource which are held by other process.

iii> No Preemption:- A process which holds a resource can release it after completing its task.

iv> Circular Wait:- There must a set of waiting process. One waits other and soon.

assign resource – assign edge
request re – request edge

Methods for Handling Deadlocks

i> Deadlocks Prevention :- The basic philosphy behind it is to prevent at least one condition.

i> Mutual Enclusion :-

It is only applied for non-sharable resource because more than one process can be granted.

ii> Hold and Wait :-

It is prevented by a process request a resource, it doesnot hold other resource.

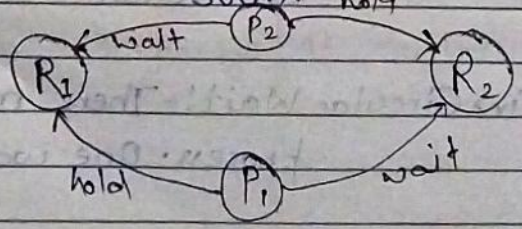
Resource utilization is low and starvation are disadvantage.

iii> No Preemption :-

A process which holds resource can release only after completing its task.

iv> Circular Wait :-

There must a set of waiting process. One waits other and soon.



Deadlock Avoidance

The side effect of deadlock prevention is device utilization is low and system throughput is reduced. In this, if a process request for available resource then, the request can grant only when it does not lead to deadlock.

So, to implement the deadlock avoidance, the algorithm examine the resource state to ensure that there can never be deadlock.

Banker's ALGORITHM

It is proposed by Dijiksta in 1965. It states,

" When a new process enters into system, it has to declare maximum number of instance of resource to use. It is necessary, the no: not exceed the total no. of resource.

When a process request for a set of resource, then it is duty of system to determine whether the allocation of resource to requesting process will leave the system.

- Concept of B. Algo.
* Resources - (available in system)
* Process - (process which require resource)
* Allocation Matrix - (matrix which show curr allocation resource)
* Max Matrix - (matrix which show maximum resource for process)
* Need Matrix - (show remaining resource)
* Available Vector - (vector repsent no. of available resource)

A=10 | B=5 | C=7

Deadlock Avoidance Deadlock Detection Date

Resources → Process	Allocation (already) A B C	Max Need A B C	Available (Current) A B C	Remaining Need A B C
P_1	0 1 0	7 5 3	3 3 2	7 4 3 P_1
P_2	2 0 0	3 2 2	5 3 2	1 2 2 P_2
P_3	3 0 2	9 0 2	7 4 3	6 0 0 P_3
P_4	2 1 1	4 2 2	7 4 5	2 1 1 P_4
P_5	0 0 2	5 3 3	7 5 5	5 3 1 P_5
Total	7 2 5		10 5 7	

Avai − Total

	A	B	C
Total →	10	5	7
Allo →	7	2	5
Curnt Avabty	3	3	2

$P2 > P_4 > P_5 > P_1 > P_3$

→ Safe sequence because not occur deadlock.

Max Need − already Allocation = Remaining

Deadlock occur when all process doesn't get any resource.

Spiral

Deadlock Detection

It is a process of determining a deadlock exist and identify process and resource involved in deadlock. The basic idea is to check allocation against resource available for possible allocation.

Once deadlock detected, way to recover it
i) Temporily prevent resource from deadlocked processes.
ii) Back off a process to some check point.
iii) Successively kill process until it deadlock free

Recovery from Deadlock

A deadlock may occur when either deadlock prevention or deadlock aboidance is not employed.

To invoke detection algorithm, if deadlock occur frequently, it invoke every time. If the frequency of occurance is less then it invoke at less frequent interval.

Two option used in breaking deadlock
i) abort one or more process to break circular wait.
ii) preempt some resource from other deadlocked process.

Unit-III 4. Memory Management Function

The task of subdividing the memory among different process is called memory management. It is a method to manage operation between main memory and disk during execution.

Why Memory Management is Required

The memory management is required :-

i) Allocate and de-allocate memory before and after process execution.
ii) To keep track of used memory space.
iii) To minimize fragmentation issue.
iv) To proper utilization of main memory.
Data Integrity

Characteristics of memory System

A typical memory system has following character :-

i) Location :- A memory location should be either internal and external.

ii) Capacity :- The word length may or may not be equal to 1, 2 or 4 byte.

i) Speed,
ii) Cost, Data transfer, Volatility, Scalability.

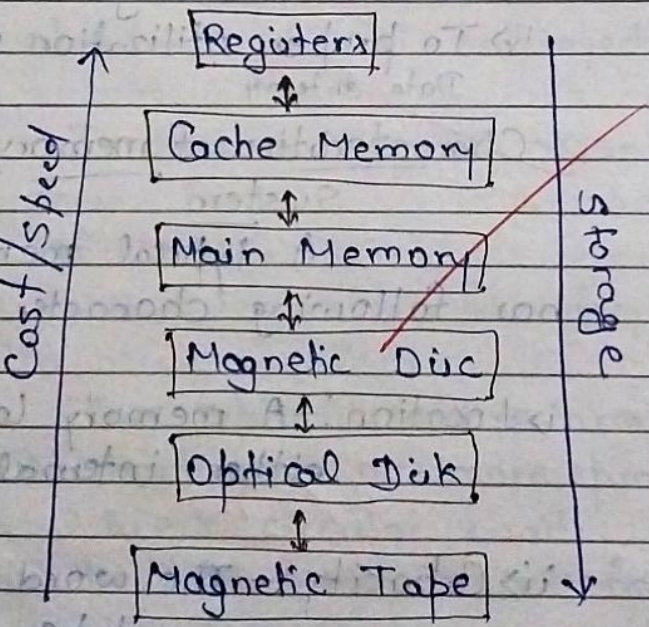
iii> Performance :- It performs several task quickly and efficiently.

iv> Unit of Transfer :- For internal memory, unit of transfer is equal to word length.

v> Physical Characteristics :- In volatile memory (RAM), the data is erased when power is off and In non-volatile (ROM), data is non-erased when power off.

