Operating System(OS)

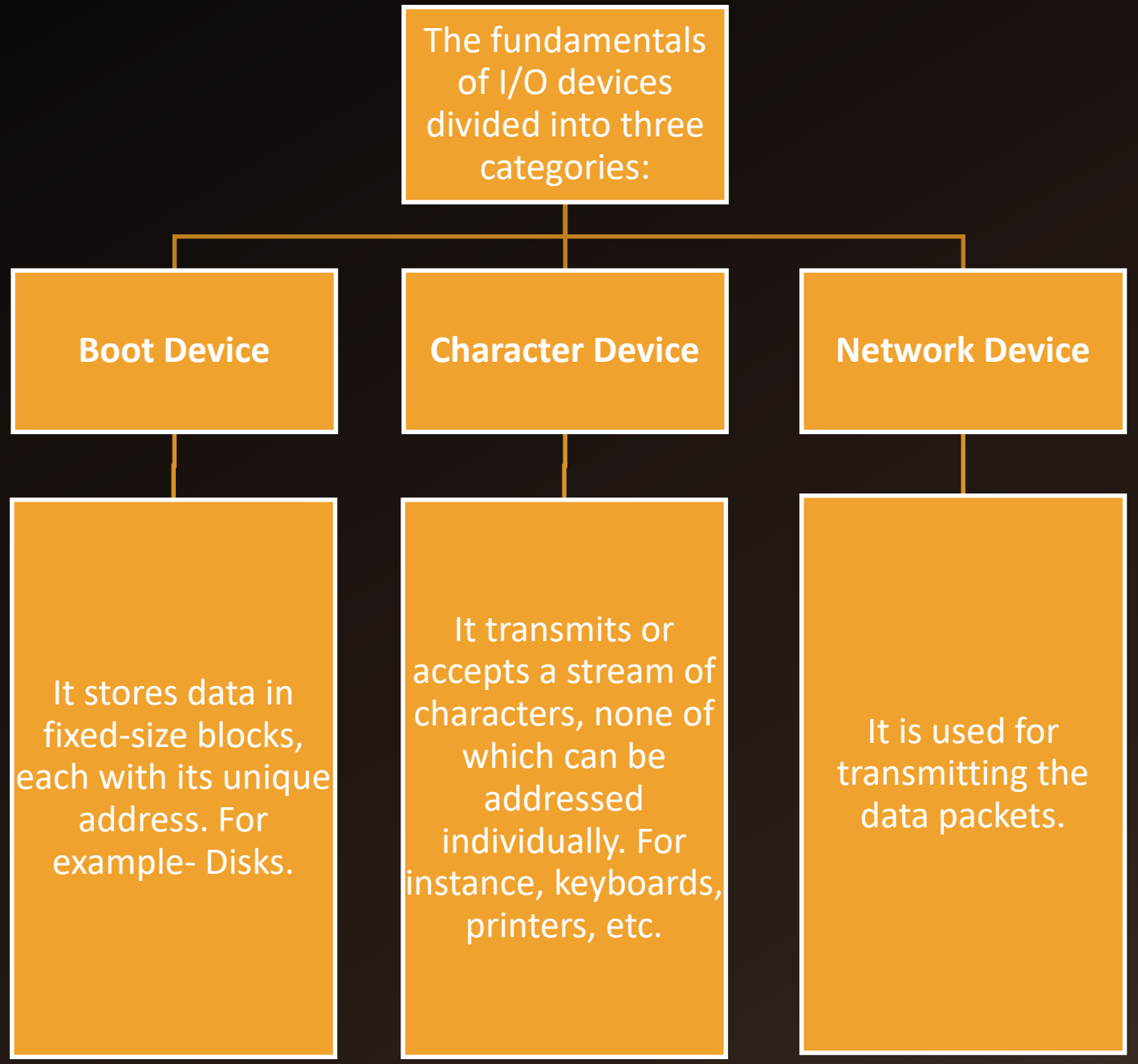
BCA IV SEM OS

Device Management

AS OPERATING SYSTEM

DEVICE MANAGEMENT IN OPERATING SYSTEM

Device management in an operating system means controlling the Input / Output devices like disk, microphone, keyboard, printer, magnetic tape, USB ports, camcorder, scanner, other accessories, and supporting units like supporting units control channels. A process may require various resources, including main memory, file access, and access to disk drives, and others. If resources are available, they could be allocated, and control returned to the CPU. Otherwise, the procedure would have to be postponed until adequate resources become available. The system has multiple devices, and in order to handle these physical or virtual devices, the operating system requires a separate program known as ad device controller. It also determines whether the requested device is available.



Functions of the device management in the operating system

It keeps track of data, status, location, uses, etc. The file system is a term used to define a group of facilities.

It allocates and effectively deallocates the device. De-allocating differentiates the devices at two levels: first, when an I/O command is issued and temporarily freed. Second, when the job is completed, and the device is permanently release

It enforces the pre-determined policies and decides which process receives the device when and for how long.

It monitors the status of every device, including printers, storage drivers, and other devices.

It improves the performance of specific devices.

Types of devices

Dedicated Device

In device management, some devices are allocated or assigned to only one task at a time until that job releases them. Devices such as plotters, printers, tape drivers, and other similar devices necessitate such an allocation mechanism because it will be inconvenient if multiple people share them simultaneously. The disadvantage of such devices is the inefficiency caused by allocating the device to a single user for the whole duration of task execution, even if the device is not used 100% of the time.

Shared Devices

These devices could be assigned to a variety of processes. By interleaving their requests, disk-DASD could be shared by multiple processes simultaneously. The Device Manager carefully controls the interleaving, and pre-determined policies must resolve all difficulties.

