Chapter-3 : Data Storage

Introduction of Secondary Storage Device:

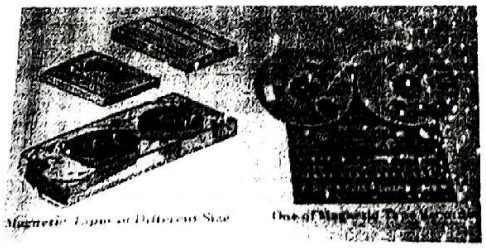
- As the Primary Storage devices are Volatile. Data cannot be stored permanently in Primary Memory.
- Therefore to solve this problem an Additional memory called Secondary storage is used in all the computer systems.
- It is Non-Volatile and it is used to store data permanently.
- Now many types of devices are available that can be used as secondary memory in the computer.
- Some of the common devices are CD, DVD, Hard Disk, Floppy Disk, Pen Drive etc..

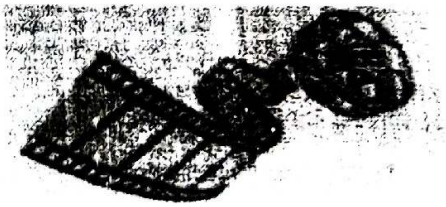
Secondary Storage Devices

Magnetic Tape	Magnetic Disk	Optical Disk	Pen Drive
	-> 1. Floppy Disk	-> 1. CD	
	-> 2. Hard Disk	-> 2. DVD	
	-> 3. Zip Disk	-> 3. Blue-Ray Disk	

Types of Magnetic Storage Devices:

1. Magnetic Tape:





- Magnetic tape is one of the most popular storage medium for large data .
- Magnetic tapes are sequentially accessed and processed.
- It is a plastic ribbon, which is coated with magnetic materials that store data permanently.
- Magenetic Tape is the form of recording which is being used for the purpose of recording and the recording which is being done in the form of magnetic.
- Sometimes the magnetic tapes are also used in the tape recorders or other form of recording too.
- Radio industry used to store programs on magnetic tape and use to broadcasting recorded media.
- The cost of storing data in tapes is inexpensive (cheap).
- Magnetic tape speed is measured in inches per second.
- High performance taps have speed more than 200 inches per second.
- **Audio Recording:** it is also used to store only sound by keeping some tracks on magnetic media.
- **Video Recording:**Video signals were very much similar to audio signals so video recording was done on Magnetic tape.
- **Data Storage:** Some companies Still used Magnetic tape for storage media instead of CD,DVD or any other.

- **Advantages:**

1. Low Cost:

- The cost of storing characters is very less as compared to other storage devices.

2. Fast:

- Copying of data is easier and fast.

3. Long term Storage and Re-usability:

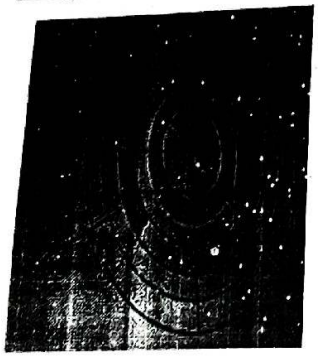
- Magnetic tapes can be used for long term storage and a type can be used repeatedly without loss of data.

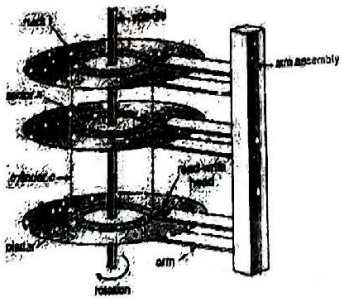
- **Disadvantages:**

1. No Direct Access(Serial Access)
   - It is a sequential access device and hence data recorded on tape cannot be accessed directly.
2. Environmental Problems:
   - Dust and uncontrolled humidity (moisture) or temperature levels can cause (cause) tape reading errors.

❖ 2. Magnetic Disk:

Storage Mechanism of Magnetic Storage Devices:





- Magnetic disk drives consist of one or more circular rotating disks coated withmagnetic material that is used for the recording of data.
- Data is stored and retrived from the disk using a conducting coil called the ***HEAD***.
- The important address related terms which are important to know are Tract,Sector,Cylinder and FAT,.lets going for detailed.
- ***Track:*** A disk drive track is a circular path on the surface of a disk on which information is mahnetically recorded and from which recorded information is read. At list one head is required to read a single track.
- ***Sector*** : Tracks are subdivided into small part which are know as sector. Sector is the smallest addressable part of disk.
- ***Cylinder:*** Tracks on each surface of the disk are numbered. In a disk pack,all the similarly numbered tracks of each surface of each disk is know as a cylinder. The terms track and cylinder are closely related.