Memory Hierarchy

A typical memory hirerachy structure is given :-



i> Regiters:- Thee are built to CPU. It is wed to scrach pad during execution. They are alo called CPU regiter. It is not a part of main memory. It contain status of CPU. Memory Address Regiter (MAR), Memory Buffer Regiter (MBR), Instruction regiter (IR) etc contained by system.

Accumulator
Program Counter
Stack Pointer

ii> Cache Memory:- It is high speed memory which is wed to increase the speed of processing. It is a part of main memory, where wed instruction are placed. It is of limited size so its manggement is done carefully.

iii> Main Memory:- It is built into CPU. CPU communicate directly with this type of memory.

iv> •Magnetic Disk:- It is wed to ~~storage~~ store large amount of data. The disk surface is coated by magnetic material. Each disk is divided into track and each track is divided into sectors.

- Static
- Dynamic

v> •Magnetic Tape:- It is flexible tape coated with magnetic oxide. On tape, data is stored one character at a time. Each character is repreented by 7 or 9 bit. Inter Record Gap (IRG) is wed to distinguish contiguous block.

vi> Optical Disk :- Compact Disk (CD) was introduced for digital audio. CD is also known as non-erasable disk that can store more than 60 minute audio information one one side. The computer uses CD-ROM, WORM and erasable optical disk.

vii> CD-ROM :- It is non-erasable disk used for store data. It is circular in shape and can hold about 600 MB of information. A highly intence laser is used to record digital information as a series of microscopic pit on reflective surface. A motor is used to rotate disk.
The intensity of reflective light changes. This change is detected by photo sensor and converted into digital system.

viii> WORM :- It stands for Write Once Read Many. It has same work as CD-ROM. The mostly used size is 5.25inch which holds from 200-800 MB of data.

ix> Erasable Optical Disk :- It uses optical technology & can be easily erased or rewritten. Its capacity is 650 MB.

Advtages: i> High Capacity
ii> Portability
iii> Relaibility

x> DVD :- Digital versatile Disk.

Characteristics of logical Address

- Generated by CPU: The logical address is produced by CPU when executing instruction.

ii> Virtual Memory: It is a part of virtual memory which provides illusion to process.

iii> Independance: It is independent of physical memory. MMU is responsible for translating logical address to physical address.

Working:

When a program makes a memory request, the address generated is logical address. The MMU translates logical address to physical address in RAM called address translation.

Characteristics of Physical Address

i> Actual Hardware Location: The physical address is location on physical memory, hardware.

ii> Used by Memory System: It is used by MMU to access data in RAM.

iii> Translation:- The OS maps logical address to physical address.

Working:

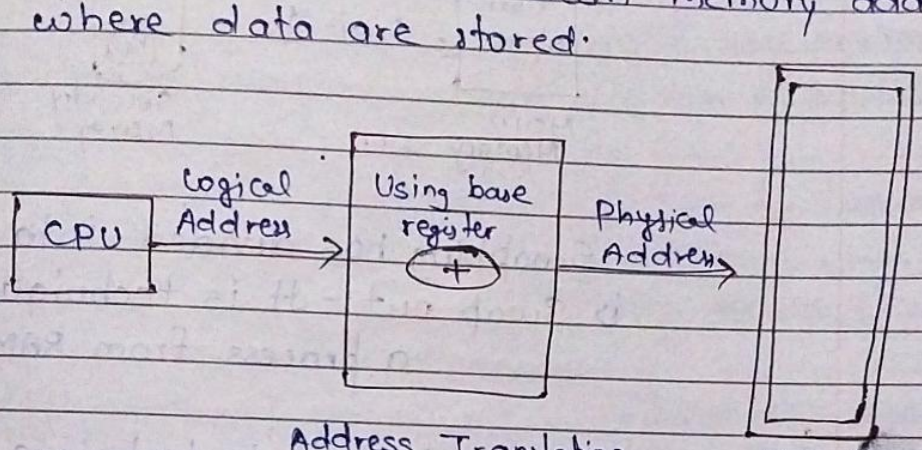
CPU generates a logical address. The MMU uses translation table to convert logical address to physical address. The physical address is then used to access data in actual RAM.

MMU translates

out and swap in. Medium term Scheduler is responsible for swapping.

(Virtual) Logical and Physical Address Space

Logical address are used to represent the information within a program's address space whereas Physical address represents the actual main memory address where data are stored.



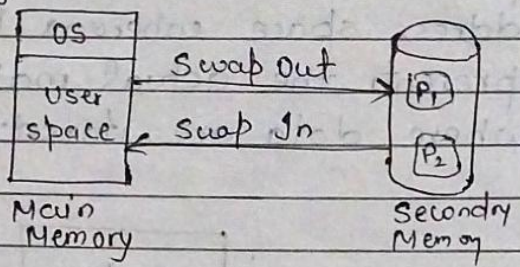
The set of logical address represent logical address space and the set of physical address represent physical address space. The content of base register are added to every logical address to obtain physical address.

SWAPPING

A process that removes data or program between computer's main memory and secondry memory. Swapper decide which process to swaped out and swap in. Medium Term Schedular is responsible for swapping.

The factor wich influence swap out are- suspended process, low priority etc.
The criteria for swap in process are- time spent in secondry memory, priority etc.

Diagram:



Swapping has divided into two concept.
i> Swap out:- It is technique for moving a process from RAM to hard disk.

ii> Swap in:- It is technique for moving a process from hard disk to RAM.

