File Management

➢File Management

Q. **What is file?**

❖**User view:**

- File is a named collection of logically related information/data.
- File is a container which contains logically related information/data.
- File is a collection of characters/records/lines.
- File is a basic storage unit

❖System view:

- File is a **stream of bits/bytes.**

- **File = data + metadata**
  - data = actual file contents
  - metadata = information about the file.

- Data of the file is exists inside the file whereas information about the file gets stored inside one structure referred as **FCB (File Control Block).**
- In UNIX environment FCB is also called as an **iNode**.
- **FCB / iNode contains information about the file like:**
  1. iNode number: unique identifier of a file
  2. Name of the file
  3. Type of the file
  4. Size of the file
  5. Parent folder location
  6. Access permissions
  7. Time stamps etc...

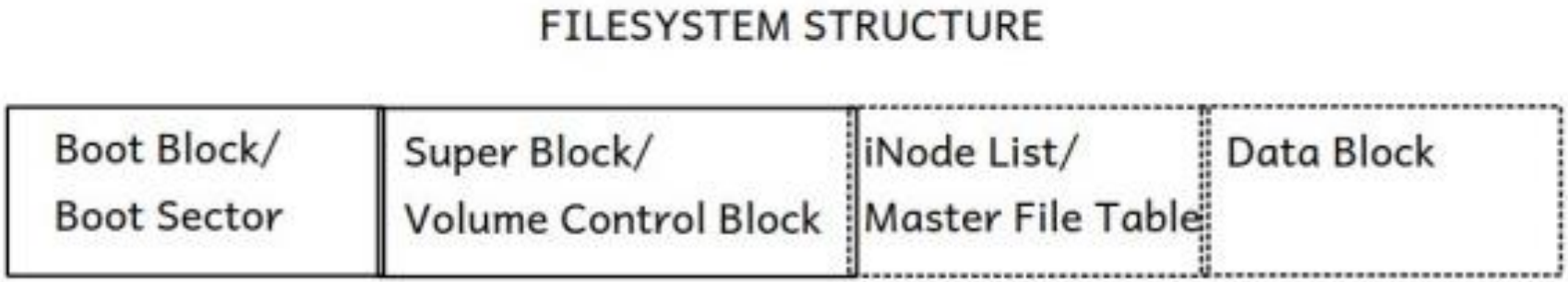
- Per file one iNode/FCB gets created by the system and

  -i.e. hence no. of iNodes = no. of files onto the disk.

- **data + metadata** of all the files are kept onto the disk, as disk may contents thousands of files, so thousands of iNodes and millions of bytes of data gets stored onto the disk, and hence all this **data + metadata** of all files need be keep onto the disk in an organized manner so that it can be accessed efficiently.

- **File system :** file system is a way to store data onto the disk in an organized manner so that it can be accessed efficiently and conveniently.
  - e.g. Each OS has its own file system like,
  - UNIX: UFS(UNIX File system),
  - Linux: Extended File system ext2, ext3, ext4,
  - Windows: FAT, NTFS etc...,
  - MAC OSX: HFS(Hierarchical File system) etc...

- **Files system Structure:** File system divides disk/partition logically into sectors/blocks, like boot sector/boot block, volume control block/super block, master file table/iNode list block and Data Block.



1. Boot Block: It contains information about booting the system like bootstrap program, bootloader etc...
2. Super Block: It contains information about remaining sections, like total no. of data blocks, no. of free data blocks, no. of allocated data blocks etc....
3. iNode List: It contains linked list of iNode's of all files exists on a disk.
4. Data Block: It contains actual data.

➢Disk space allocation methods:

- When a file is requesting for free data blocks, then in which manner free data blocks gets allocated for that file and how its information can be kept inside inode of that file is referred as disk space allocation method.

❖Three disk space allocation methods are there:

1. **Contiguous Allocation**
2. **Linked Allocation**
3. **Indexed Allocation**

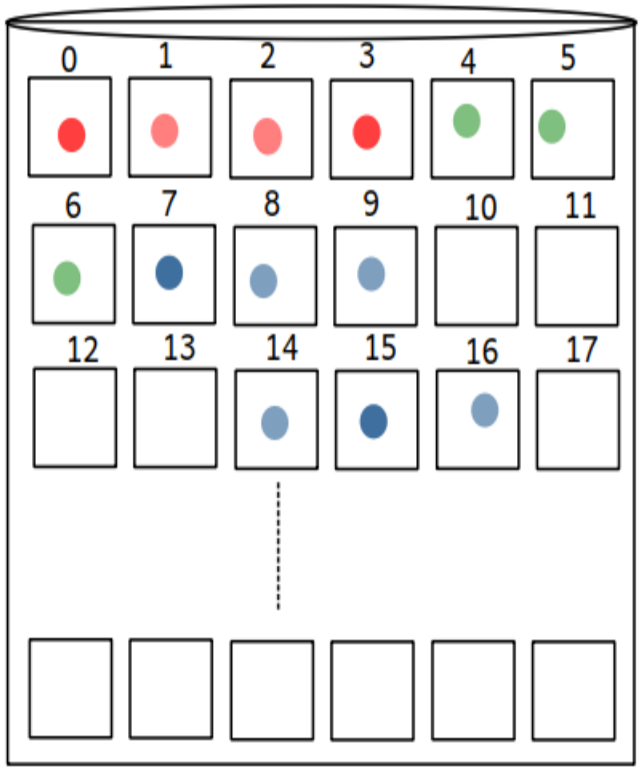
1. **Contiguous Allocation :** free data blocks gets allocated for a file in a contiguous manner.

