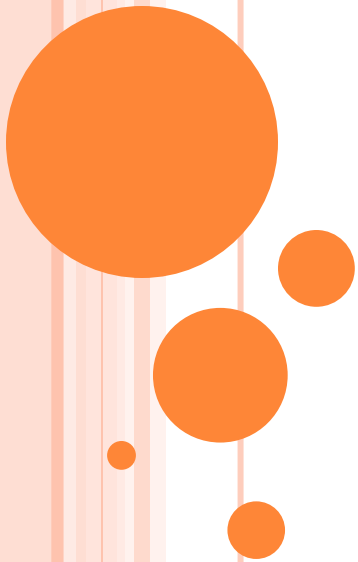# STORAGE DEVICES

CS-305

STORAGE DEVICES

- Used to store data, information and programs permanently .
- Also known as secondary storage, mass storage.

STORAGE DEVICES

- Storage is required for the following reasons:
- Main memory is a temporary memory.
- The storage is required to store data and programs permanently.
- The capacity of main memory is limited.

STORAGE DEVICES

- Different storage media are used to store data, information and programs.

- It is called **non-volatile** memory. Because its contents remain safe even if the computer is turned off.

STORAGE DEVICES

- Storage media are available in different sizes and capacities.

- Examples: Hard disk, Solid state drives, USB flash drives, Memory cards and optical discs.

STORAGE DEVICES

- A hardware unit to store and retrieve data to and form a storage medium is called storage device.
- Two important functions of a storage device are reading and writing.

STORAGE DEVICES

o A storage can be compared on the basis of the following characteristics:

➤ **Capacity:**

✓ Maximum amount of data that can be stored on a media.

✓ Usually indicated terabyte or gigabyte.

➤ **Speed:**

✓ Measured by access time and data transfer rate.

✓ It is measured in milliseconds (ms).

✓ Millisecond= one thousands of second

✓ Measured in KBps, MBps or GBps

BASIC UNIT OF DATA STORAGE

Unit	Denoted	Storage capacity
Bit	Bit	Binary digit 0's and 1's
Byte	Byte	8 bits
Kilobyte	KB	1024 bytes $= 2^{10}$
Megabyte	MB	1024 kilobytes $= 2^{20}$
Gigabyte	GB	1024 Megabytes $= 2^{30}$
Terabyte	TB	1024 Gigabytes $= 2^{40}$
Petabyte	PB	1024 Terabytes $= 2^{50}$
Exabyte	EB	1024 Petabytes $= 2^{60}$
Zettabyte	ZB	1024 Exabyte's $= 2^{70}$
Yottabyte	YB	1024 Zettabytes $= 2^{80}$

DATA ACCESS METHODS

- Different methods of accessing data from secondary storage devices are as follows:

1. Random Access Method
2. Sequential Access Method

DATA ACCESS METHODS

1. Random Access Method

- Data can be retrieved directly from any location on the storage medium in any order.

- Random access devices move directly to a particular location on the medium when data located at that location is needed.

- Almost all devices used with computer today are random access devices such as hard drives, CD/DVD drives and USB flash drives.

DATA ACCESS METHODS

1. Random Access Method

- Also known as direct method.

- Sometime called Addressable media.

- It means that storage system can locate each piece of stored data at a unique address.

DATA ACCESS METHODS

2. Sequential Access Method

o Data can be retrieved in the same order in which it is stored on the medium.

o The data cannot access directly.

o This process reads data from the beginning.

o It continuous reading data until required data is not found.

DATA ACCESS METHODS

2. Sequential Access Method

- Accessing data is slow and time consuming.
- It is not commonly used access methods.
- Used in magnetic tapes.
- Magnetic Tapes are typically used with computer for backup purpose.
- It moves in sequence to read the data from a specific location like audio tape.

