Secondary Memory

This type of memory is also known as external memory or non-volatile. It is slower than main memory. These are used for storing data/Information permanently. CPU directly does not access these memories instead they are accessed via input-output routines. Contents of secondary memories are first transferred to main memory, and then CPU can access it. For example : Hard disk, CD-ROM, DVD etc.

Electronic data is a sequence of bits. This data can either **reside in** :

• **Primary storage** - main memory (RAM), relatively small, fast access, expensive (cost per MB), volatile (go away when power goes off)

• **Secondary storage** - disks, tape, large amounts of data, slower access, cheap (cost per MB), persistent (remain even when power is off)

Data storage has expanded from text and numeric files to include digital music files, photographic files, video files, and much more. These new types of files require secondary storage devices with much greater capacity than floppy disks.

Primary storage (or main memory or internal memory) , often referred to simply as memory , is the only directly accessible to the CPU. Primary memory can be divided into **volatile** and **nonvolatile** memories.

Primary storage (Main Memory) has three main functions:

1-It stored all or part of the program that being executed.

2-It also holds data that are being used by the program.

3-It also stored the operating system programs that manage the operation of the computer.

Limitation of Primary storage

1. **Limited capacity**- because the cost per bit of storage is high.
2. **Volatile** – data stored in it is lost when the electric power is turned off Or interrupted.

Secondary Storage Devices

Data storage can refers to the primary and secondary storage of computer data. Computer memory refers to the data that a CPU can directly access. Alternatively referred to as **storage**, **storage media**, or **storage medium**; a **storage device** is a hardware device capable of holding information.

A **data storage device** is a device for recording (storing) information(data). A **storage device** may hold information, process information, or both. A device that only holds information is a recording medium.

Electromagnetic data may be stored in either an analog data or digital data format on a variety of media. All information is data. However, not all data is information. Many data storage devices are also media players.

Why Secondary storage?

- Used in computer system to overcome the limitations of primary storage.
- Has unlimited capacity because the cost per bit of storage is very low.
- Used to store large volumes of data on a permanent basis.
- Physical components which data is stored are called storage media.
- Hardware components that read /write to storage media are called storage devices.

Q/Definition -What does Storage mean?

Storage is a process through which digital data is saved within a data storage device by means of computing technology.

Storage is a mechanism that enables a computer to retain data, either temporarily or permanently.

Storage may also be referred to as computer data storage or electronic data storage.

Physical components which data is stored are called storage media.

Storage is among the key components of a computer system and can be classified into several forms, although there are **two major types**:

Volatile Storage : Requires a continuous supply of electricity to store/retain data. It acts as a computer's primary storage for temporarily storing data. Examples of volatile storage is random access memory (RAM).

Non-Volatile Storage : A type of storage mechanism that retains digital data even if it's powered off or isn't supplied with electrical power. This is often referred to as a **secondary storage mechanism**, and is used for permanent data storage. Examples of non- volatile storage include **hard disk**, **USB storage** and **optical media.**

Q/Definition - What does Storage Device mean?

A storage device is any computing hardware that is used for storing, porting and extracting data files and objects. It can hold and store information both temporarily and permanently, and can be internal or external to a computer, server or any similar computing device. A storage device may also be known as a storage medium. Storage devices are one of the core components of any computing device. They store virtually all the data and applications on a computer, except hardware firmware.

They are available in different form factors depending on the type of underlying device. For example, a standard computer has multiple storage devices including **RAM**, **cache**, a **hard disk**, an **optical disk drive** and externally connected USB drives.

Hardware components that read /write to storage media are called storage devices. **There are two different types of storage devices:**

Primary Storage Devices: Generally smaller in size, are designed to hold data temporarily and are internal to the computer. They have the fastest data access speed, and include RAM and cache memory.

Secondary Storage Devices: These usually have large storage capacity, and they store data permanently. They can be both internal and external to the computer, and they include the hard disk, compact disk drive and USB storage device.

The most common external storage devices are **tape** and **disk devices**. External memory operates at much slower speed than internal memory and it stores programs and data that are not currently being used by the CPU.

External storage is also known as secondary storage or auxiliary storage. External storage is normally the place where a large amount of programs and data are stored permanently, when the power is turned off.

Mass Storage Device (MSD):

Q/Definition - What does Mass Storage Device (MSD) mean?

A **mass storage device** (MSD) is any storage device that makes it possible to store and port large amounts of data across computers.

MSDs are portable storage media that provide a storage interface that can be both internal and external to the computer. A mass storage device may also be referred to as an auxiliary storage device.

The term is commonly used to describe **USB** mass storage devices.

Auxiliary Storage :

Q/Definition - What does Auxiliary Storage mean?

Auxiliary storage is any storage that is made available to the system through input/output channels.