Virtual Devices

Virtual devices are a hybrid of the two devices, and they are dedicated devices that have been transformed into shared devices. For example, a printer can be transformed into a shareable device by using a spooling program that redirects all print requests to a disk. A print job is not sent directly to the printer; however, it is routed to the disk until it is fully prepared with all of the required sequences and formatting, at which point it is transmitted to the printers. The approach can transform a single printer into numerous virtual printers, improving performance and ease of use.

Features of Device Management

- The OS interacts with the device controllers via the device drivers while allocating the device to the multiple processes executing on the system.
- Device drivers can also be thought of as system software programs that bridge processes and device controllers.
- The device management function's other key job is to implement the API.
- Device drivers are software programs that allow an operating system to control the operation of numerous devices effectively.
- The device controller used in device management operations mainly contains three registers: command, status, and data.

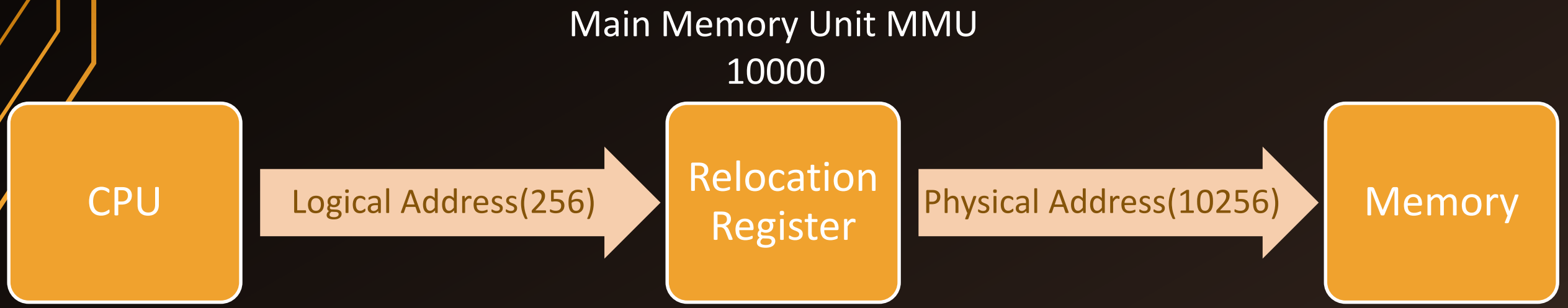
Logical and Physical address in OS

LOGICAL ADDRESS

- It is also known as a virtual address.
- It is a address generated by CPU during program execution.
- This address is used as a reference to access the physical memory located by CPU

PHYSICAL ADDRESS

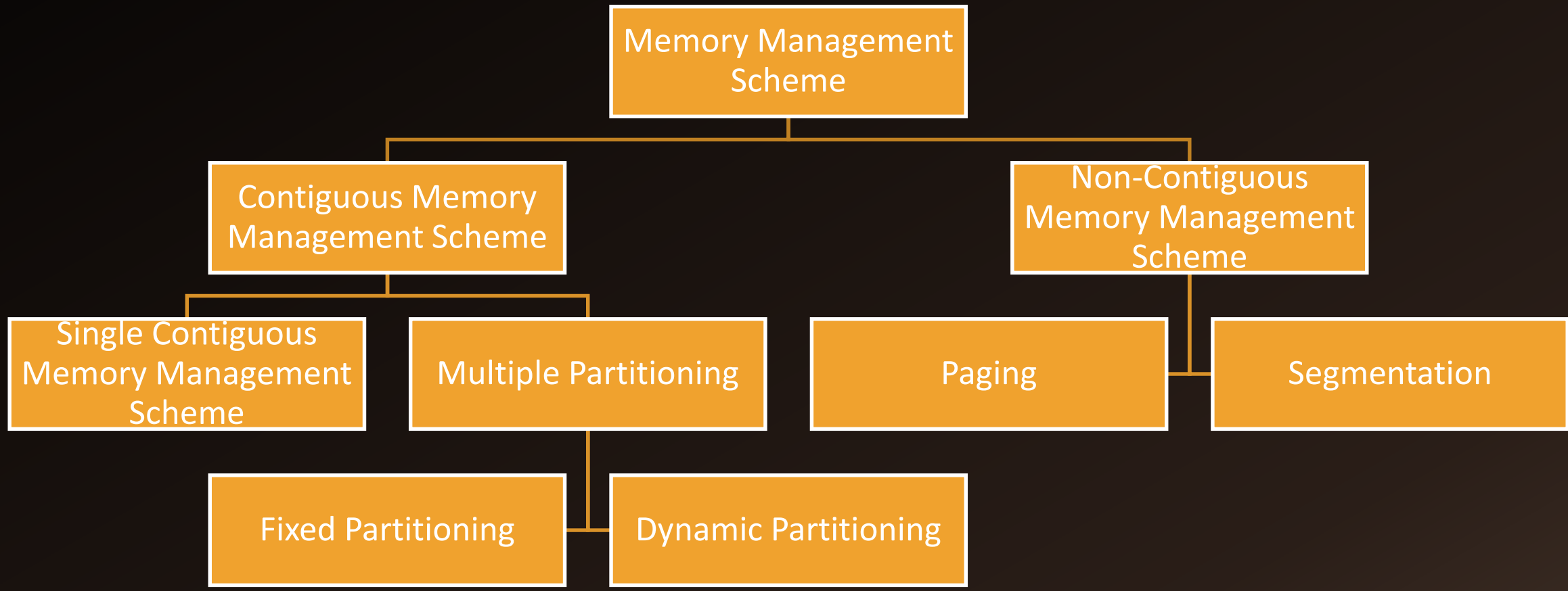
- It is the actual address in main memory where data is stored.
- Physical address are used by the memory management unit(MMU) to translate logical address to physical address.