- FAT: When you are using floppy dis... retrieved using specific address mech... track and sector. But the question is wh... of stored data is stored on the first track ...
- ... are available, in three forms of Magnetic

(a) **Floppy Disk:**

(b) **Hard Disk:**

(c) **Zip Disk:**

The only difference between Floppy Dis... circular disk of plastic material wi... which are coated with iron...

- FAT: When you are using floppy disk or hard disk, the data is stored or retrieved using specific address mechanism where the data is addressed as track and sector. But the question is where this address is stored. The details of stored data is stored on the first track which is called FAT.
- They are available in three forms of Magnetic disk

(a) **Floppy Disk:**

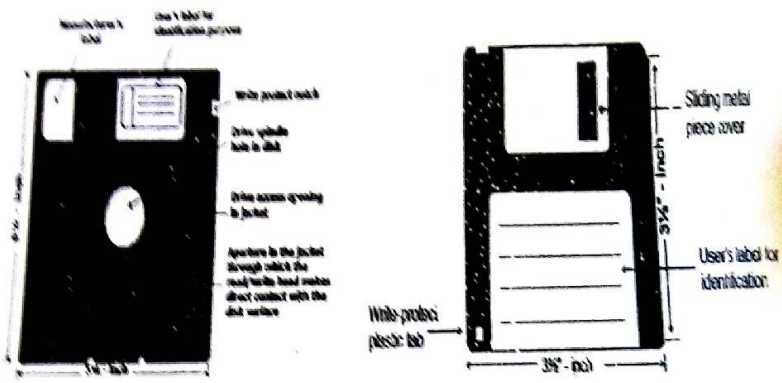
(b) **Hard Disk:**

(c) **Zip Disk:**

The only difference between Floppy Disk and Hard Disk, Floppy Disk has only one circular disk of plastic material where as Hard Disk has more than one metal plates which are coated with iron oxide material.

(a) Floppy Disk:

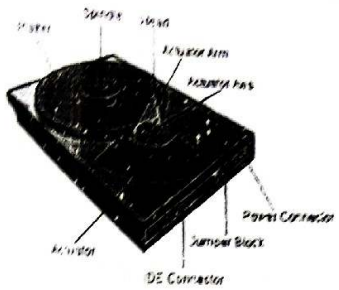
- A floppy disk is a round, flat piece of flexible plastic coated with magnetic oxide.
- It is kept in square plastic jacket cover.
- They are very cheap as compared to other storage devices.
- They were introduced by IBM in 1972.
- Produced now by various manufacturers in many sizes and capacities.
- It is known as Floppy Disk because it is made of Flexible plastic that can be bend easily.
- Floppy disks are slower to access than hard disks and have less storage capacity.
- Floppy disks are much less expensive. And most importantly, they are portable.

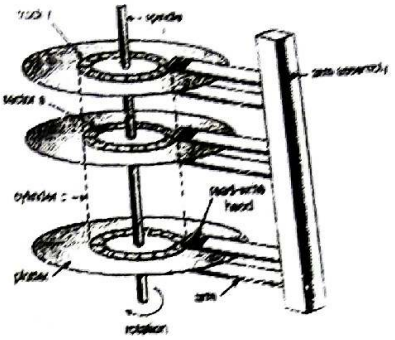


- **Types of floppy disks:**
  - ✓ 5 ¼ inch (5.25")
  - ✓ 3 ½ inch (3.5")
  - ✓ 8"(inch floppy disk)

- The most common floppy disk now used to the 3.5" disk, also know as 1.44 MB floppy.
- The 5.25" disk also known as 1.2 MB floppy.
- 8" and 5.25" floppy disks were popular in the past but are superseded by the 3.5" disks.
- The floppy disk widely used until about 1987.
- They should always be stored in a place where it is not very hot or humid (moist).

(b) Hard Disk:





- Hard disks are the most popular secondary storage device.
- It is a thin magnetic disk made of metal plate, which coated on both sides with a magnetic material.
- It is store more data and faster than floppy disks.
- Most of the computers come with 500GB hard disk today.
- Today the capacity of hard disk has been increased up to TBs (Tera Byte) in routine.
- A disk is divided into many tracks. Information is stored in these tracks on both the sides.
- Spindle is the base where all the tracks are mounted.
- It has a read/write head which does the task of reading from disk and writing on disk.