When the RAM is full and a new program needs to run, the OS selects the program that is currently in RAM. The selected data is moved to secondry memory, making space in RAM for new.

Advantages:
i> Process not need long wait for execution
ii> It utilize main memory
iii> Multiple process can be run.
iv> Concept of virtual memory is used.

Memory Allocation

The memory allocation is an action of assigning the physical or virtual memory address space to a process. Memory is divided according to type of user's environment. If there is only single user system, then memory is divided into two parts whereas in multi-user envrionment, memory is divided into number of partitions.

Memory is alloted to process by two method:-

i> Contigious

ii> Non-Contigious

i> Contigious Memory Allocation:- In a single process system, the memory is divided into two parts. One part holds the OS and other for various process. When a resident process completes its task, it is removed from ~~m~~ memory and new process replaced it by OS.

Usually OS is loaded in low memory because it needs to track first and last address of memory which is allocated to user. When the process comes, the OS checks the process size and the size of memory where it is located on. The size of process is not exceeded to available size of memory. As it takes memory, their remaining execution is going complete.

Two types of Contigious Memory:- i> Fixed(static)

ii> Variable(dynamic)

PDT - Partition Description Table → Track Status

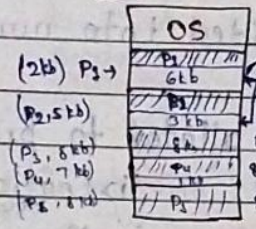
JMS

Concept of Multiprogr.

Partition After process coma

i> Fixed Partitioning :- It is done when the system is manufactured first. The number and sizes of each partition is usually defined during system generation. It is depend upon capacity of available memory, degree of multiprogramming and size of process. Each partition is allocated to each process.

RAM



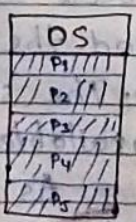
Internal frag. is occur

Internal Fragmentation

Disad.
1) Fragment
2) Limited size
3) Inefficient utilization

ii> Variable Partitioning :- In this partitioning, there is no fixation on numbers and size of partitions. Partitions are made according to the size of requesting process untill the memory is full. In this, allocation is done when a process request for memory, memory manager creates a suitable portion for process if there is contigious free sufficient memory and the remaining area is returned to free memory.

External frag. is occur



if the process P2 and P3 got executed, there is the space of 3kb is left in memory. Whenever a new process of 3kb wants memory, then it won't get any memory because the free space occurs at P2 and P3. This is called External fragmentation (not contigious)

Disad.
1) Ext. Frag.
2) Complex memory allocation
3) Difficult implementation

Adv.
1) merge two contigious area

Buddy system

So, to avoid External Fragmentation, one of the following four algorithms are used :-

i> First fit
ii> Next fit
iii> Best fit
iv> ~~Nex~~Worst fit

i> First fit :- It allocates the first free allocation which is large enough to hold the process.

ii> Next fit :- In this, searching of free partition starts not from begning of free list.

iii> Best fit :- It allocates the smallest free partition that meets the requirements of requesting process. It firstly searches entire free partition and then allocate the memory.

Time Consig
int. Frag.

iv> Worst fit :- It searches the largest free partition to the requesting process in order to reduce the rate of production of small holes.

Fragmentation

The process of dividing a computer file into fragments that are stored in different parts of computer storage, is called fragmentation.

JMS:

When a file is fragmented, it is stored on storage device in non-contigious block. Because memory blocks are so small, they cannot be assigned to processes and thus remain idle.

Fragmentation occurs when a file is too large to fit into a single contigious block of free space or when the blocks of free space are insufficient to hold the file.

Disad.
1) Slow Performance
2) Space Wastage
3) Data loss
4) Risk of system crash
5) Reduce battery life

There are two main types of fragmentation:-
i) Internal Frag.
ii) External Frag.

i) Internal Fragmentation:- Internal fragmentation occurs when there is unused space within a memory block. If a system allocates a 64kb memory to store a file that is only 40kb in size, that block will contain 24kb of free space, is called internal fragmentation.

ii) External Fragmentation:- It occurs when a storage device has many small block of free space. This can happen when a system creates and deletes files, leaving many free block of space. When a system needs to store a new file, it may unable to find single contigious block of free space to store the file, called external fragmentation.

	Internal Frag.	External Frag.
i>	Fixed size memory block of space is alloted to process.	Variable size memory block of space is alloted to proces.
ii>	It occurs when the process is smaller than memory.	It occurs when the process is remored.
iii>	To remove this, best-fit block should used.	To remove this, compaction and paging is used.
iv>	It occurs with paging and fixed partitioning.	It occurs with segmentation and dynamic partitioning.
v>	It occurs in worst fit memory allocation method.	It occurs in best fit and first fit memory allocation.

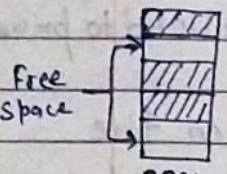
Compaction

Compaction is a technique to collect all the free memory present in the form of fragments in one large piece of memory which can be used to run other process.

It does by moving all the process towards one end of memory and all the available free space towards other end so it becomes contigious.

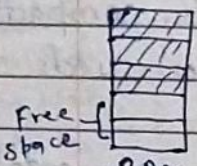
Although the compaction technique is very useful in making memory utilization efficient and reduce external fragmentation but large amount of time is wasted hence it reduces efficiency.

Before Compaction:



The memory has some free space between occupied space (external fragmentation). Due to ~~this~~ less free space between occupied space, large process cannot be loaded.

After Compaction:



All the occupied space has been moved up and free space at bottom. This makes the space contigious and remove external fragmentation. Process with large memory requirement can be loaded into RAM.

Sonali 14/11/24

PAGING In Non-Contigious

Paging is a memory management scheme that allows permits the physical address space of a process to be non-contigious. It allows fitting of various process of varying ~~process~~ sizes into memory that has external fragmentation.