Difference Between Logical address and Physical Address

Parameter	LOGICAL ADDRESS	PHYSICAL ADDRESS
Basic	generated by CPU	location in a memory unit
Address Space	Logical Address Space is set of all logical addresses generated by CPU in reference to a program.	Physical Address is set of all physical addresses mapped to the corresponding logical addresses.
Visibility	User can view the logical address of a program.	User can never view physical address of program.
Generation	generated by the CPU	Computed by memory management unit(MMU)
Access	The user can use the logical address to access the physical address.	The user can indirectly access physical address but not directly.
Editable	Logical address can be change.	Physical address will not change.
Also called	virtual address.	real address.

Memory Management Techniques

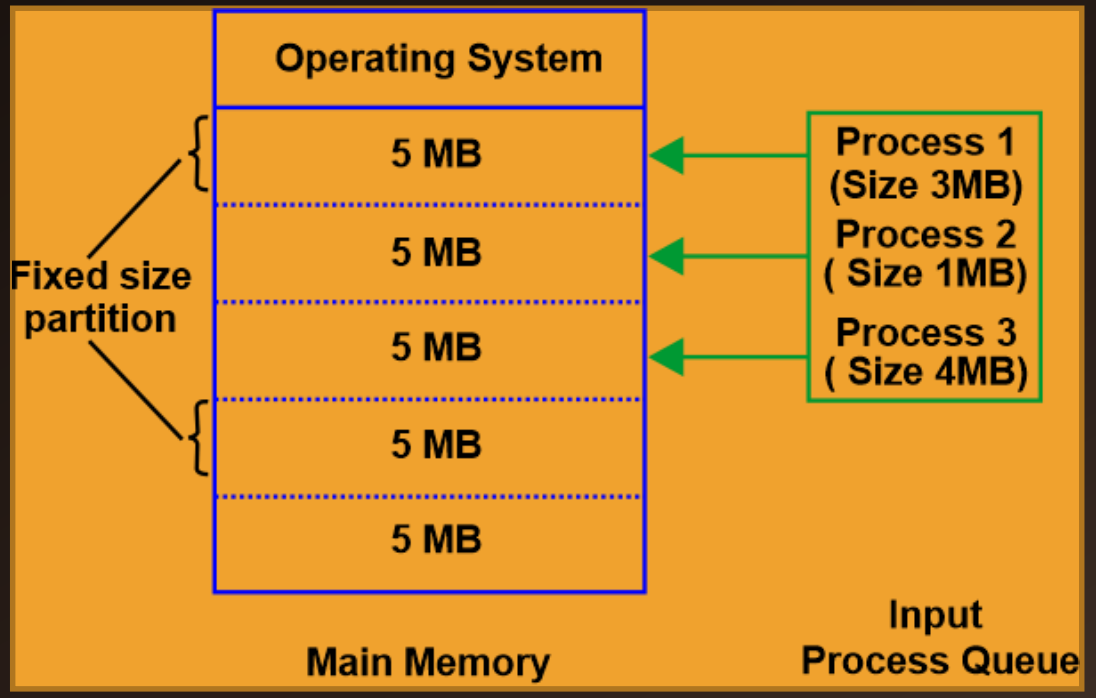


Contiguous Memory Allocation(CMA) in Operating System

In a contiguous memory management scheme, each program occupies a single block of storage location such as a set of memory locations with consecutive addresses.

operating system memory allocation method is contiguous memory allocation. What, however, is memory allocation? A software or process requires memory space in order to be run. As a result, a process must be given a specific amount of memory that corresponds to its needs. Memory allocation is the term for this procedure.

- **Fix-size Partitioning Method**
- **Flexible Partitioning Method**



Single continuous memory allocation.

- Is this scheme the main memory is divided into two contiguous areas or partitions.
- This OS resides parametric in one partition, generally at the low memory and user process is loaded into other partition.

ADVANTAGES OF SINGLE CONTIGUOUS MEMORY ALLOCATION

- Simple to Implement.
- Easy to manage and design.
- In this schema, once a process is loaded, it is given fully processor's time, and no other process will Interrupt it.

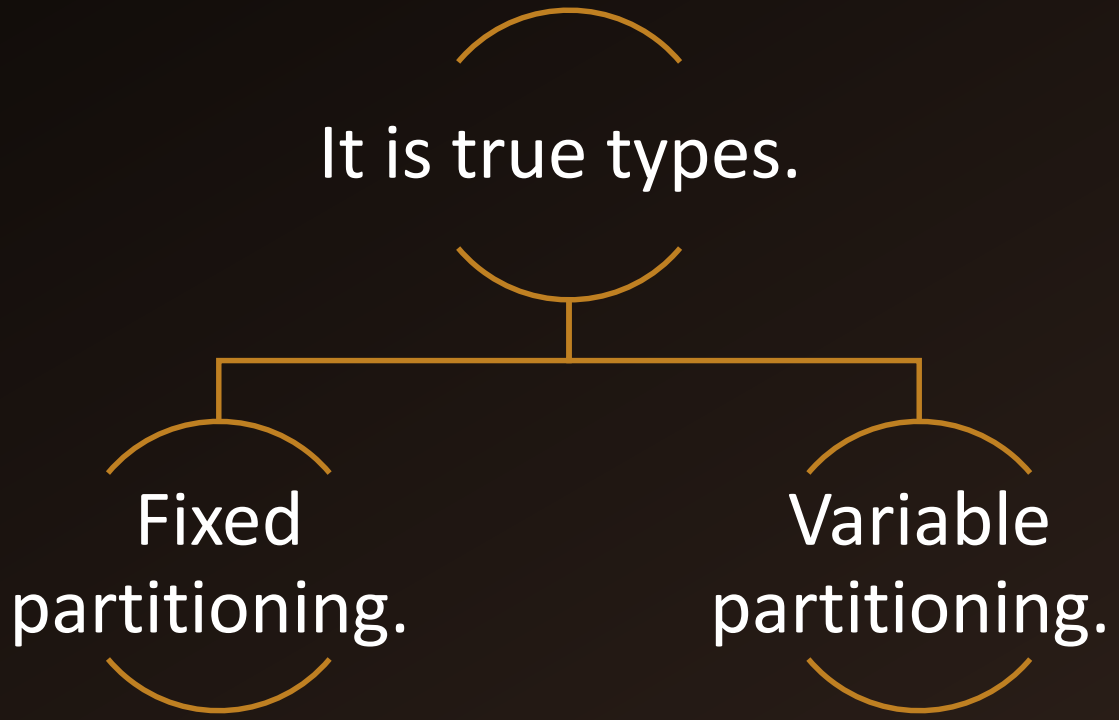
DISADVANTAGES OF SINGLE CONTIGUOUS MEMORY ALLOCATION

- Wastage of memory space.
- The CPU remained Ideal.
- It can only be executed if the program is too long.
- It does not support multi programming.