- Actuator is actually a motor which moves head in order to reach under particular track.
- **Platters:** there are several platters which are of magnetically coated iron material which actually store the data. Platters are two sided which means data can be recorded in both side.
- **Spindle:** spindle is the base where all the platters are mounted.in order to move all platters, spindle moves to locate particular track.
- **Head:** also know as read/write head which does the task of reading from disk and writing on disk.it comes with 2 conducting coils which create magnetism in order to read or write the data.
- **Actuator:** it is actually a motor which moves head in order to reach under particular task.
- **Actuator arm and axis.** It moves the heads on an arc across the platters as they spin
- **IDE connector:** it connect hard disk and mother board in order to transfer the data to and from computer memory. It is a type of serial cable which is connected.
- **Power connector:** it supplies power to spindle motor and actuator motor.

3. Optical Disks:

- There are available three forms:
  - (a) CD
  - (b) DVD
  - (c) Blue Ray Disk

(a) CD (Compact Disk):

- The CD is a shiny, silver color metal disk of 5 ¼ inch diameter.
- It has a storage capacity of about 650 megabytes.
- It is a Read-only storage medium.
- Once any information is recorded in CD then the recorded information cannot be altered.
- A CD is read with the help of a CDROM reader, which uses a laser beam for reading.
- **Different type of variation of CD are as follow.**
- CD-ROM (read only memory)
- Mini CD (only 80 mm)
- CD-R (record data or music only once)
- CD+R(double layer technology in a cd+r allows for almost twice as much storage space)
- CD-RW(erased and reused).

- **Advantages:**
  - CD cost is very less and the storage capacity is good.
  - Optical disk drives do not have any read/write heads.
  - Optical disk drives have a data storage life of about 30 years.
  - Their small size, they are easy to carry.

- **Disadvantages:**
  - It is a read-only storage device. Data once recorded, cannot be erased or modified.
  - Data access speed is slower than magnetic disks.

(b) DVD (Digital Versatile Disk):

- DVD is an optical disk storage device that can be used for data storage, including movies with high video and sound quality.
- DVD ROM uses the same principle as a CDROM for read/write.
- On each layer data is recorded. Thus the capacity can be doubled and can have two layers on each side which will hold up to 17 gigabytes of vedio,audio, or other information.
- For recording a data or information and for reading information from DVD, laser beam is used.
- For focusing a laser on the Disk a lens is used, with the help of this lens the data is written and recorded on the DVD
- Storage capacity of DVD is 4.7 GB. Which is enough for a 133 minute movie of original size or almost 4 to 5 movies of low format.

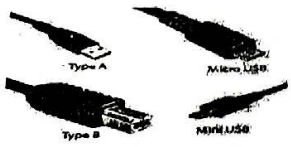
- **Advantages:**
  - Large storage capacity than CD.
- **Disadvantages:**
  - More expensive than CD.
  - Like CD, DVD also can be damaged if not handle properly.

(c) Blue-Ray Disk:

- It is an optical disk storage device.
- Its main uses are high-definition audio, video, picture and data storage.
- The name Blue-ray Disk is derived from the Blue laser (violet colored) used to read and write this type of disc.
- In 2006,along with the introduction of blu-ray disc,the whole movie industry met another revolution.
- Blue-ray disc has much large storage capacity than DVD.
- A dual layer Blue-ray Disk can store 50 GB, almost six times the capacity of a dual layer DVD.
- Blue-ray Disk was developed by the Blue-ray Disk Association.
- A group of companies representing customer electronics, computer hardware.
- The disk has the same size as a standard DVD or CD.

❖ Pen Drive:

- This drive is very easy to carry in your pocket like pen therefore it is called Pen Drive.
- It is also known as Flash Drive.
- A Pen Drive is consists of a small printed circuit, that is covered with a plastic or metal body.



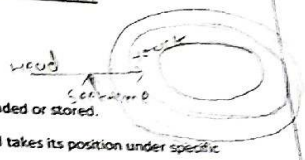
- A Pen drive use a standard Type-A of USB connection, and they can be connected directly to a personal computer.
- Pen Drive is a special type of EEPROM.
- Now a day it comes in various shapes and stylish designs.
- We can also run application, view video, play songs, cut, copy, delete, move data from it directly.

- **Advantages:**
  - It is portable.
  - Available in many sizes. Ex. 2GB, 8GB, 16GB, 32GB etc.
  - Protect to the scratches and dust.
  - So they are much safe as compared to CD, DVD, Floppy disks.