It is used to store/retrieve data from HD to RAM.

In paging, physical memory is divided into fixed partition called 'frame'. Virtual address space is also divided into blocks, is called 'pages'. It is the amount of space in ~~hard disk~~ hard disk used for storing data of RAM.

The virtual (logical) address of a process is divided into two parts - Page number and offset. The Page Map Table contains page number and base address of frames in physical memory. The base address is combined with offset to determine actual memory address.

the value of

MMT - Memory Map Table
PMT - Page Map Table

The page and frames sizes are determined by hardware. Operating System keeps track of states of each frame using MMT. It indicates whether the frame is free or allocated.

F = M/P

No first fit or best fit algorithms are used because the frame sizes are equal to page size.

Hardware Support for Paging

This technique deals with protecting the memory for storing of mapping tables and speeding up mapping of virtual memory to physical memory.

The size of PMT must be large enough to accomodate the maximum size process in the system. A dedicated register 'Page Map Table Limit Register' is used to record highest virtual page number for process. Another register 'Page Map Table Base Register' is maintained to set the base address of PMT.

PMTLR
PMTBR in PCB

Disadvantages:

i> Due to fixed size of page, it may not utilize properly. (Internal Frag.)
ii> Page tables consume large amount of memory.
iii> Paging is a complex system to implement and debug.
iv> Too many pages in physical memory at same time can lead to thrashing.
v> OS needs to track pages on disk which can reduce performance.

Physical address is 1-Dimensional
virtual address is 2-Dimensional

SEGMENTATION

It is a memory management scheme in which a single process is divided into blocks of related information, called 'segments'. It provides dynamic relocation, protection and sharing.

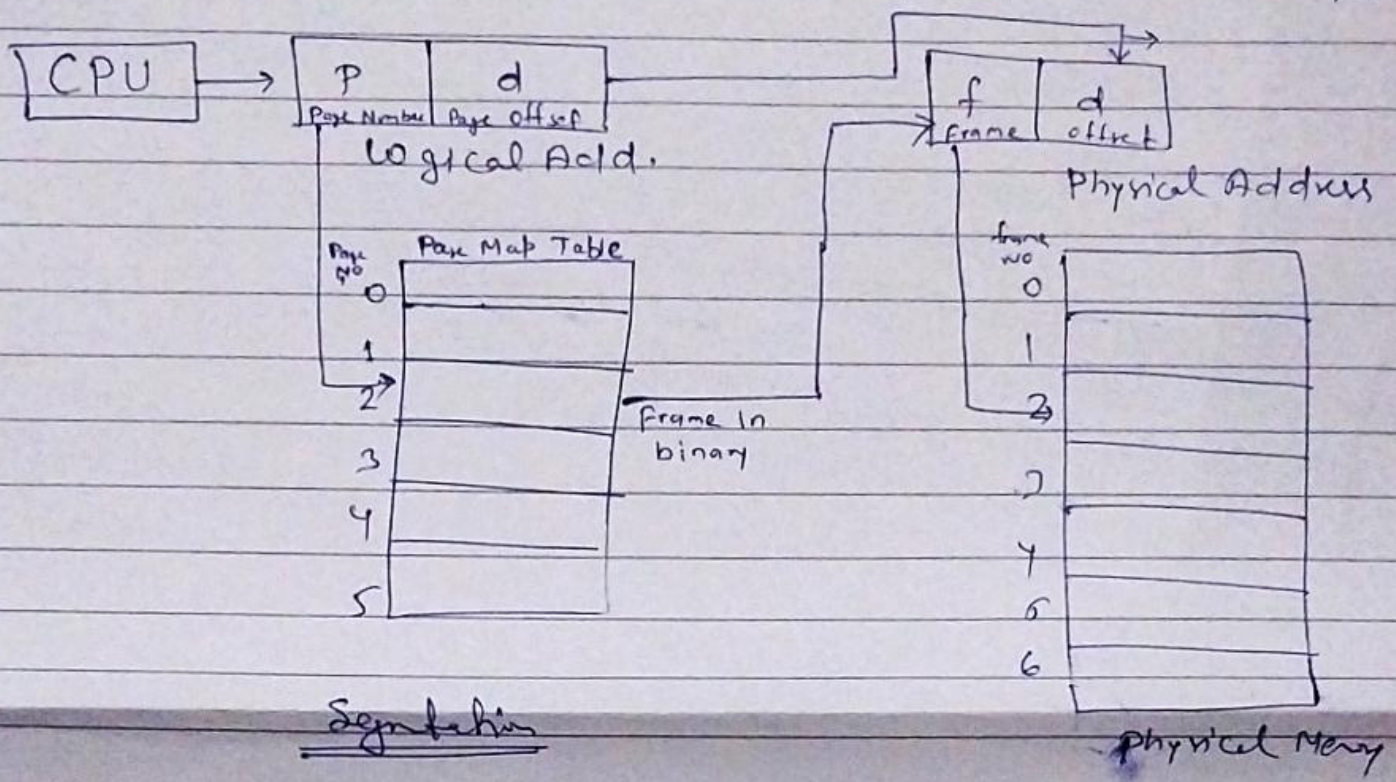
Generally, a program consists of set of instructions, global and local data and stacks so, a segment is a collection of such entities. Four segments are- CODE, DATA, STACK and SHARED.