OS	P1	P2	P3
4MB	2MB	4MB	8MB
Balance 6MB	Yes	Yes	Fail

MULTIPLE PARTITION CONTINUOUS MEMORY ALLOCATION.

In this operating system needs to drive the Available main memory into multiple parts to load multiple process into main memory.



FIXED SIZE PARTITIONING SCHEME

This technique is also known as static partitioning.

In this schema the system divides the memory into Fixed size of partitions.

the partitioning may or may not be the same size.

OS	4MB	SYSTEM	FREE	External fragmant	DONE?
P1	2MB	2MB	0MB	0MB	YES
P2	4MB	6mb	2MB	2MB	YES
P3	8MB	6MB	6MB	-2MB	YES

VARIABLE SIZE PARTITION SCHEMA.

This schema is also known as dynamic partition.

It overcomes the drawback of internal fragmentation that is caused by static partitioning.

As partition size varies According to need of deep process so in this partition schema there is no internal fragmentation.

Advantage.

Remove internal fragmentation.

Maintain multi programming.

Closest execution space available.

OS	P1	P2	P3	P4	
2MB	2MB	2MB	5MB	10MB	NEED
2MB	2MB	2MB	5MB	BLOCK	USED

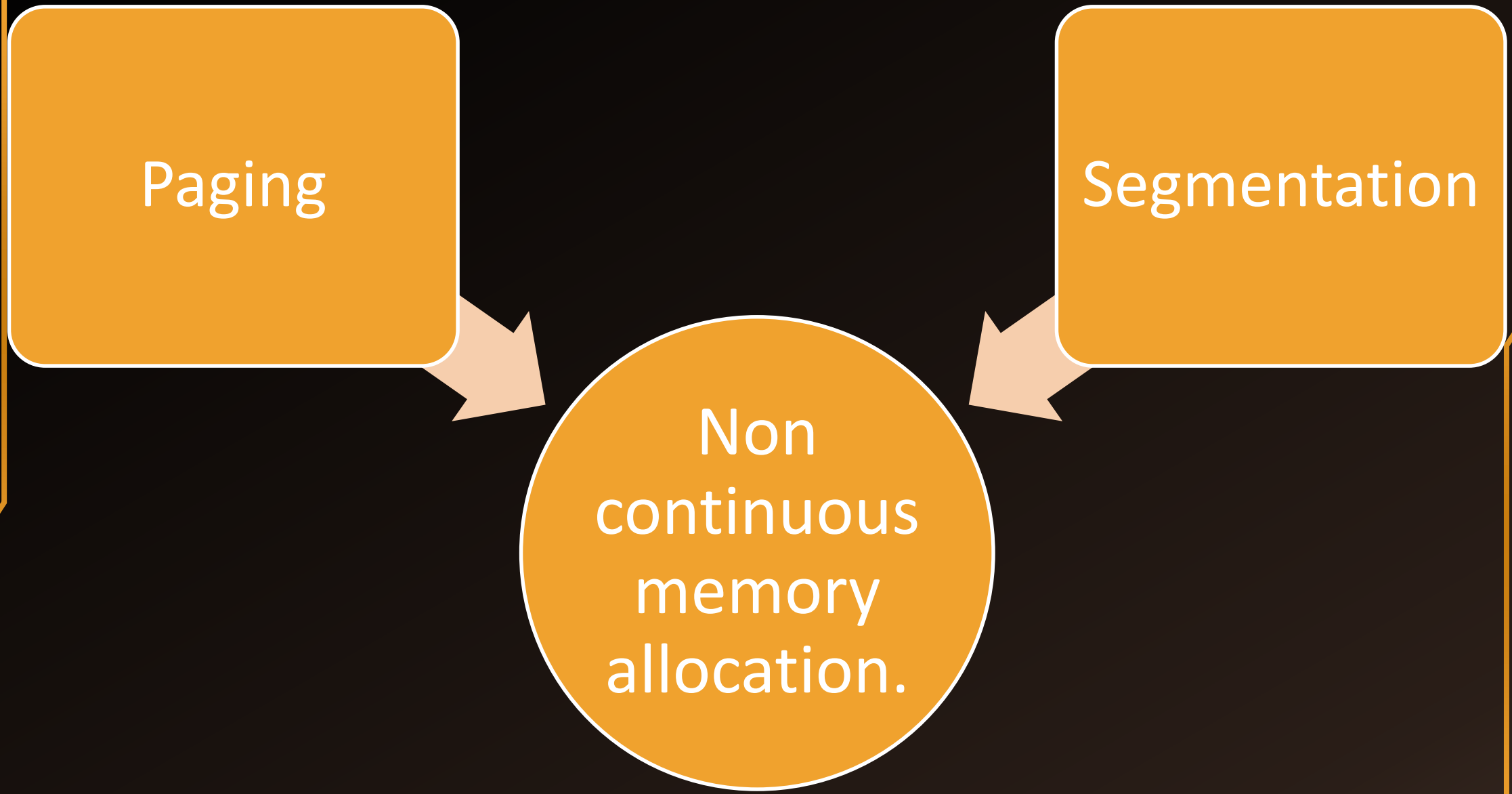
NON CONTINUOUS MEMORY ALLOCATION.