Disk Space Allocation Method:

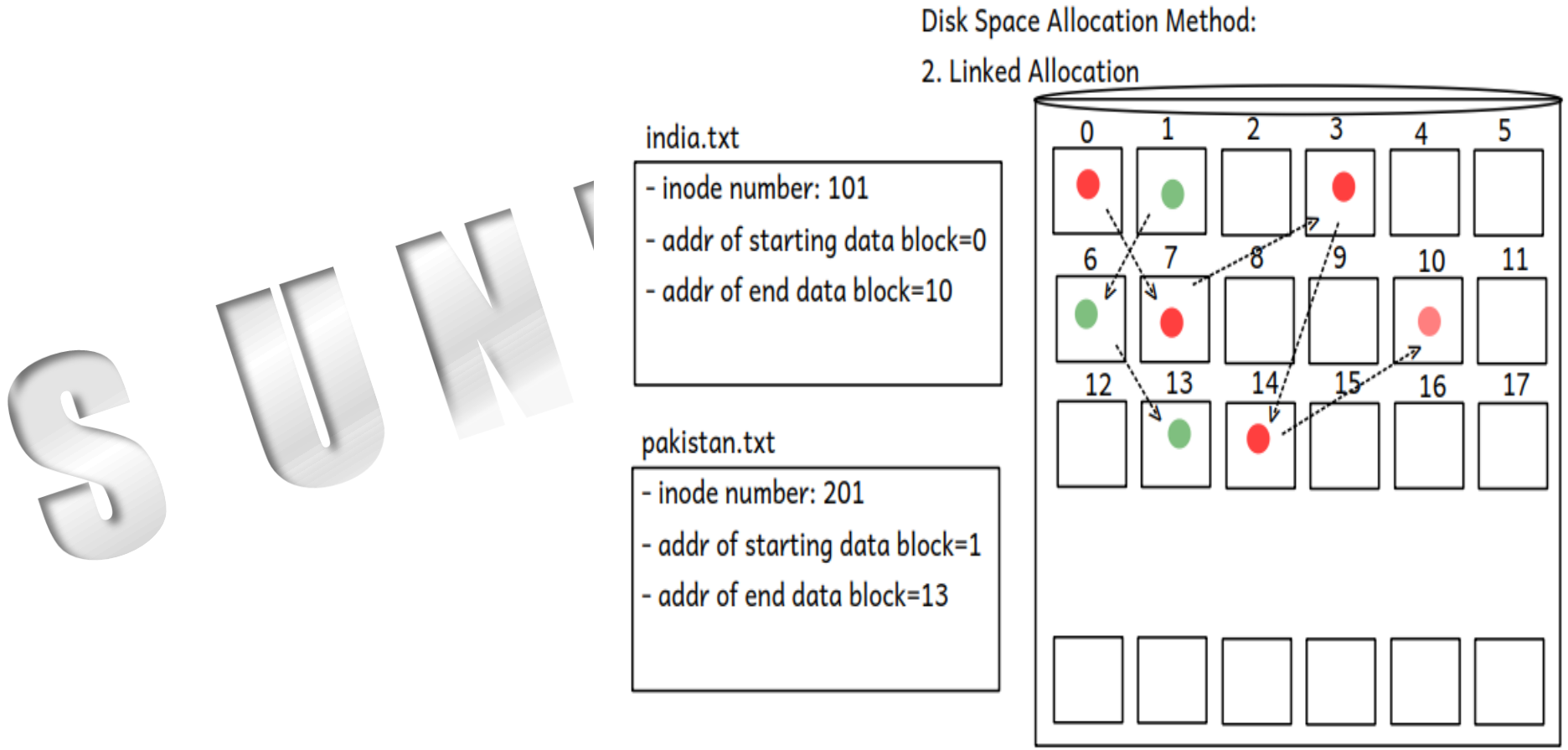
1. Contiguos Allocation

india.txt
- inode number: 101
- addr of starting data block=0
- count=4

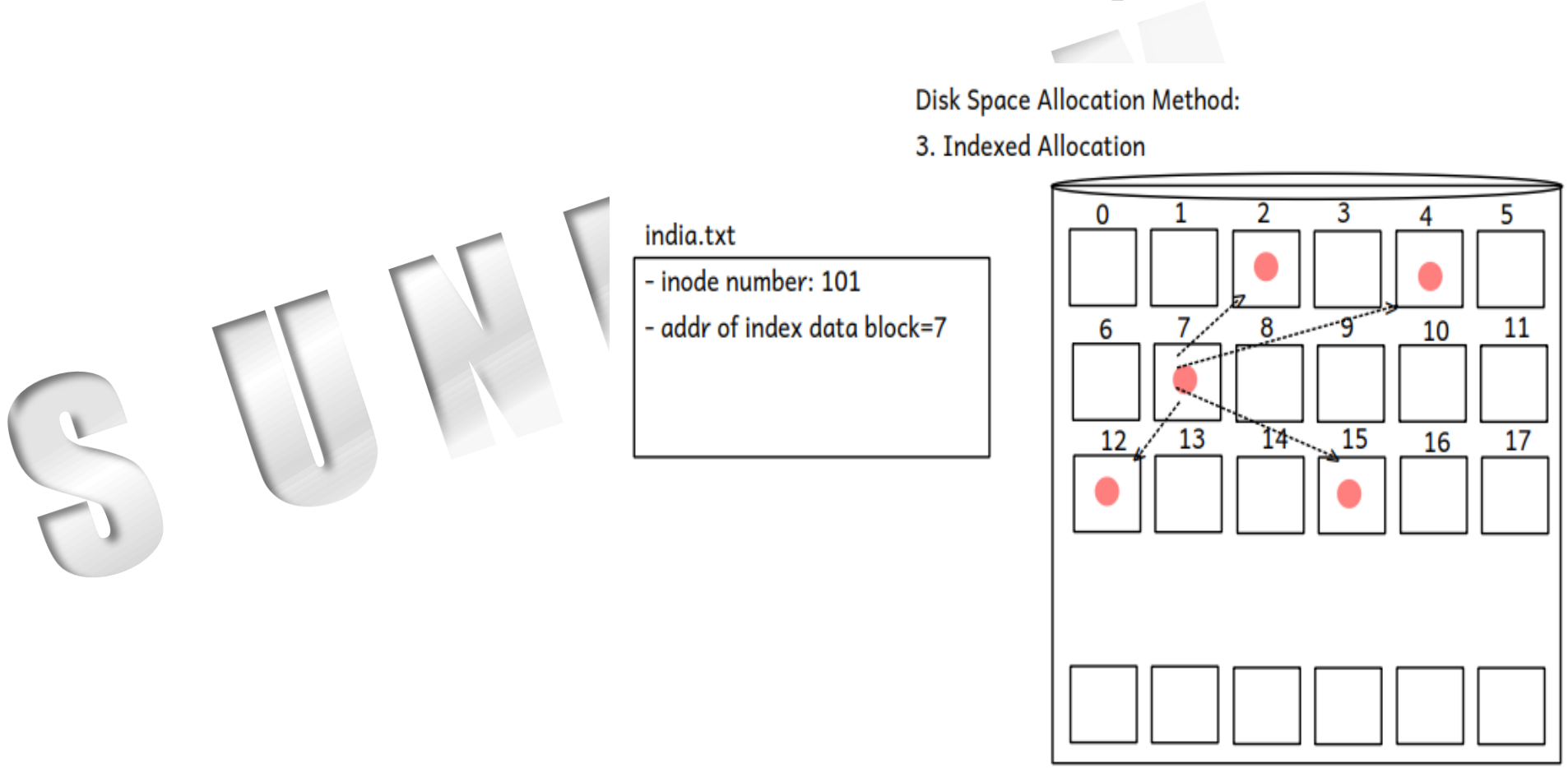
pakistan.txt
- inode number: 201
- addr of starting data block=4
- count=3



2. **Linked Allocation:** any free data blocks gets allocated for a file in a linked list manner.



3. **Indexed Allocation :** any free data blocks gets allocated for a file, as by maintaining an index data block information about allocated data blocks can be kept inside it.



➢Disk Scheduling Algorithms:

- When system want to access data from a disk, request can sent to disk controller and disk controller accepts one request at a time and complete it.
- There are chances that at a time more than one requests for accessing data from the disk can be made by the processes running in a system, in that case all the requests can **be kept in a waiting queue of the disk maintained by an OS,** and there is need to schedule/select only one request at a time and sent it to the disk controller, to do this there are certain algorithms referred as **disk scheduling algorithms.**

1. **FCFS (First Come First Served):** request which is arrived first gets accepted and completed.
2. **SSTF (Shortest Seek Time First):** request which is closed to the current position of the head gets accepted and completed.
3. **SCAN:** head keeps scanning the disk from starting cylinder to end cylinder and whichever request came across gets accepted and completed.
4. **C-SCAN (Circular SCAN):** head scans the disk only in a one direction
5. **LOOK:** this policy can be used either with SCAN/C-SCAN, in this, if there is no request in a waiting queue then movement of the head gets stopped.