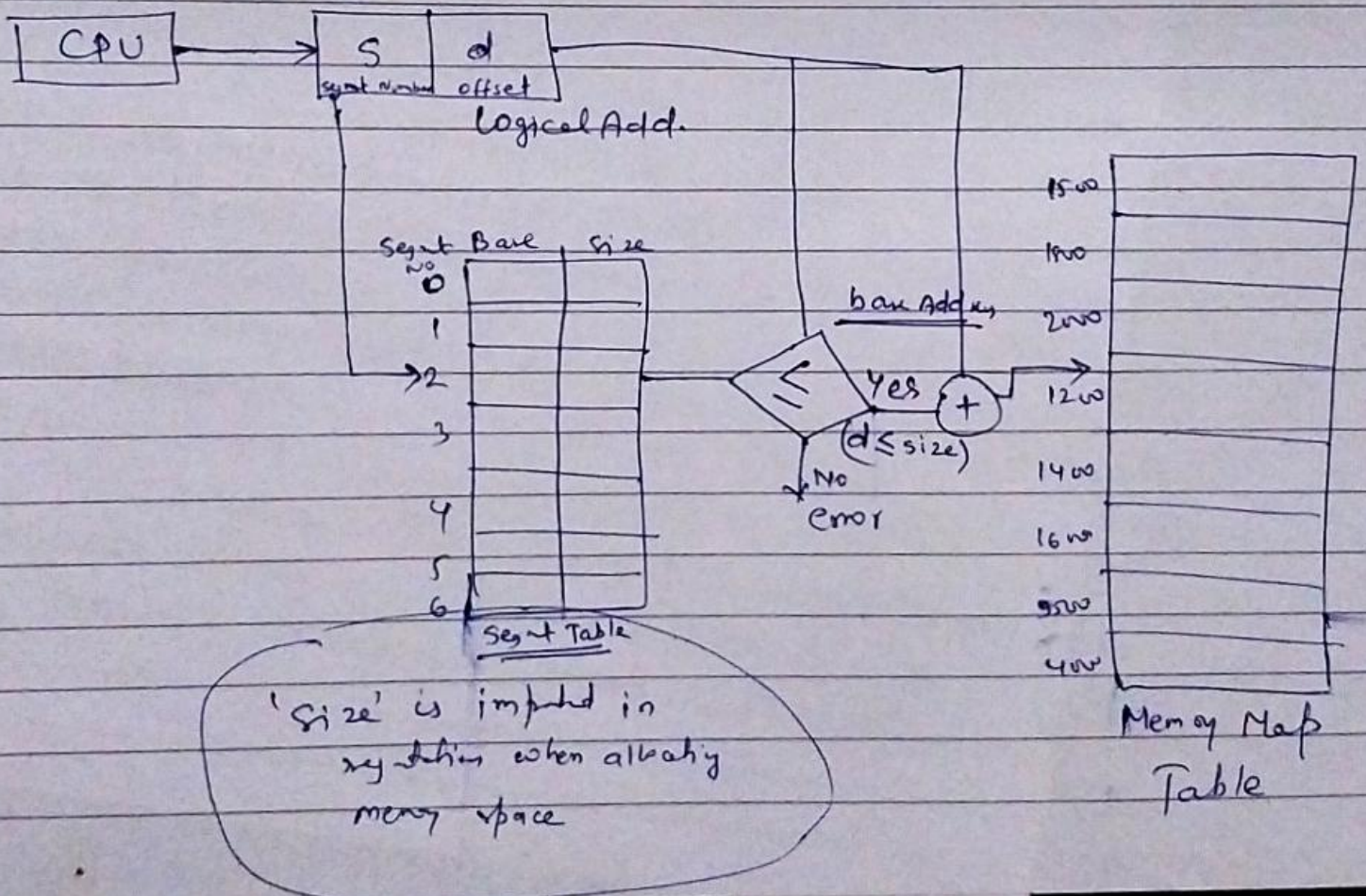
Address generated by CPU in segmentation consists of two components-
<segment number, offset>

When a segmented process request for memory, the OS creates a suitable portion as large enough to accomodate the need of each segment. The base and size of loaded segment are collected in a table called Segment Descriptor Table (SDT).

SDT can put either in fast register or in memory. A SDTBR is set to base of running process and since its size may vary so, SDTLR is used to contain the last segment number

Used to store/retrieve data from secondary memory to main memory as page.





Disadvantages:-

i> It can cause external fragmentation.
ii> The segment table requires more memory for each entry.
iii> It can be more difficult to implement and manage than paging.
iv> It can be challenging to allocate contigious memory.
v> It can be difficult to swap segments of different sizes.

* Difference between Paging and Segmentation.

Paging	
i> The program is divided into fixed sizes.	The program is divided into variable size.
ii> For paging, Operating System is accountable.	for segmentation, compiler is accountable.
iii> Page size is determined by hardware.	Segment size is determined by user.
iv> It is faster	It is slower
v> It results in internal fragm.	It results in external fragme.
vi> Paging is invisible to user.	segmentation is visible to user.
vii> It is hard to share procedure between processes.	It can share procedures between process.
viii> Protection is hard to apply for paging.	Protection is easy to apply for segmentation.
ix> Page is reffered to as physical unit of information.	It is referred to as logical unit of info

Virtual Memory

The secondry memory that is used to keep the portion of address space of executing process, is called virtual memory. It is a memory management scheme which allows partial loading of virtual address in physical memory.

The Operating System decide which section to bring in, when to bring and where to place it in main memory. The virtual memory system allows automatic migration of portions of address between main memory and secondry memory.

Virtual memory is implemented by maintaining the image of virtual address space of process in secondry memory and then into main memory.

Performance Increment with Virtual Memory

Partial loading of addreses into physical memory, reduces the amount of physical memory used per process so, many process can be loaded into physical memory simultaneously.

Management of Virtual Memory

When paging is used as memory management scheme, the implementation of virtual memory requires maintainance of one page map table per process. As size of virtual memory can be much greater than main memory, the size of PMT much larger.

The Operating System maintains one MMT to maintain a list of portions of physical memory available for allocation.

