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### Compare the hard disk with floppy disk

- 1- Hard disks *store much more data* per square inch of recording surface.
- 2- Because aluminum platters are less sensitive than floppy disks to variations in temperature and humidity and to mechanical stress, this allows the hard disks to *have more tracks* per radial inch and to write more bits per inch along each track.
- 3- *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 disk. For floppy disks system the maximum transfer rate is typically between **30,000** and **150,000** characters per second. For hard disk system the maximum transfer rate between **200,000** and **2 million** characters per second.
- 4- *Access times are also faster for hard disks than floppy disks*. The access time for a hard disk is about **25 to 70 msec**, while the access time for floppy disks is about more than **100 msec**. Whenever a computer is operating, its hard disk is spinning. Which means there is no need to wait for the disk to come up to its speed, while floppy disks cannot afford to turn constantly because their heads rub against the recording surface whenever the disk is turning, startup time needed to bring a floppy disk to operating speed is about 30 seconds.
- 5- Floppy disks are *transportable* while the hard disk is *not transportable*.

### Hard disks also have several disadvantages:

- 1) They tend to be *noisier* than floppy disk drives, because of their constant high-speed spinning.
- 2) More important is the sensitivity of hard disks. Head crashes can be caused by a bent disk, dust or cigarette smoke inside the drive, or a good thump to the side of the drive.

Because hard disks operate on extremely precise mechanical tolerances, they are more sensitive to shock than floppy disks.

- 3) The hard disk *drives cost much higher* than floppy disk drives.

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## 14- Optical disks

Several new technologies take advantage of optics to store and retrieve data. The **compact Disc (CD)**, **Digital Versatile Disc (DVD)**, and **Blu-ray Disc (BD)** discussed below, employ light to read data encoded on a reflective surface.

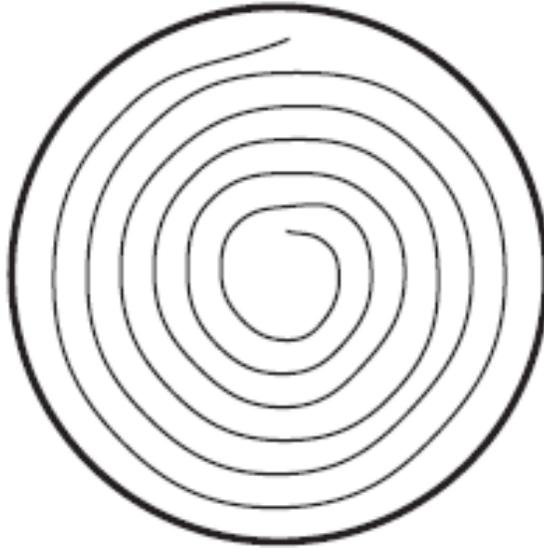
### 1-The Compact Disc

The CD was introduced in 1983 as a medium for playback of music. CDs have the capacity to store 74 minutes of audio or nearly 700 MB capacity. Since the introduction of the CD in 1983, CD technology has improved in terms of price, density, and reliability, which led to the development of **CD ROMs** (CD read only memories) for computers, which also have the same 700 MB capacity. Their low cost, only a few cents each when produced in volume, coupled with good reliability and high capacity, have made CD ROMs the medium of choice for distributing commercial software, replacing floppy disks.

CD ROMs are “read only” because they are stamped from a master disk similar to the way that audio CDs are created. A CD ROM disk consists of aluminum coated plastic, which reflects light differently for **lands** or **pits**, which are smooth or pitted areas, respectively, that are created in the stamping process.

Unlike a magnetic disk in which all of the sectors on concentric tracks are lined up like a sliced pie (where the disk rotation uses **constant angular velocity**), a CD is arranged in a spiral format (using **constant linear velocity**) as shown in Figure 9. The pits are laid down on this spiral with equal spacing from one end of the disk to the other. The speed of rotation, originally the same 30 RPM as the floppy disk, is adjusted so that the disk moves more

slowly when the head is at the edge than when it is at the center. Thus CD ROMs suffer **from the same long access time as floppy disks because of the high rotational latency.**



**Figure 9: Spiral storage format for a CD.**

Because the pits are only 0.6 micron wide ( a micron is the equivalent of one millionth of a meter), the path of this spiral are separated by small distance of only 1.6 micron.

If the spiral were stretched out in a straight line it would be approximately 3.75 miles (6 kilometers) long. It also includes no fewer than 2 billion pits. Naturally, the laser beam that reads these pits and lands must be correspondingly small. The scanning beam is approximately one micron in diameter which makes it only a little larger than the wavelength of the light that forms its beam.

CD ROM technology is appropriate for distributing large amounts of data inexpensively when there are many copies to be made, because the cost of creating a master and pressing the copies is distributed over the cost of each copy. CDs also cannot be written after they are pressed.

## **How a CD-ROM is organized:**

The recordable surface of a CD-ROM is divided into the following three sections:-

- 1- The lead-in.
- 2- The data area.
- 3- The lead-out.

The lead-in occupies the first four millimeters of the CD's inner edge and contains a type of table of contents.

The lead-in is followed by the data area which can occupy up to 33 millimeters, depending on how much data is on the CD. Finally, the lead-out range marks the end of the data. It follows immediately after the data area and is approximately 1 millimeter wide.

## **2-The Digital Versatile Disc (Digital Video Disc).**

An optical digital disc for storing movies and data. Introduced in the USA in 1997, and developed by both the computer and movie industries, the disk uses the same diameter platters as a CD (120mm/4.75" diameter), but holds 4.7GB rather than 700MB. Whereas CDs use only one side, DVDs can be recorded on both sides as well as in dual layers in each side for a total capacity of 17 GB. The DVD technology is an evolutionary step up from the CD, rather than being an entirely new technology, and in fact the DVD player is backwardly compatible—it can be used to play CDs and CD ROMs as well as DVDs.

## **3- Blu-ray Disc**

Blu-ray disc is the name of the next generation optical disc format jointly developed by the Blu-ray disc association (BDA), a group of the world's leading consumer electronics, personal computers and media manufacturers (including Apple, Dell, Philips, Hitachi, HP, JVC, LG, Mitsubishi, Panasonic, Pioneer, Samsung, Sharp, Sony, TDK, and Thomson).

The format was developed to enable recording, rewriting and playback of high-definition video (HD), as well as storing large amount of data more than five times the

storage capacity of traditional DVDs and hold up to 25 GB on single layer disc and 50 GB on a dual layer disc.

While current optical disc technologies such as DVD, and CD depend on a red laser to read and write data, BD technology uses a blue-violet laser, hence the name Blu-ray. Despite the different types of laser used, Blu-ray products can easily be made backwards compatible with CDs and DVDs through the use of a BD/DVD/CD compatible optical unit. The benefit of using a blue-violet laser is that it has a shorter wavelength (405 nm) than a red laser (650 nm), which it makes possible to focus the laser beam on spots with even greater precision. This allows data to be packed more tightly and stored in less space so it's possible to fit more data on the disc even though it's the same size as a CD and DVD.