➢Memory Technologies

❖ There are four methods by which data can be accessed from the computer memory:

1. Sequential Access: e.g. Magnetic Tape
2. Direct Access: e.g. Magnetic Disk
3. Random Access: e.g. RAM Memory
4. Associative Access: e.g. Cache Memory

❖Magnetic Disk : Hard Disk Drive Structure

- HDD is made up of one or more circular platters arranged like CD rack.
- A Circular platter is a made up of non-magnetic substance like aluminum or aluminum alloy, which is coated with a magnetic substance.

➢Magnetic Disk : Hard Disk Drive Structure

- **HDD** is made up **of one or more circular platters** arranged like CD rack.
- A Circular platter is a made up of **non-magnetic substance like aluminum or aluminum alloy**, which is coated with a magnetic substance.
- Coating of magnetic substance is either from one side to the platter or from both the sides (for increasing its capacity) and hence platter in a magnetic disk may be either single sided platter or double sided platter.
- **Circular platter is divided into the hundred's of concentric rings called as tracks** whereas **each track is divided into thousands of same size of blocks called as sectors.**
- Usually the **size of each sector is 512 bytes**
- There **is one conducting coil referred as head which is used to access data from the sector i.e. head can read and write data from and into a sector at a time.**
- **Head writes and read data sector by sector i.e. block by block, and magnetic disk is also called as block device.**

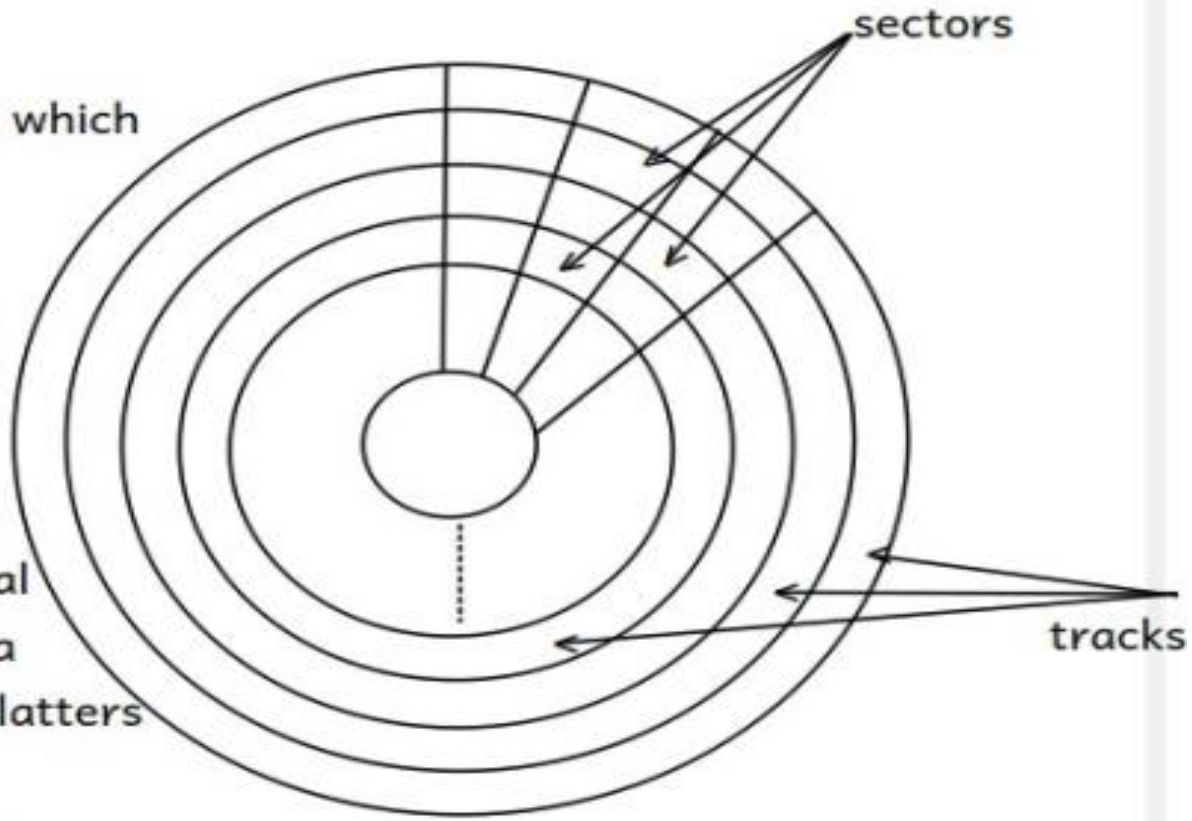
- All the operations like read, write, control etc... in a HDD are controlled by **disk controller**, and hence movement of the head also controlled by it.