FMT is used when the required page is not found in main memory. One FMT is prepared and maintained for each active process.

Problems to Virtual Memory Concept

i) Allocation Policy :- It decides how much real memory to be allocated to each process.

ii) Fetch Policy :- It decides about when and which items are to brought into RAM.

iii) Replacement Policy :- It decides about when a new item is to brought and replaced with new one.

iv) Placement Policy :- It decides about placement of an incoming item in physical memory.

19/11/24

Unit-IV: I/O Management Function

The device management is the management of device in which OS tracks devices, allocating and deallocating device, monitoring device, installing device etc.

I/O traffic controller keeps the track of status of device and I/O schedular decides how I/O processor process a request and provide path from memory to device.

Dedicated Devices

A peripheral device that is assigned to perform single task at a time, is called dedicated device. It is allocated to a job for its entire duration.

Ex-ATM, printer

Some devices lend themselves to this form of allocation. It may be inefficient if the job does not fully and continually utilize the device.

Shared Devices

The devices that can be accesed by multible user simultaneously, is called shared device Ex-Disk-DASD. Information is stored on direct access device is directly accesible.

Input-Output Devices

The computer mainly works on input-process-output cycle. The user feed data to computer as input. These data are then converted into machine language and after this, data is stored in ~~machine language and~~ memory where they are taken for processing and after processing the result is displayed as output.

Throughtout the whole cycle, the process deals with various I/O and storage devices.

i> Input Devices:

The device that is used to supply input to computer for processing, is called input device. Ex- Keyboard, Mouse etc.

CCD

Various common input devices are as follows:-

i> Keyboard:- It is an input device that is used to input key typed characters into computer. Mainly, keyboard with 104 key is used widely. Various types of keys include numeric key, character key, function key etc.

ii> Mouse:- It is an input device that is used in GUI system in which we interact through pictures. It is a navigation or pointing device used to supply input. It contain two specific button and a ball to supply input.

iii> Smart Card Reader: The device that is used to decode the data stored on the magnetic strips of smart card, is called smart card reader. Ex- ATMs contains magnetic strips on the back of card to store important data.

iv> Light Pen: It is a type of pointing device that is used to choose a displayed menu on screen for a program. It doesn't emit light, it react to light through photo-sensitive detector. It is used for marking portion of screen.

v> Scanner: It is a type of input device that is used to transfer printed or handmade documents to computer. Flat bed scanner is widely used. It is cheaper and have better resolution.

CCD

vi> Bar Code Reader: It is made up of bars of different width and spacing that gives algebraic and numeric information about products and address. Bar code scanners are fast, accurate and efficient.

vii> Digital Cameras: These are the type of image capturing and video capturing device which uses magnetic or semiconductor technology to store data. The picture and video are of best quality or resolution based on type of Camera

CGA - Colour Graphic Adaptor
EGA - Enhanced Graphic Adapter
VGA - Video Graphic Adapter
XGA - Extended Graphic Adapter

JMS

ii> Output Device: The device that is used for taken or display output of processed data, is called output device. It is the third phase of processing cycle. In this, the information is displayed in soft or hard form.

Two types of output device:-
i> Soft copy Output
ii> Hard copy output

i> Soft copy output: It is a type of output which is available to user till computer is on. This is not a permanent type output.

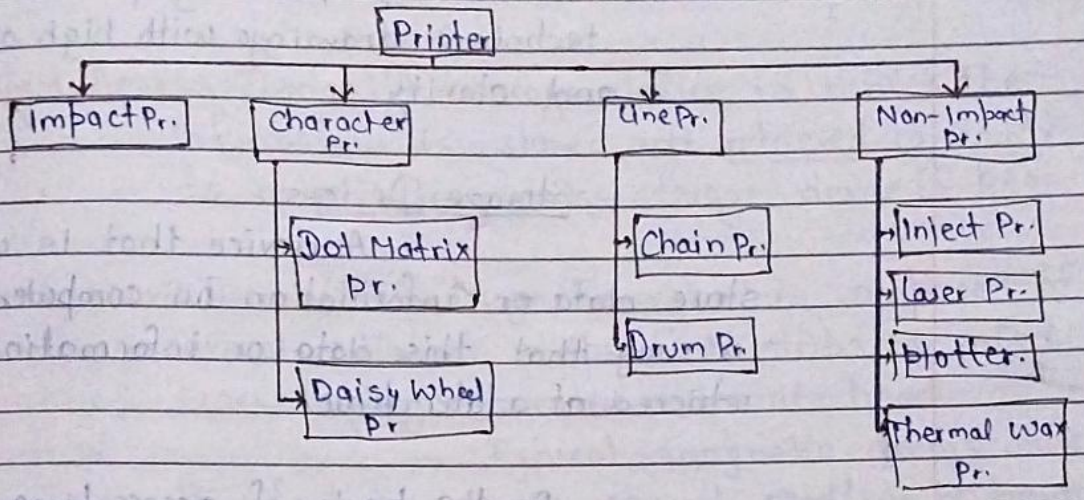
ii> Hard copy output: It is a type of output which can be read directly and immediately. It is produced on paper and is permanent type o/p

Various are common output device:-

i> Computer Monitor: The monitor or Visual Display Unit is a device that displays visual information from a computer. It is essential setup allowing users to see output generated by computers. Various types of monitors like LED, LCD and OLED comes in different sizes resolution and types.

OLED - Organic LED

ii> Printer: It is a peripheral device that produces hard copy of document. It translates digital data from a computer into physical form on paper.



iii> Speaker: It is a computer hardware output device that provides audio output for various multimedia application. It allows user to hear sound effects, music and other audio elements while using computer. Speakers can come in different sizes and configration, from built-in speaker on laptop to external speaker connected to desktop.

iv> Projector: It is a device that allows user to display the content from their computer screen onto a larger surface, known as projector screen with a larger audience.