Noncontiguous allocation also known as dynamic or linked Allocation.

In this technique. Each process is allocated a series of noncontiguous blocks of memory that can be. Allocated anywhere in this physical memory.

There is no loss of memory in this allocation.

OS	4MB	SYSTEM	WORK	WORK 2	WORK 3
P1	2MB	2MB	RUN P1	P3(2MB)	P4(2MB)
P2	4MB	4MB	RUN P2		P4(4MB)
P3	8MB	6MB	WORK AFTER p1 OR p2	P3(6MB)	P4(2MB)
P4	16MB	8MB	WORK AFTER P1 OR P2 OR P3	WORK AFTER P1 OR P3	P4(8MB)


Paging
Segmentation
Non continuous memory allocation.

Difference between Contiguous and Non-Contiguous Memory Allocation in operating system

S.NO	Contiguous Memory Allocation	Non-Contiguous Memory Allocation
1.	Contiguous memory allocation allocates consecutive blocks of memory to a file/process.	Non-Contiguous memory allocation allocates separate blocks of memory to a file/process.
2.	Faster in Execution.	Slower in Execution.
3.	It is easier for the OS to control.	It is difficult for the OS to control.
4.	Overhead is minimum as not much address translations are there while executing a process.	More Overheads are there as there are more address translations.
5.	Both Internal fragmentation and external fragmentation occurs in Contiguous memory allocation method.	Only External fragmentation occurs in Non-Contiguous memory allocation method.
6.	It includes single partition allocation & multi-partition allocation	It includes paging and segmentation.
7.	Wastage of memory is there.	No memory wastage is there.
8.	In contiguous memory allocation, swapped-in processes are arranged in the originally allocated space.	In non-contiguous memory allocation, swapped-in processes can be arranged in any place in the memory.
9.	It is of two types: 1.Fixed(or static) partitioning 2.Dynamic partitioning	It is of five types: 1.Paging 2.Multilevel Paging 3.Inverted Paging 4.Segmentation 5.Segmented Paging
10.	It could be visualized and implemented using Arrays.	It could be implemented using Linked Lists.
11.	Degree of multiprogramming is fixed as fixed partitions	Degree of multiprogramming is not fixed

Paging in os

In Operating Systems, Paging is a storage mechanism used to retrieve processes from the secondary storage into the main memory in the form of pages.

The main idea behind the paging is to divide each process in the form of pages. The main memory will also be divided in the form of frames.

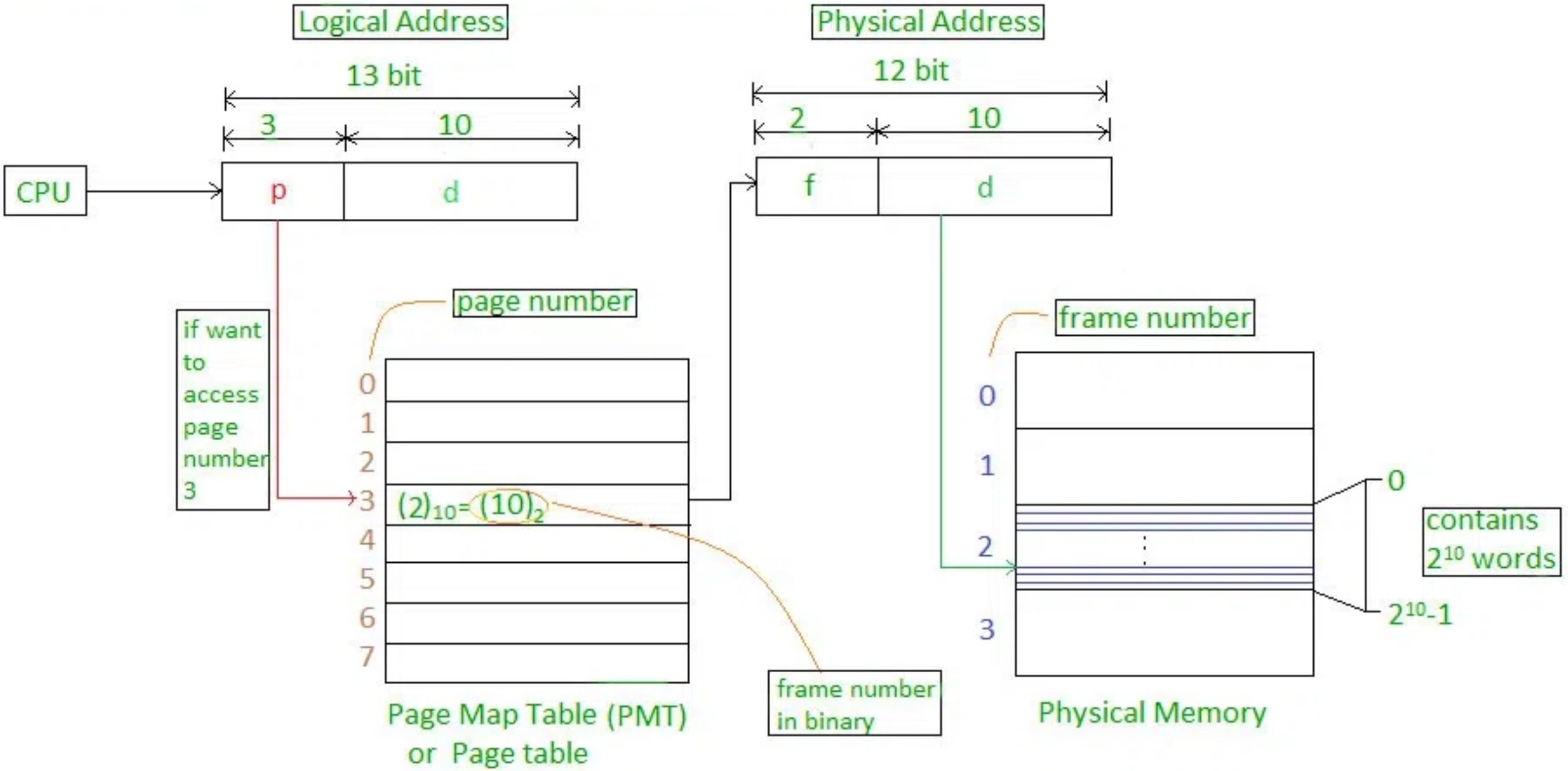
One page of the process is to be stored in one of the frames of the memory. The pages can be stored at the different locations of the memory but the priority is always to find the contiguous frames or holes.