DIFFERENCE BETWEEN MEMORY AND STORAGE

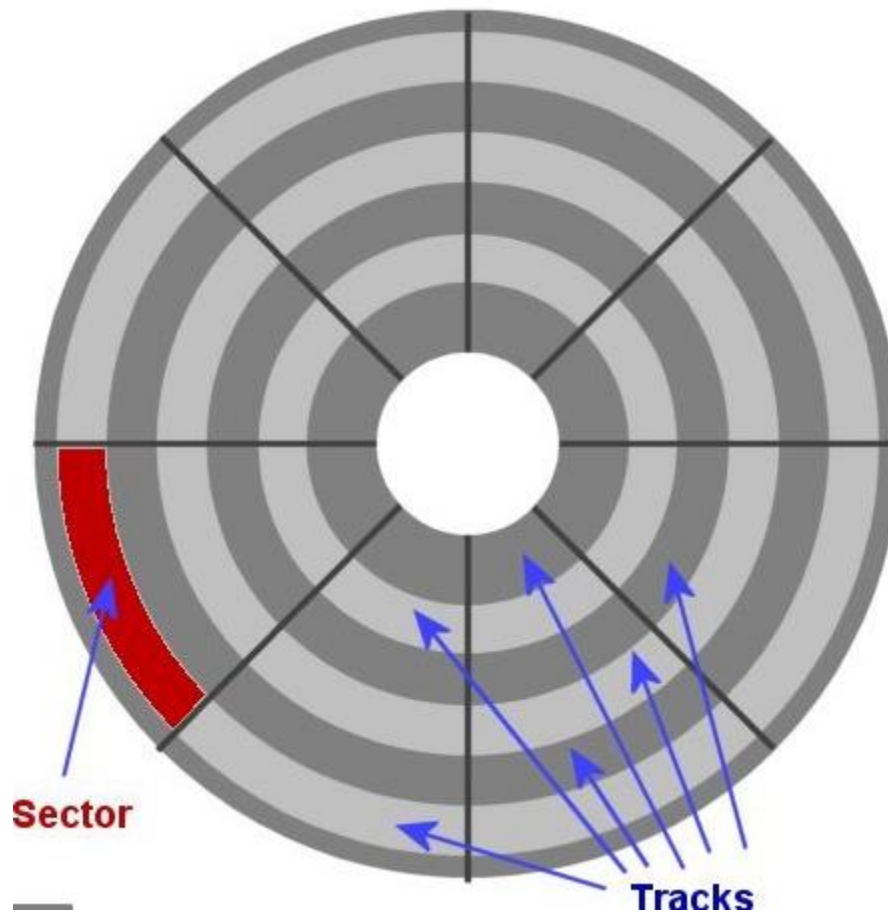| Memory	Storage
o Volatile	o Non-Volatile
o Faster than storage	o Slower than memory
o More expensive	o Less expensive
o Smaller in size	o Generally bigger in size
o Programs are copied from storage during execution.	o Programs are stored in storage and no execution take place
o Capacity of memory is less than storage	o Capacity is much more than memory

MAGNETIC DISK

- Used magnetic material to store data, instructions and information on disk surface.
- The data on magnetic disks is stored in tracks and sectors.
- Tracks form circles on the surface of a magnetic surface.
- Each track on a disk is divided in to sectors.
- Each sectors up to 512 bytes of data.
- Examples: Hard disk, Floppy disk and zip disks etc.

MAGNETIC DISK

HARD DISK

- Primary storage device in a computer to store the programs and data permanently.
- Also known as hard disk drives or hard drive.
- Most PC have at least one hard disk drive.
- Some larger scale computers contains hundreds of hard disk.
- Capacity of hard disk can be up to 8 TB or more.

HARD DISK

- Traditional hard disk is a type of magnetic disk.
- Also called fixed disk because it is fixed in the system unit.
- Consists of several circular disk is called Platters that are coated with magnetic material.
- Each platter has two read/write heads, one for each side.

HARD DISK

- The hard disk also has arms that moves read/write heads to the proper location on the platters to read and write data.

- The platters in the hard disk typically spin at a high rate between 5400 and 15000 revolutions per minute (RPM)

- User can write and read data from many times.

- The disk must be formatted before any data can be written on a hard disk.

HARD DISK

- Formatting is a process that creates tracks and sectors.
- Two or more sectors combined to form a cluster.
- Cluster is the smallest unit of disk space that stores data.

HARD DISK PERFORMANCE

The following factors affect the performance of hard disk:

- **Seek Time:**
  - Also called positioning performance.
  - Time required by read/write head to reach the correct location on the disk.
  - Measured in millisecond
- **Spindly Speed:**
- Also called Transfer Performance.
- It is the speed at which the drive transfer data.
- It is measured in Revolutions per minute(RPM)
- **Latency:**
- Time required by spinning platter to bring desired data to read/write head.
- Measured in milliseconds.

HARD DISK PERFORMANCE

EXTERNAL HARD DISK

- A external hard disk is a separate hard disk that is connected to USB port.
- Advantage: it can be installed without opening the system unit.
- Some hard disk can also communicate with system unit wirelessly.
- The entire hard disk is enclosed in a sealed case.
- Storage capacity up to 4 TB or more.

EXTERNAL HARD DISK

FLOPPY DISK

- Also called diskette.
- Consists of thin plastic disk coated with magnetic material.
- This disk is enclosed a plastic jacket.
- Introduced by IBM in early 1970s.