- **Seek Time:** time required for the disk controller to move head from its current position to the desired track.
- **Rotational Latency:** after reaching head at desired track, circular platter gets rotated till the head does not comes aligned with the desired sector, and time required for this rotation is referred as rotational latency.

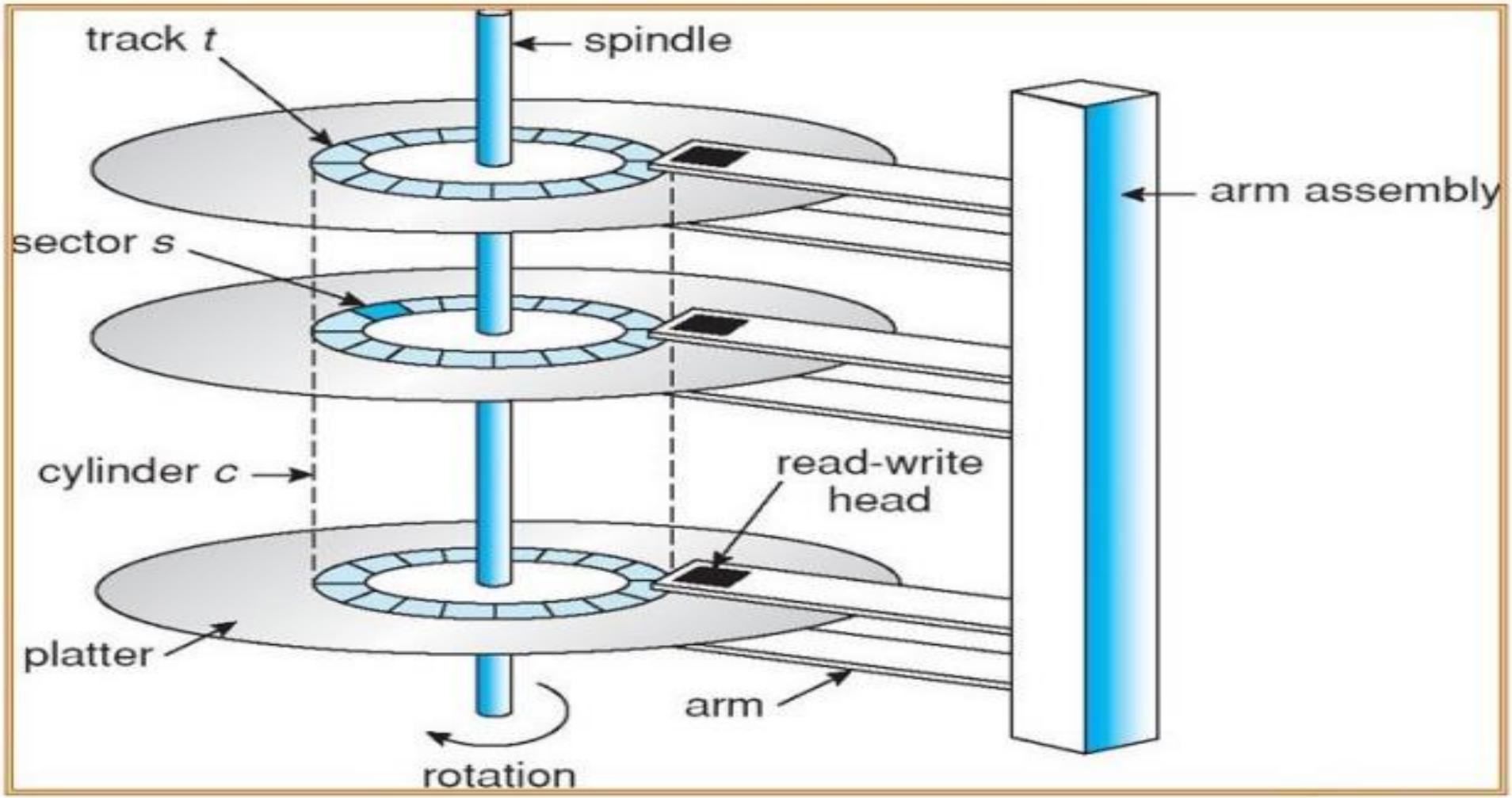
- **Access Time = Seek Time + Rotational Latency.**

Hard Disk Drive:(HDD)

- It contains a "circular platter"(s) made up of non-magnetic material like alluminum or alluminium alloy, which is coated with a magnetic substance.
- Each platter is divided into hundreds of concentric rings called as "tracks" and each track is divided into fixed size of blocks called as "sectors".
- Size of each sector on each track is same usually size of the sector = 512 bytes.
- Cylinder: A cylinder is any set of all of tracks of equal diameter in a hard disk drive. It can be visualized as a single, imaginary, circle that cuts through all of the platters (and both sides of each platter) in the drive.
- Seek Time: it is the time required for a disk controller to move head from its current position to desired cylinder.
- Rotational Latency: Once head moved at desired cylinder, time required to rotate the platter to get alligned with desired sector is called as rotational latency.