Pages of the process are brought into the main memory only when they are required otherwise they reside in the secondary storage.

Paging in os

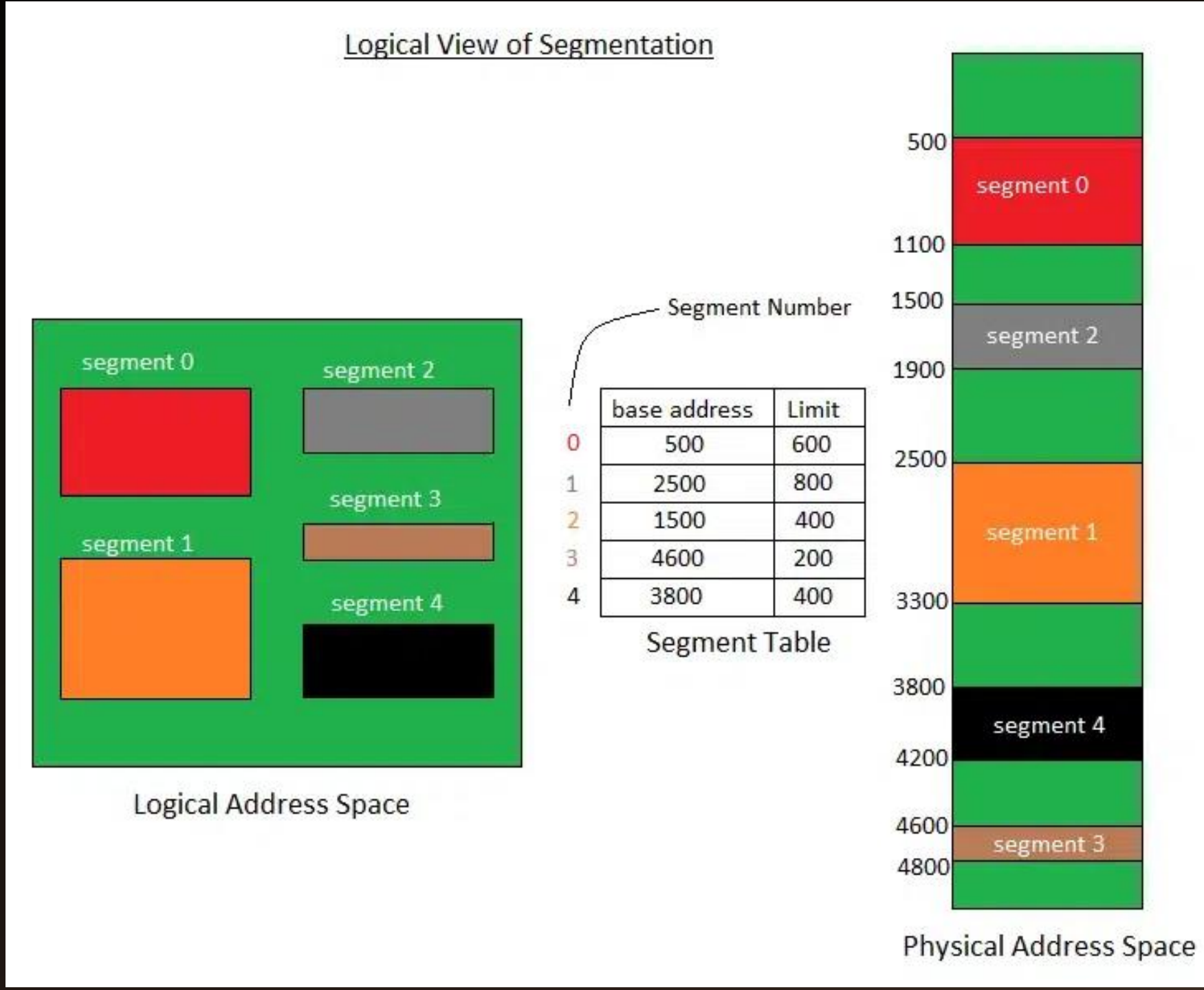
Number of frames = Physical Address Space / Frame size = 4 K / 1 K = 4 = 2^2

Number of pages = Logical Address Space / Page size = 8 K / 1 K = 8 = 2^3



SEGMENT IN OPERATING SYSTEM.