SSD- Solid State Drive

iv) Plotter: It is a device that is used to create high-quality graphics and for printing large engineering drawing or architectural blueprint. This results in precise and detailed output, making plotters ideal for technical drawings with high accuracy and clarity.

Storage Devices

A device that is used to store data or information in computer in such a way that this data or information may be retrieved at a later time.

On the basis of access time, the storage device classifies into three categories:

i) Serial Access Device
ii) Completely Direct Access Device
iii) Direct Access Device

i) Serial Access Device: It is a device in which the information is stored and retrieved in a strict manner. Ex- Magnetic Tape Unit. Information is stored in them as record form. Each record can be identified by its physical position on tape. These are mainly used for applications that only require sequential accessing.

ii> Completely Direct Access Device: A device in which the access time time does not vary and it remains constant for every request. Ex- Magnetic core memory, semiconductor memory, ROM etc. It is used in main memory.

iii> Direct Access Device: A storage device in which the information is stored and retrieved randomly, is called directaccess storage device. Ex- RAM.

i> Fixed Head Drum/Disk: Magnetic drum is composed of several adjacent strips. Each strips is called track having separate read/write head.

Typical magnetic drums move very fast and have several read/write head. So, a random access to read or write can be accomplished in 5 or 10 milliseconds.

Charact:

rotation speed ≃ 10 msec
maximum access time ≃ 10 ms
Ave. access time ≃ 5ms
Capacity = 10 milion byte
serial access time ≃ 1 ms

ii> Moving Head Drum/Disk: It uses flat disk with a series of concentric circles, one for each read/write head. The heads are physically moved from track to track and such unit called moving head.

Ex- FD, HD.

Av. access time ≃ 30ms
Capacity = 100 milion bytes

Disk scheduling Algorithm
1) First come first serve
2) shortest seek time first
3) SCAN
4) C-SCAN
5) Circular SCAN 6) Circular LOOK

OS

Buffering

A process in which the data is stored in a buffer or cache, which makes this data more accessible than original source. It is an area in memory that is used to hold data that is transmitted from one place to another. It is used to manage speed mismatch between two devices.

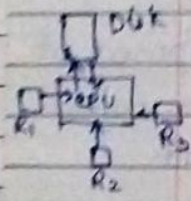
(PPT)

Adv:
1) Efficiency
2) Reduce time delay
3) Better resource utilization

Disad:
1) Memory used
2) Complexity

Spooling

SPOOL stands for Simultaneous Peripheral Operation on line. A spool is a buffer that holds output for a slower device during execution of a program. So, spooling is done with the help of high speed device.



(Y.D)

A ring buffer mechanism is used for spooling. In first step called spooler, the output of process is written to ring buffer. The second process reads line from ring buffer and write them on printer. It improves the performance of system. It leads to multiprogramming. It keeps CPU and I/O working at higher rate.

Types:-
1) Print spooling
2) Job spooling
3) Email spooling

Adv:
1) Efficient use of resource
2) Queue management
3) Better user experience

Disad:
1) Storage requirement
2) Complexity

Spooling	Buffering
i) It overlaps I/O of one job with execution of another job.	It overlaps I/O of one job with executing of same job.
ii) It is more efficient.	It is less efficient
iii) It process data at remote place.	It doesn't process data at remote place.
iv) It handles large amount of data.	It handles limited amount of data.
v) It is more complex	It is less complex
vi) It uses tempory memory (buffer)	It uses disk or special storage area (spool)

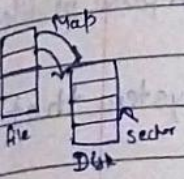
File System
i) Window - NTFS
ii) Unix - Unix file sys.
iii) Dos - fat file system
iv) Linux - Extended file system
v) Big data - zfs file system

Before storing a file on memory, it is divided into blocks then maps to Disk

JMS

Unit-IV 6. File Management

Disk Size
= Plat. x Surfa. x Track x sector x Data



The collection of related information that is stored on secondry memory permanently, is called file. It generally represents programs and data. It may be numeric, alphabetic or binary.

File information can be a text file, object programs, executable program and so on. Source file is a sequence of subroutines and functions organised as declaration followed by executable statement. Executable file is a series of code sections that the loader bring into memory and execute them.

e System is a dule/software OS (Kernal)

Functions of File System

Following are the major functions of file system as follows.

i) It locates the information from secondry storage into main memory.
ii) It manages secondry storage medium.
iii) Each block of file is tracked.
iv) It provides disk scheduling
v) It extracts directory content.
vi) It supports protection and sharing of files between multiple user.
vii) It provides backup facilities when system crashes.

File Attributes (Metadata)

A file has certain attributes which may vary from one O.system to another:-

i> Name: The name given to file when saving may read the purpose of file

ii> Type: It is used for those system that support different types.

iii> Location: It tells where the file is stored on disk.

iv> Size: It define file size in kb, mb, tb etc.

v> Protection: To protect the file information from external hacker or fraudster.

vi> Modify time and date: It denotes the time and date when file is created

vii> Extension: It defines how the data within the file is organised like .xl, .ppt

viii> Permission: It means the permission required to open file for whom can see file.

ix> Encryption: It defines data security that protect file's content from unauthorized user.

x> Access Time
xi> File Owner
xii File lock info.

File Operations

File operation is an action performed on a file in computer like create, delete etc. Various types of operation are :-

i> Create: The file is created in the file system. It allocates space to store file.

ii> Open: The file may open to read, modify the content.

iii> close: When the user needs get fullfill, it must close the file.

iv> Read: To read a file with the help of system call.

xii) Move

xiii Search

v> Write: To ~~read~~ write a file, with the help of system call specyfing the name of file to written to file.

vi> Reposition: File can be re-positioned from one location to another.