Moving-head Disk Machanism



➢Input Output Devices

- Devices which are connected to the motherboard externally through ports referred as peripheral devices or peripherals.
- An IO Devices are also referred as an external devices.

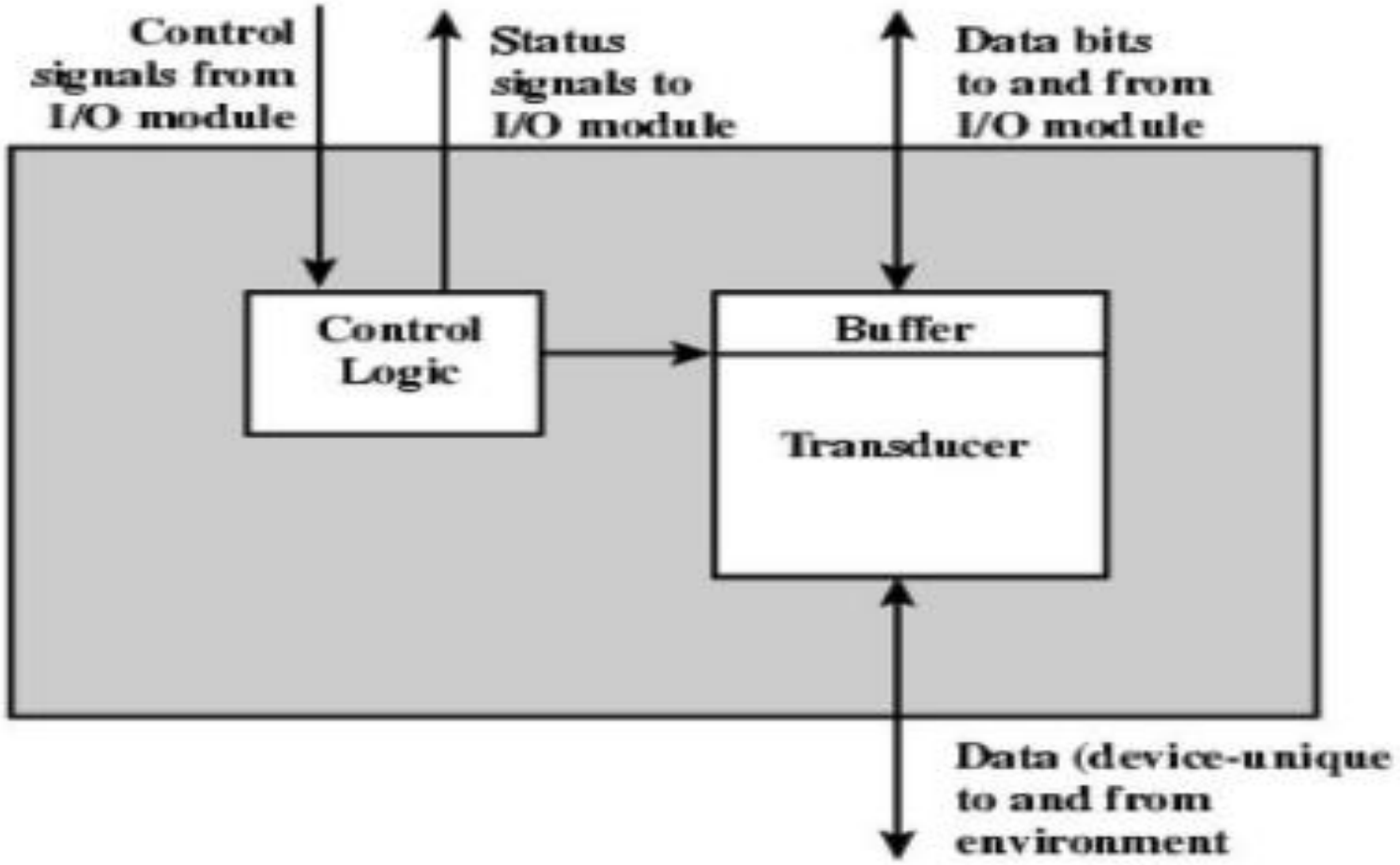
❖ Input Devices :

- Keyboard, Mouse, Scanner, Bar Code Reader, Eye Recognition System, Voice Recognition System, Touch Pad, Touch Screen etc...

❖Output Device :

- Monitor, Printer, Speakers, Projector etc...