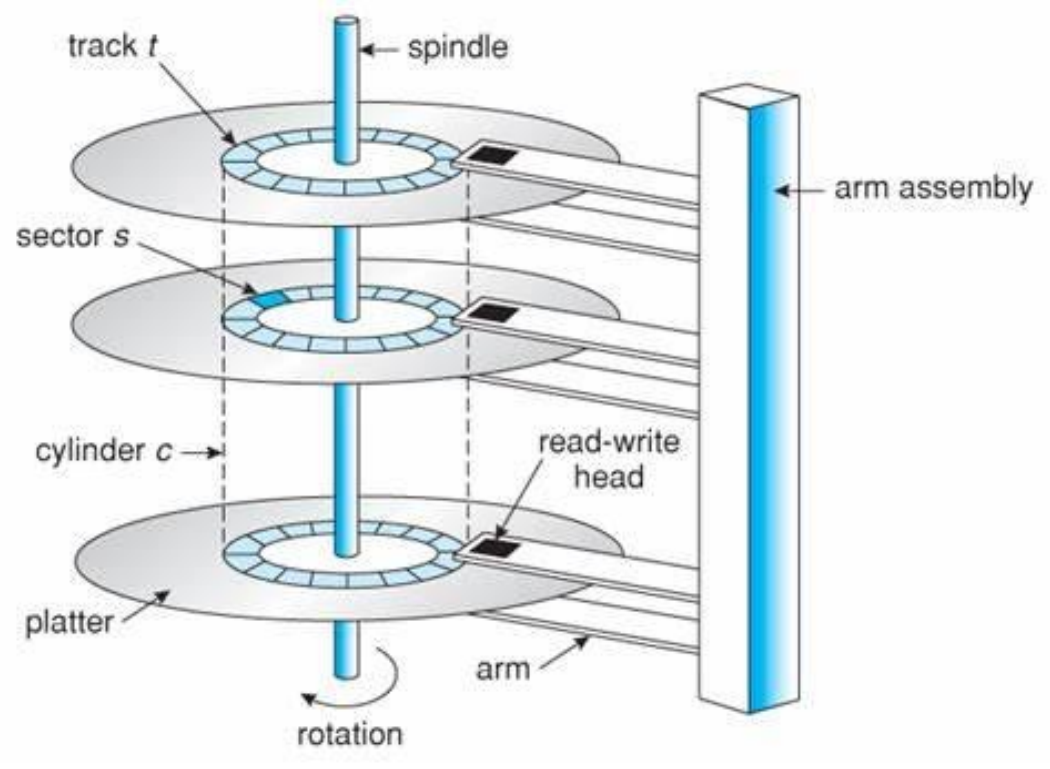
Segment is a memory management technique in which team memory is divided into variable size parts. Each part is known as a segment which can be allocated to the process.



Difference Between Paging and Segmentation in Operating System

Sr. No	Key	Paging	Segmentation
1	Memory Size	In Paging, a process address space is broken into fixed sized blocks called pages.	In Segmentation, a process address space is broken in varying sized blocks called sections.
2	Accountability	Operating System divides the memory into pages.	Compiler is responsible to calculate the segment size, the virtual address and actual address.
3	Size	Page size is determined by available memory.	Section size is determined by the user.
4	Speed	Paging technique is faster in terms of memory access.	Segmentation is slower than paging.
5	Fragmentation	Paging can cause internal fragmentation as some pages may go underutilized.	Segmentation can cause external fragmentation as some memory block may not be used at all.
6	Logical Address	During paging, a logical address is divided into page number and page offset.	During segmentation, a logical address is divided into section number and section offset.
7	Table	During paging, a logical address is divided into page number and page offset.	During segmentation, a logical address is divided into section number and section offset.
8	Data Storage	Page table stores the page data.	Segmentation table stores the segmentation data.

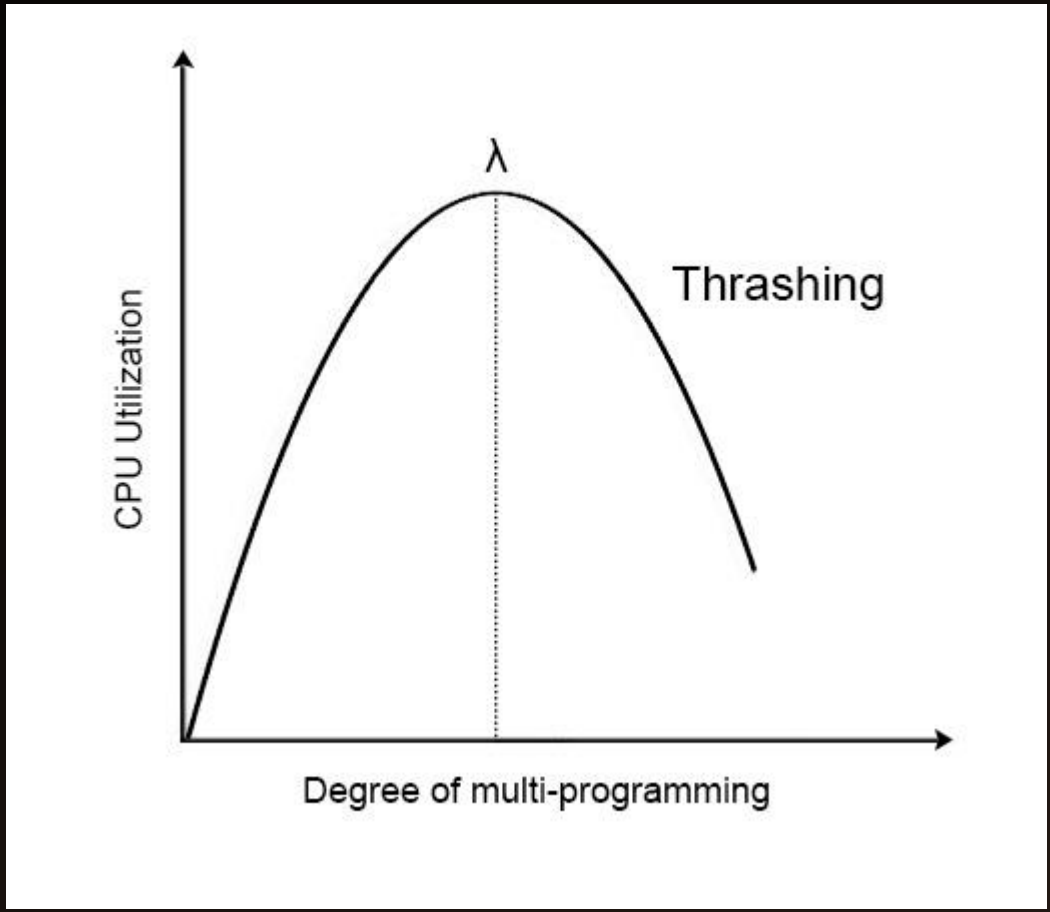
Hard Disk Architecture in Operating System



