Magnetic Disks (Hard Disks)

How a Hard Disk Drive (HDD) Works | Magnetic Memory Explain
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→ In the Magnetic disks the data (bits) are stored in the form of a ———

→ Non-volatile storage of information.

→ Rotating platter coated with a thin magnetic material.

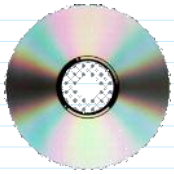
→ Data is stored as tiny magnets.

→ Types of magnetic devices

- Magnetic drum — Made of solid metal
- Floppy Disks — Made of bendable plastic
- Compact Disks (CD/DVD) — optical disks
- Hard Disks — Made of metal/glass

62.5 Kbytes

8" floppy disk (360 Kbytes) 5.25" (800 Kbytes) 3.5" (1.2 Mbyte)



4.7"

3.5"

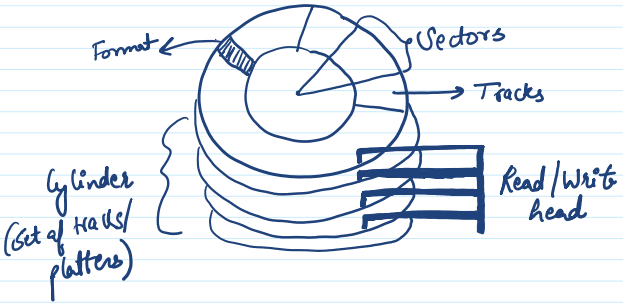
U ~ 700 MB 47B

Flash Drives :- (Small circuit boards)

Pen-drives

1.8" solid-state disk (SSD)
(512 GB)

Organization of data on a Hard Disk :-



HARD DISK

⇒ Hard disk is made up of platters (flat plates that stores the data)
(typically 1 to 5)

⇒ Each plate has its own read/write head.
and has two recording surfaces in various sizes.
(1-8 inches)

⇒ Stack of platter typically rotates at a speed of 5400 to 7200 rpm

⇒ Each disk surface is divided into

concentric circles called tracks.
No. of tracks per surface → (1000 – 5000)

⇒ Within each platter data is organized into

Tracks
(concentric rings)

Sectors
(fractions of a ring) (64 – 200 sectors/track)

Each sector standard size is
512 – 2048 bytes

⇒ Sector is the smallest unit that can be read or written

⇒ Constant no. of sectors per track.
⇒ Capacity of all sectors is same.

Three components of the access time in hard disk:

① Seek Time:–
→ The time required to move the head to the desired track.
→ Average seek time are in the range (8–20 msec)

② Rotational Delay:–
→ Once the head is on the correct track, we must wait for the desired sector to rotate under the head.
→ The average delay or latency is the time for half the rotation.
Example:– 3600 rpm,
average rotational delay = 0.5 rotation / 3600 rpm
= 8.3 msec

③ Transfer time:–
→ Total time to transfer a block of data (typically, a sector)
→ Transfer rates are typically 15 MB/sec or more.

Average Access Time =

Seek time (T_{seek}) + rotational latency ($T_{Rot.}$) + data transfer time (T_{trans})

T_{seek} → Time taken by read/write head of disk to move from one part of disk to another.

T_{rot} → Time taken by a sector of a disk to rotate under the read-write heads of disk drive.

Example:-

⇒ Consider a disk with 32 surfaces, 64 tracks, 512 sectors/pack. 256 bytes of data are stored in a bit serial number in a sector. The number of bits required to specify a particular sector in a disk is:

No. of surfaces = $32 = 2^5$

Tracks per surface = $64 = 2^6$

Sectors per surface = $512 = 2^9$

No. of sectors = no. of surfaces × tracks per surface × sectors per track.

$= 2^5 \times 2^6 \times 2^9 = 2^{20}$

⇒ bits required to specify a particular sector

$= \lceil \log_2 2^{20} \rceil = 20$

⇒ Consider a disk with sector size 512 bytes, 2000 tracks per surface, 64 sectors per track, three double-sided platters, and average seek time of 10 msec.

① Capacity of the disk?

Bytes/track = $512 \times 64 = 32K$

Bytes/surface = $32K \times 2000 = 64000K$

Bytes/disk = $64000K \times 3 \times 2$

$= 384000K$

② If the disk platter rotates at 7200 rpm, and one track of data can be transferred per revolution, What is transfer rate?

Transfer rate = Capacity of a track / average rotational delay

= 32K / 4.5 msec = 7111 kbytes/sec

Interfacing I/O devices is more complex as compared to interfacing memory systems.

① Interfacing Memory Systems
- Cache → static RAM
- Main Memory → Dynamic RAM

only these types

② Interfacing I/O devices
- → Wide variety of peripherals
- → Widely varying speeds
- → Data Transfer rate can be irregular
- → Slower than processor and memory