➢External Device Block Diagram :



➢Structure of an External Device

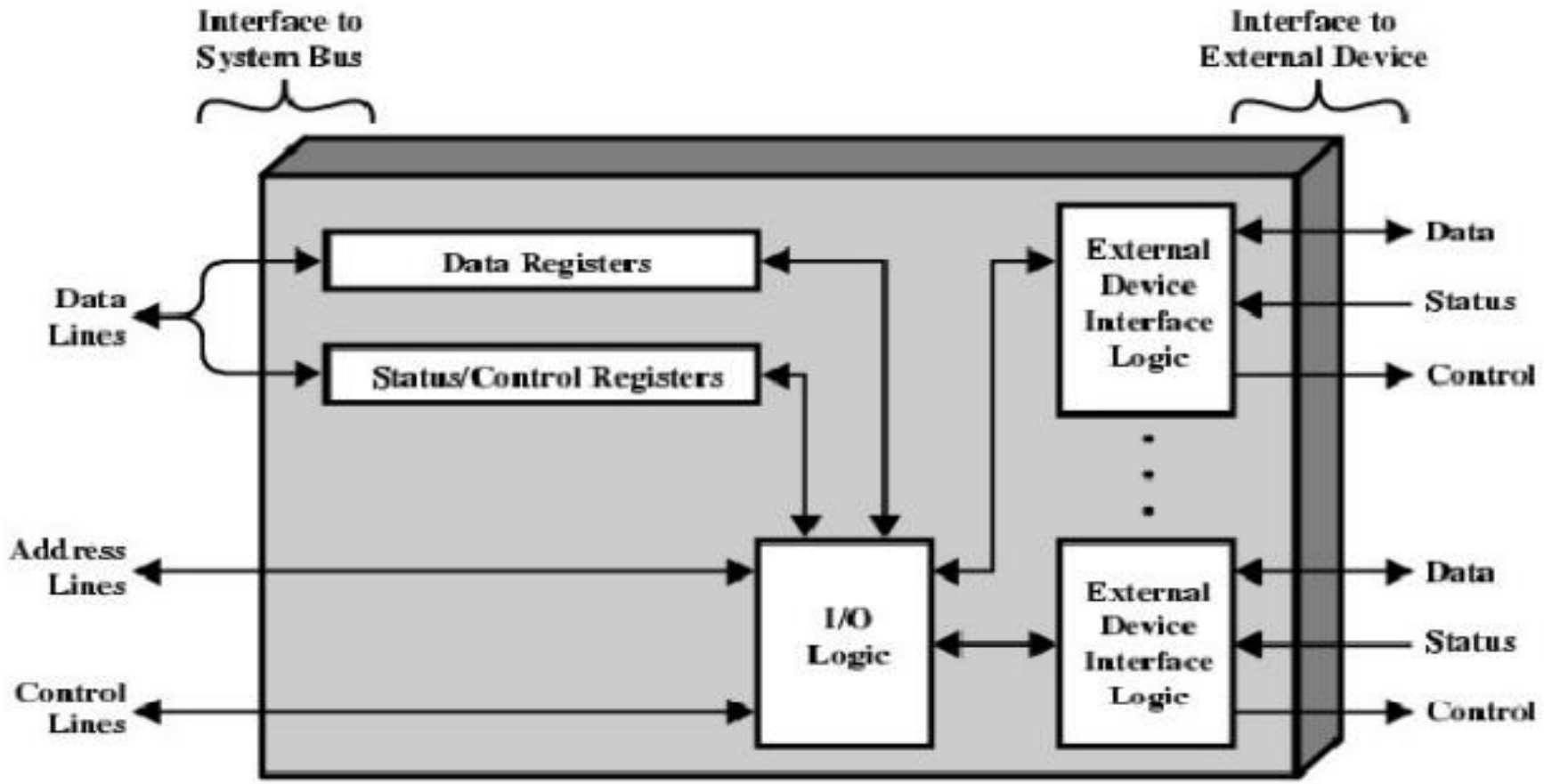
- External Device has three major blocks:

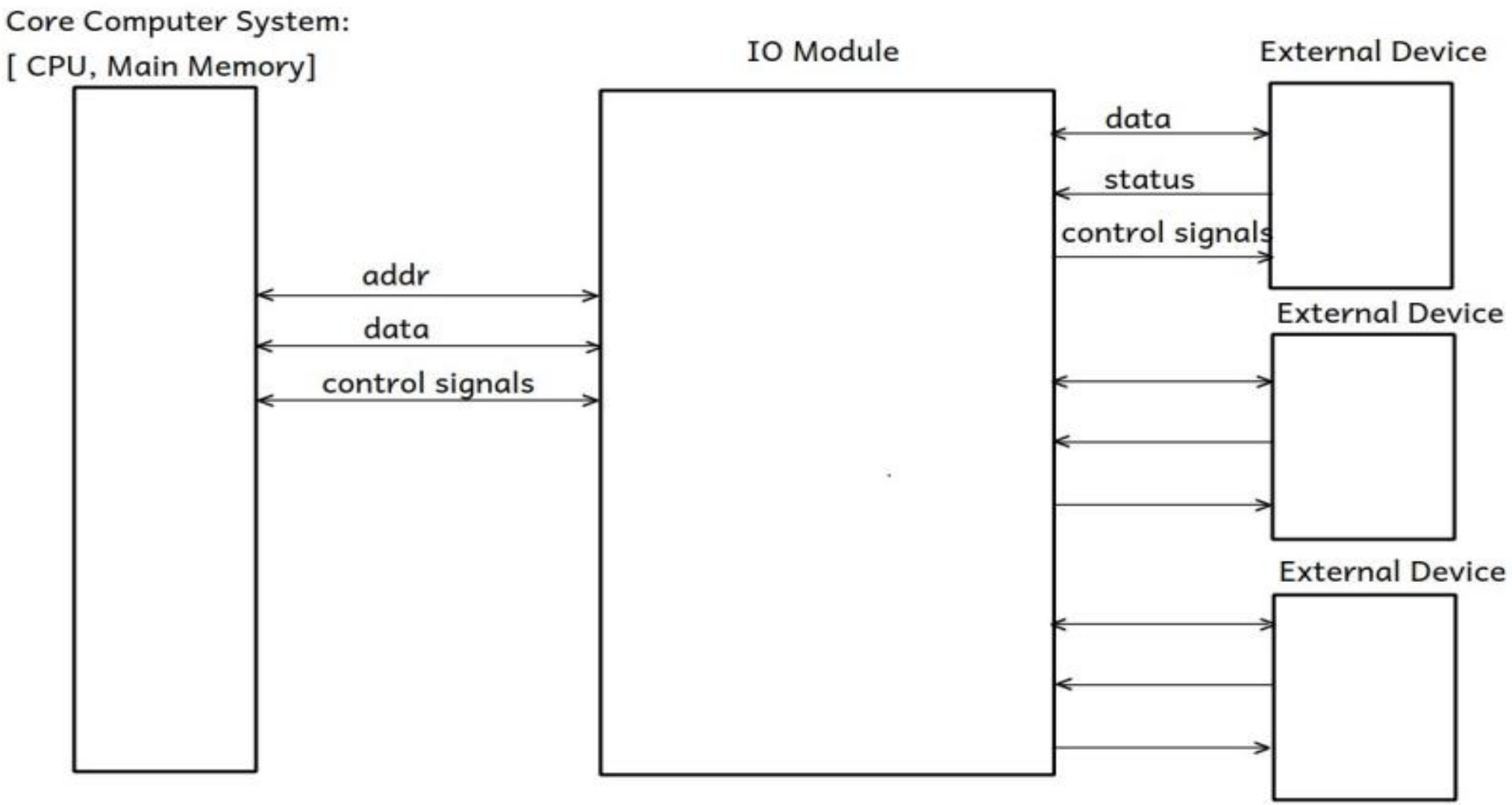
1. **Control Logic Block(Controller):** controls all the operations of that device.
2. **Buffer:** each device has got's its own memory in which data can be stored temporarily referred as a buffer.
3. **Transducer:** this component converts any other form of energy into an electrical enery and converts an electrical energy into another form, this block of an external device is used to do communication with the outside world.

➢IO Modules/IO Ports:

- Core Computer system is not able to communicates directly with any external device and hence I/O modules acts as an interface between core computer system and an I/O devices.
- I/O Modules contains all the logic to communicates with an I/O devices.
- Single I/O module can be used for communication between one device or with more one devices as well

➢I/O Module Structure Diagram :




Core Computer System:
[CPU, Main Memory]
IO Module
External Device
data
status
control signals
addr
data
control signals
External Device
External Device

- Whenever there is transfer of data either from core computer system (i.e. Bus) to an IO devices or vice-versa, it is referred as an **I/O**.

❖**There are three IO techniques:**

1. **Program driven IO**
2. **Interrupt IO**
3. **DMA i.e. Direct Memory Access**

1. Program driven IO:

- All the logic/steps required for an I/O is there into one program, and by means of executing that program by the CPU I/O can be done.

❖ **Advantages:**

- Simple

❖ **Disadvantages:**

- As the CPU remains wholely involved in an IO, less CPU utilization, and hence system performance is low.

2. Interrupt IO:

❖What is an interrupt?

- An interrupt is a signal received by the CPU due to which it stops an execution of one job and starts an execution of another job.

❖Advantages:

- In this IO, the CPU remains involved in an IO whenever gets interrupted, and hence its utilization can be maximized.

❖Disadvantages:

- When there is a data transfer between main memory & secondary memory unnecessary involvement of the CPU is there.

3. DMA (Direct Memory Access):

- Whenever there is a transfer of data between core computer system and IO devices (e.g. main memory and secondary memory), the CPU initiates an IO and gives control of an IO process to the DMA controller, and hence onwards that IO process is controlled by the DMC controller till the end i.e. the DMA controller will work on behalf of the CPU and after finishing an IO it sends acknowledgement to the CPU, and by the time the CPU can execute another jobs, and utilization of the CPU can be maximized further.
- e.g. 8237 DMA controller

Thank you!

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