This term refers to any addressable storage that is not within the system memory (RAM). These storage devices hold data and programs for future use and are considered nonvolatile storage that retains information even when power is not available. They trade slower read/write rates for increased storage capacity. **Auxiliary storage may also be referred to as secondary storage.**

Auxiliary storage, secondary storage, or external storage are devices that store noncritical system data like documents, multimedia and programs, which are used whenever they are required. The best example of auxiliary storage is **hard disk drives and optical storage media like CDs, DVDs.**

Computer systems store data on secondary storage devices. Data can be arranged in **several ways**, and the arrangement determines the manner in which individual records can be **accessed or retrieved**.

Records are **stored** in files in **two different ways**:

- **Sequential Storage** :in this method records are stored sequentially, as records are added one after another, in a file.
  Magnetic tape is a typical example of such a storage device. Suitable for **sequential** processing applications where most of the data records need to be processed one after another.
- **Direct or Random Storage**: in this method records are stored randomly in a file. Key field is used to locate the physical address of the record.

Main categories of storage technology used today are:-

1. **Magnetic storage Devices.**
2. **Optical Storage Devices.**
3. **Memory Storage Devices**

1) Magnetic Storage Devices :

a. Magnetic tape

- Cassette
- Magnetic Tape

b. **Magnetic disk**

- Floppy Disk
- Hard Disk

Cassette tape : Cassette type has been widely used for many years as external storage. The **main disadvantage** of cassette tape is that they are sequent-access storage devices. That is, to find information on the tape you must search through the tape sequentially, which means that to read the last item on a tape, you must wind the tape (using cassette recorder) past all the previous items.

Magnetic Tape:- Commonly used sequential –access secondary storage device.

- Physically , the tape medium is a plastic ribbon.

-Storage Capacity of a tape **is (data recording density * length)**

-**Data recording density** is the amount of data that can be stored on a given length tape. it is measured in **bytes per inch**(bpi).

-Can be transmitted characters/second from tape to the memory. measurement unit is **bytes/second**(bps). Typically value of data transfer rate is 7.7 MB/second.

Advantages of magnetic tape are:

a. Storage capacity is unlimited.

b. Cost per bit of storage is very low.

c. Tape can be reuse many times.

d. Easy to handle and store.

e. Very large amount of data can be stored in small storage space.

Disadvantages:

a. Because to their sequential access nature they not suitable for storage of data that require to be access randomly.

b. should be property labeled because some data stored on a particular tape is not erased by mistake.

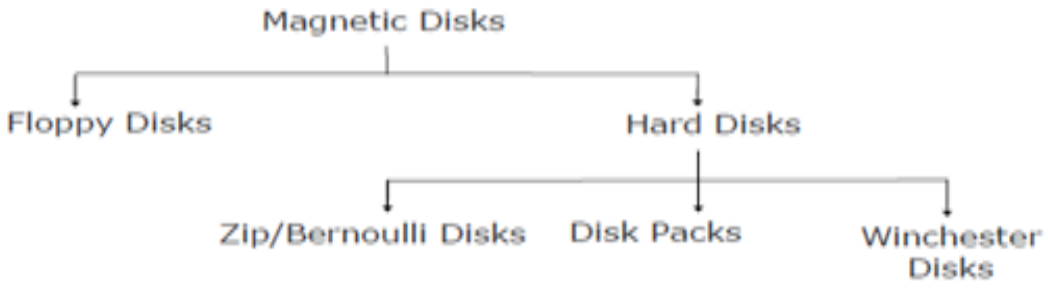
Uses of magnetic tape:

1.Backing up of data .

2.Archiving of used data.

b. **Magnetic disk**

- Floppy Disk
- Hard Disk



Floppy Disk Drive (FDD) :

Q/Definition - What does Floppy Disk Drive (FDD) mean?

A **floppy disk drive** (FDD), or floppy drive, is a hardware device that reads data storage information. It was invented in 1967 by a team at IBM and was one of the first types of hardware storage that could read/write a portable device.

FDDs are used for reading and writing on floppy discs. Floppy disks are now outdated, and have been replaced by other storage devices such as USB.

Hard Disk Drive (HDD) :

Q/Definition - What does *Hard Disk Drive (HDD)* mean?

A **hard disk drive** (HDD) is a non-volatile computer storage device containing magnetic disks rotating at high speeds. It is a secondary storage device used to store data.

Non-volatile means data is retained when the computer is turned off. A hard disk drive is also known as a **hard drive**.

A hard drive fits inside a computer case. The disk moves at an accelerated rate, allowing data to be accessed immediately. Most hard drives operate on high speed **interfaces using serial ATA** (**SATA**) or Serial Attached **T**echnology. All data is stored magnetically, allowing information to be saved when power is shut off.