- **Disadvantages:**
  - It is costly than Optical disk.
  - If the internal circuit is damaged then it is to be repaired or replaced.

Reading / Writing Data to and from Storage Devices:

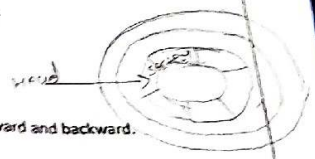
Seek Time:



- First of all the head gets the address of file to be loaded or stored.
- After reading the address of specific data, the head takes its position under specific track.
- The time taken to reach the head under specific sector is known as Seek Time.
- In short,

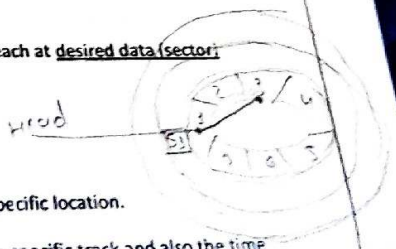
  Seek Time= Time taken by head to reach the desired track.

Rotational Delay / Latency:



- After the head reaches specific track, it stops moving forward and backward.
- Now as the head taken or reached its desired track.
- The time taken by head to reach desired sector after reaching desired track, is known as Rotational Delay / Latency.
- It's called Rotational Delay because in this case the head remains as it is, just disk rotates itself.
- In short,

  Rotational Delay / Latency= Time taken by head to reach at desired data (sector) after reaching at particular track.



Access Time:

- Access time is the total time for the head to reach specific location.
- The time taken to reach head at specific position on specific track and also the time taken to reach head under a specific sector is known as Access Time.

- In short,

  Access Time= Seek Time + Rotational Delay / Latency

❖ Response Time:

- **The total time from the beginning till end of the whole operation is known as Response Time.**
- **In short,**

  Response Time= Access Time + Data Transfer Time

❖ Flash Memory

- **flash memory can be used to store data that you want to retain across power cycling of the PIC32.**
- **Program flash memory is divided into 128 pages of 4 kB each. Each page is divided into eight rows, each consisting of 128 four-byte words.**
- **Flash can only be erased a page at a time, by setting all bits to ones. Writes can only flip ones to zeros, never zeros to ones. Writes can only be done to a single four-byte word or an entire row at once.**
- **Flash has a limited lifespan so you should minimize writes and erasures.**
- **USB flash memory is simply a data storage device that contains non-volatile flash memory and an integrated USB interface.**
- **A flash memory is currently structured in at least four different ways with different features. They are NOR type, NAND type, AND type, and DINOR type.**

❖ Cloud Storage

What is Cloud Storage?

- **Cloud storage is a cloud computing model that stores data on the Internet through a cloud computing provider who manages and operates data storage as a service.**
- **It's delivered on demand with just-in-time capacity and costs, and eliminates buying and managing your own data storage infrastructure.**
- **This gives you agility, global scale and durability, with "anytime, anywhere" data access.**

How Does Cloud Storage Work?

- Cloud storage is purchased from a third party cloud vendor who owns and operates data storage capacity and delivers it over the internet in a pay-as-you-go model.
- These cloud storage vendors manage capacity, security and durability to make data accessible to your applications all around the world.
- Applications access cloud storage through traditional storage protocols or directly via an API.
- Many vendors offer complementary services designed to help collect, manage, secure and analyze data at massive scale.

❖ Types of Cloud Storage

- There are three types of cloud data storage: object storage, file storage, and block storage. Each offers their own advantages and have their own use cases:
- **Object Storage** –
- Applications developed in the cloud often take advantage of object storage's vast scalability and metadata characteristics.
- Object storage solutions like Amazon Simple Storage Service (S3) are ideal for building modern applications from scratch that require scale and flexibility, and can also be used to import existing data stores for analytics, backup, or archive.
- **File Storage** –
- Some applications need to access shared files and require a file system.
- This type of storage is often supported with a Network Attached Storage (NAS) server.
- File storage solutions like Amazon Elastic File System (EFS) are ideal for use cases like large content repositories, development environments, media stores, or user home directories.
- **Block Storage** –
- Other enterprise applications like databases or ERP systems often require dedicated, low latency storage for each host.
- This is analagous to direct-attached storage (DAS) or a Storage Area Network (SAN). Block-based cloud storage solutions like Amazon Elastic Block Store (EBS) are provisioned with each virtual server and offer the ultra low latency required for high performance workloads.