- ***Consider a hard disk with:***
- ***4 surfaces***
- ***64 tracks/surface***
- ***128 sectors/track***
- ***256 bytes/sector***
- ***What is the capacity of the hard disk?***
- ***Disk capacity = surfaces * tracks/surface * sectors/track * bytes/sector***
  *Disk capacity = 4 * 64 * 128 * 256*
  Disk capacity = 8 MB
- ***The disk is rotating at 3600 RPM, what is the data transfer rate?***
- *60 sec -> 3600 rotations*
  1 sec -> 60 rotations
  Data transfer rate = number of rotations per second * track capacity * number of surfaces (since 1 R-W head is used for each surface)
  *Data transfer rate = 60 * 128 * 256 * 4*
  Data transfer rate = 7.5 MB/sec
- ***The disk is rotating at 3600 RPM, what is the average access time?***
- *Since seek time, controller time and the amount of data to be transferred is not given, we consider all three terms as 0.*
  Therefore, ***Average Access time = Average rotational delay***
  Rotational latency => 60 sec -> 3600 rotations
  1 sec -> 60 rotations
  Rotational latency = (1/60) sec = 16.67 msec.
  Average Rotational latency = (16.67)/2
  = 8.33 msec.
  Average Access time = 8.33 msec.

What is Thrashing in Operating System

Thrashing is a condition or a situation when the system is spending a major portion of its time servicing the page faults, but the actual processing done is very negligible.



Causes of thrashing:

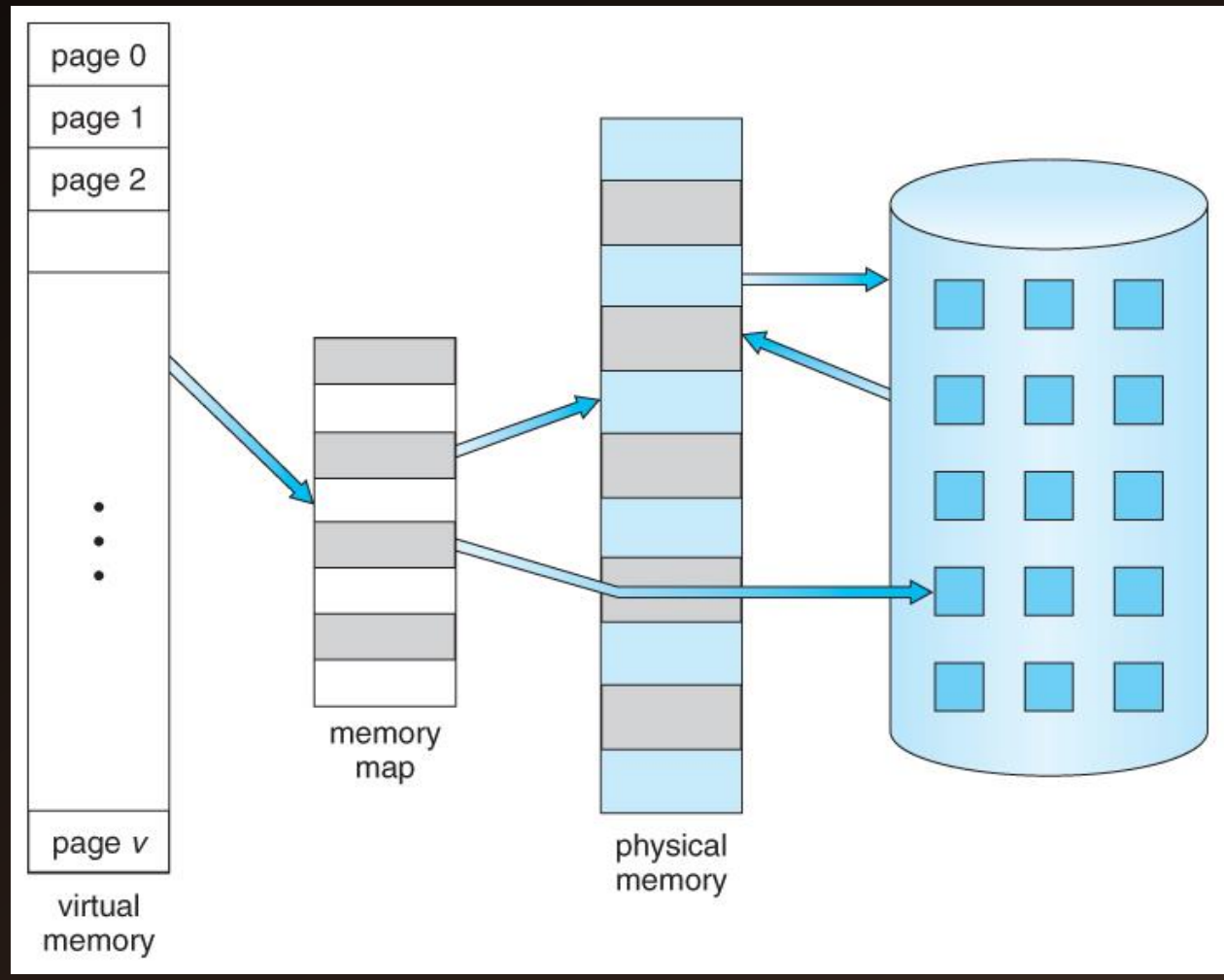
1. High degree of multiprogramming.
2. Lack of frames.
3. Page replacement policy.

What is virtual memory

- Virtual Memory is a technique allows the execution of processes that are not completely in the memory.
- It allows to share files easily and to implement shared memory.
- Provides efficient mechanism for ps creation.

Need

- It is necessary to put the data used in execution mandatorily present in physical memory.
- But this implication will limit the size of program to the size of memory present.
- Thus we Introduce the concept of Virtual Memory management.



Thanks

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