Search > Delete

vii) Delete: File can be deleted to make free.

viii> Trauncate: Trauncating a file means deletion of specific content, no whole file.

ix> Append (extend): A file can be appended from file.

Search > Rename

x> Rename: File can be renamed many times.

xi> Copy: Copy of file can be made for sharing that file to other.

Access Methods for File

To read or write a file information or record, is called file access. There are several ways for information to be accesed:-

i> Sequential Assess
ii> Direct Access
iii> Other Access method

i> Sequential Access: In sequential access method, the information in the file is processed in sequential order. The writing and reading of data in a sequential order. Ex- magnetic tape. The read and write operation on file autimatically advances the file pointer.

Use:-
i> Text file
ii> Audio & Video
iii> Backup system

Charst:
i> Data is accesed one record right after the last.
ii> Read a pointer to be moved by one.
iii> Write allocates space for the record.
iv> It is implemented by file system.

ii> Direct (Random) Access: It means accessing a point with in storage point without moving sequentially. There is no restriction on the order of reading or writing for direct access file. It is used in magnetic disk. It can store large amount of information.

Use:-
i> Database
ii> Multimedia application
iii> OS virtual memory

Charst: i> No restriction in reading or writing block.
ii> The file is viewed as numbered sequence
iii> It is much faster for large files.

iii> Other Access Method: It can be built on top of direct access for fast direct accessing by involving concept of index. Index is a table which contains pointers to various blocks. In some file system, multilevel index can be formed such that 1st level index point to IInd level.

File Management

File system is a mechanism that provides an online storage of program or data so that it can be retrieved later. Users enter its information in to system through file. The file system permanently stored on storage that holds permanent data.

A file system is designed in such manner that it not only defines a file and attributes but also maps the logical file on to the physical storage.

There are four types of file system:-

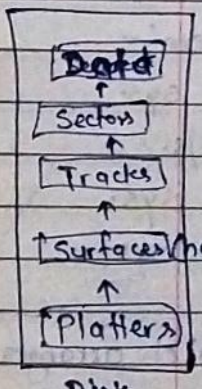
i> Simple file sys.
ii> Basic file sys.
iii> logical file sys.
iv> physical file sys.

i> Simple file system: It is the part of file system which arranges ~~which arrange~~ the user's files in a manner which is seen by user. It arranges the files in directories and subdirectories along with extension name. It is the responsibilities for create structure of files for user.

ii> Basic File System: This file system helps user in reading and writing records in terms of physical block on secondry storage. For identifying the physical block, the basic file system manages the numeric disk address in terms of drive, side, cylinder etc.

iii> Logical file system: It manages metadata information which includes the entire file system structure except actual data. It also manages directory structure File Control Block (FCB). It provides protection and security to file.

iv> Physical File System: It manages how the data are arranged on physical storage. It consists of device drivers and interupts handlers and it manages the transfer of information between main memory and secondry storage. It provides physical address of form. The information generated by it are used by Basic file system to help user.



Adv:
i> Disk utilization
ii> Retrieve faster

Methods for allocation

The allocation methods define how the files are stored in disk blocks. The main purpose of this is efficient disk space utilization and fast access to file blocks.

Three methods for this is based on our requirement
i> Contigious Allocation
Non-Contigious Allocation
ii> Linked Allo.
iii> Indexed Allo.

FAT - File Allocation Table

Access/seek time increases in Non-Cont.

JMS

i> Contigious Allocation:- In this scheme, each file occupies a contigious set of blocks on the disk.

Ex- if a file requires 'n' blocks and is given a block 'b' as starting location, then the blocks assigned to file be - b, b+1 ... b+n-1.

The directory entry for file with contigious allocation contains address of starting block and length of allocated portion.

First fit and best fit are the most common algorithm used to select a free hole from set of holes.

access/seek time decreased

Disad:
1) Disk fragmen.
2) Hard to require file size
3) Difficult to grow file

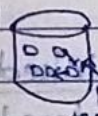
← continue allocate block (sequentially)

Non Contigious

ii> Linked Allocation:- In this scheme, each file is a linked list of disk blocks which need not to contigious. The disk blocks can be scattered anywhere on disk. The directory entry contains a pointer to the starting and ending file block. Each block contains a pointer to the next block occupied by the file.

Hence external fragmentation is removed in linked allocation because any free block may be allocated to any file.

Disad:
1) Efficiency
2) Space utilization is low
3) reliability
4) Time Consuming



Two things, it has
→ Data
→ Pointer of next node

iii> Indexed Allocation:- In this scheme, all the blocks number of a file is brought into one block, called indexed block. The directory entry contains the address of index block. The 'ith' entry in index block contains disk address of 'ith' file block. When the first block is written, then its number is put into first index of index block.

Disad:
1) Concept
2) Pointer > 1 linked allocation
3) Pointer overhead

Hence index allocation removes the problem of external fragmentation.

Free Space Management

It is used to maintain free area. It records all disk blocks that are free. When a file is created, free space is allocated to it and when it is deleted, its space is added to free space list.

i) Bitmap or Bit Vector:- It is a collection of bits where each bit corresponds to disk block. The '0' indicates the block is free and '1' indicates allocated block. It is very simple and efficient to find blocks on disk.

ii) Linked List:- In this, free blocks are linked together and address of first block is stored at a specific location on disk and cached in memory. First free block contains the address of next free block.

iii) Grouping:- In this, first free blocks contains address of 'n' free consequtive blocks. The last blocks also contains address of another 'n' free blocks and so on. Hence, we get sufficient large free blocks.

iv) Counting:- It stores the address of first free block and a number 'n' of free contigious disk blocks that follows first block. So, free space list contains a disk address along with a count.

Monday 4/11/24