FLOPPY DISK

- Portable storage medium and can be removed from one computer and inserted into another computer easily.
- Its not commonly used now a days.
- Only store a small amount of data.
- Data accessed speed of floppy disk is slower than hard disk.
- Inexpensive storage media.

FLOPPY DISK

FLOPPY DISK

- Standard size of floppy disk is $3\frac{1}{2}$ inch.

- Capacity of floppy disk is 1.44 MB.

- The circular piece of plastic on $3\frac{1}{2}$ inch. diskette is enclosed in a shell.

- A piece of metal covers the reading and writing area. It is called shutter.

OTHER DISK

- Zip Disk
- Portable disk
- More storage capacity than floppy disk.
- Its storage capacity 1000 MB.
- Zip drive used to read/write on zip disk.
- Can not be used conventional floppy disk.
- Introduced in 1995 by Iomega.

OTHER DISK

- Zip Disk

OTHER DISK

- Super Disk
- Produced by Imation.
- Capacity 120 MB or 250 MB.
- Can also read the standard 1.44 MB floppy disk.
- Popularly used in notebook computers.

OTHER DISK

- Super Disk

OTHER DISK

- Super Disk

OTHER DISK

- Super Disk

OTHER DISK

- HiFD Disk
- HiFD stands for High floppy disk.
- Produced by Sony Corporation.
- Introduced in 1998.
- Capacity is 200 MB.
- Can also read the standard 1.44 MB floppy disk.

OTHER DISK

- HiFD Disk

OTHER DISK

- HiFD Disk

OPTICAL DISK

o   Form of removable storage

o   includes CDs, DVDs etc.

o   Optical drives use a LASER to read and write data on optical disk.

o   LASER: Light amplification through stimulated Emission of Radiation.

o   Laser beam writes on the surface by creating small pit(hole) in the disk.

OPTICAL DISK

- Optical disks commonly store data in a single track that spirals from the centre of the disc.

- Most desktop and laptop computers have at least one optical drive.

- Reads data by focusing laser beam on the surface of the disc.

OPTICAL DISK

- A laser detects the presence of a pit.

- The presence of a pit indicates 1 and indicates 0.

- Optical storage capacity is 700 MB to several GB.

Optical Disk

MAIN CATEGORIES OF OPTICAL DISC

- CD
- DVD

MAIN CATEGORIES OF OPTICAL DISC

- CD
  - Compact disc
  - Used to store photos, audios and computer software.
  - The Contents of CD can be read by CD drive.
  - Available in three types read only, recordable and rewriteable.

MAIN CATEGORIES OF OPTICAL DISC

- Different types of CDs are as follows:
- CD-ROM
- ➢ Compact disc read only memory.
- ➢ Data stored on CD-ROM can only be read.
- ➢ It can store up to 700 MB of data.
- ➢ Used to store audio, photos, distributed in new application software and games.

Main Categories of Optical Disc

- Different types of CDs are as follows:
- CD-R
- ➢ Compact disc recordable
- ➢ Write data on once but can read it many times.
- ➢ The data written to CD-R cannot erased.
- ➢ Also known as CD-burners.
- ➢ Also known as WORM (write once read many)

MAIN CATEGORIES OF OPTICAL DISC

- Different types of CDs are as follows:
- CD-RW
- ➢ Compact disc rewriteable
- ➢ Also known as erasable optical disc.
- ➢ Used the technology both magnetic and optical.
- ➢ Normally used for applications using large volumes of storage with little update activity.

MAIN CATEGORIES OF OPTICAL DISC

- DVD
  - Digital Video disc
  - Similar to CDs expect that is uses a laser beam with shorter wavelength.
  - Storage capacity much greater than CD.
  - It can store up to 17 GB of data.
  - Available in three types, which are read only, recordable and rewriteable.

MAIN CATEGORIES OF OPTICAL DISC

DVD are available in different types:

- DVD-ROM
  - ➢ Digital video disc read only memory.
  - ➢ High capacity optical disc that users can only read but not write or erase.
  - ➢ Used to store high definition videos, music and software.

MAIN CATEGORIES OF OPTICAL DISC

DVD are available in different types:

- DVD-R

  ➢ Digital video disc recordable

➢ Similar to CD-R.

➢ Write data on it once but can read many times,

MAIN CATEGORIES OF OPTICAL DISC

DVD are available in different types:

- DVD-RW

  ➢   Digital video disc rewritable.

  ➢ User can write data on CD-RW many times by erasing the existing contents.