Hard disks are three types are:

1. Zip/Bernoulli disks

2. Disk packs

3. Winchester disks

There are many different **factors** to consider when looking to **expand** your **computer data storage capacity** by means external hard drive storage. These include storage **capacity**, **cost**, **ease of use**, **security concerns**, **access to data**, **data safety**, and **maintenance**.

Hard disk is still a common storage device for all computers. Hard disk store data in **tracks** divided into **sectors**.

Hard drives have become the primary storage devices for PCs because they are **convenient** and **effective**. Like a floppy disk system, a hard disk system is also a random-access storage device.

Now some differences between Hard disk and Floppy Disk :

- The hard disk are formatted into **tracks** and **sectors**, just like floppy disks, but with **higher number of tracks**.
- The hard disks used with personal computer have a storage capacity of about 10 k to 9.1 G byte, compare with a capacity of about 150 k to 2.88 M bytes for floppy disks.

- Hard disks can transfer data faster than floppy disks. (The transfer rate depends on the **density** of the stored data and the rotational speed of disks). For floppy disk system the maximum transfer rate is typically between 30.000 and 150.000 characters per second. For hard disk systems the maximum transfer rate between 200.000 and 2 million character per seconds.

- Access times are also faster for hard disk than floppy disks. The access time for a hard disk is about 25 to 70 m sec, while the access time for floppy disk is about more than 100 m sec.
- Finally because the hard disk drivers cost much higher than floppy disk drivers, soon the floppy disks become popular among users of small business computer.

Advantages of magnetic disks

1. More suitable than magnetic tapes for a wider range of applications because they support direct access of data .

2. Very large amount of data can be stored in a small storage space.

3. They are used for transferring data and programs from computer to another , which are not linked together.

4. Magnetic disks are less vulnerable to data corruption.

Disadvantages of magnetic disks

- More difficult to maintain the security of information stored on shared.

Uses of magnetic disks:

- **U**ses for applications that are based on random data processing.
- As a backup device for off-line storage of data.
- Archiving of data.
- Transferring of data and programs.

2) Optical storage Devices

- Compact Disk Read Only Memory(CD-ROM)
- Digital Video Disk Read Only Memory(DVD-ROM)
- CD Recordable (CD R)
- CD Rewritable (CD RW)

Advantages of optical disks

- Consists of a circular disk.
- Laser beam technology is used for recording/ reading of data on the disk.
- Also known as **laser** disk or optical laser disk.
- High capacity
- Large amounts of data can be stored.
- Storage **capacity** of an optical disk is (**Number of sectors*Number of bytes per sector**).

CD – ROM

- CD – ROM means **Compact Disk –Read only Memory**.
- Provide an excellent medium to distribute large amounts of data at low cost.
- The most popular alternative to magnetic storage systems are optical storage media. The most type of optical storage medium is the compact disk (CD), which is used in CD-ROM,CDR, and CDRW systems.
- Since 1990s nearly all PCs have been sold with a built in CD-ROM drive. Customer are now buying more system with DVD-ROM driver.
- Today's most popular storage medium is the CD-ROM. Developers have been adapting many hard drive based software applications to run on the CD-ROM drives. Some applications take advantage of the easy distribution method offered by CD-ROMs while other applications take advantage of the huge amount of storage space and special properties the CD-ROM offers over conventional drives.

CD-R (CD-Recordable)

- Write once Read many
- Same as CD-ROM and has same capacity
- Information recorded on them can be read by any ordinary CD-ROM drive.

CD-RW(CD-Read/Write)

- Same as CD-R and has same storage capacity.
- Allow users to create their own CD-ROM disks by using a CD-recordable(CD_R).

Digital Video Disk (DVD)

- Looks same as CD-ROM but has capacity of 4.7 GB or 8.5 GB.
- Designed primarily to store and distribute movies.
- Can be used for storage of large data.
- The cost-per –bit of storage is very low.

Advantages of optical disk

- ✓ Optical disks have a data storage life in excess of 30 years.
- ✓ Easy to handle , store , and port from one place to another.
- ✓ Music CDs can be played on computer having a CD_ROM drive.

Disadvantage of optical disks

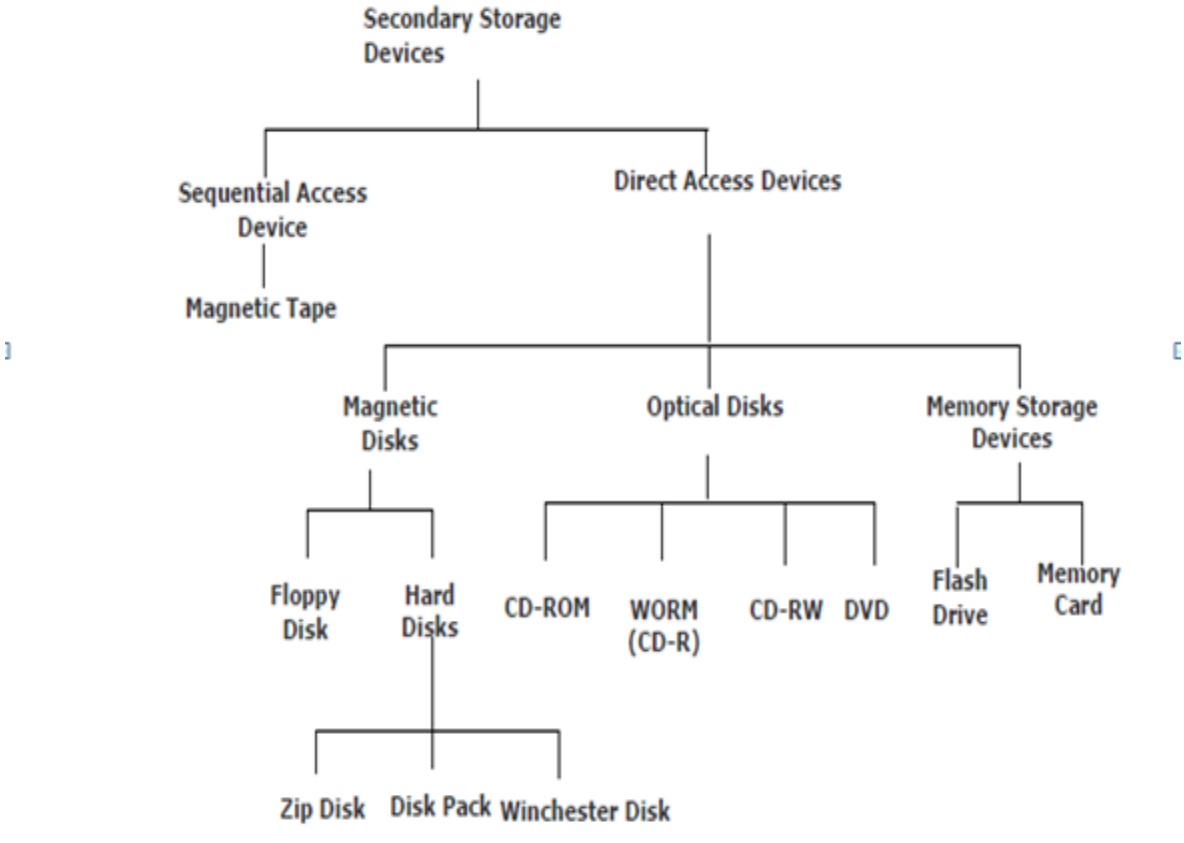
- It is largely read –only storage medium.
- The data access speed for optical disks is slower than magnetic disks.

Uses of optical disks

- ❖ For distributing large amounts of data at low cost.
- ❖ For distributing of electronic version of conference proceedings, journals, magazines , books, etc
- ❖ For distributing of new versions of software products .
- ❖ For distributing of a wide variety of multimedia applications.
- ❖ For archiving of data.

3)Memory Storage Devices

- **Flash Drive :**
  - New secondary storage device
  - Easy transport of data from one computer to another.
  - Comes in various shapes
  - May have different added features.
  - Plug-and – Play device that simply plugs a USB port of computer.
  - Available storage capacities are 8 MB,16MB,64MB, 120MB, 256MB,512MB, 1GB,2GB,4GB,and 8GB.



Compare between CD and DVD

	CD	DVD
Stands for	Compact Disc	Digital Versatile Disc
Purpose	CDs are made with the purpose of holding audio files as well as program files.	DVDs are made with the purpose of holding video files, movies, substantial amount of programs, etc.
Media type	Optical disc	Optical disc
Encoding	Various	Various
Capacity	Typically up to 700 MiB (up to 80 minutes audio)	DVD can range from 4.7 GB to 17.08 GB.
Read mechanism	780 nm wavelength (infrared and red edge) semiconductor laser, 1200 Kib/s (1×)	650 nm laser, 10.5 Mbit/s (1×)
Write mechanism	1200 Kib/s (1×)	10.5 Mbit/s (1×)
Types	CD-R, CD-RW, CD-Text, CD + Graphics, CD + Extended Graphics, Super Audio CD, CD-MIDI, CD-ROM, Video CD, Super Video CD, Photo CD, CD-I, Enhanced CD, VinylDisc and Bootable CD.	DVD-RW, DVD+RW, DVD-RAM and Blu-Ray.
Developed by:	Philips, Sony	Philips, Sony, Toshiba, and Panasonic