Lecture (2)

Data storage

Is a technology consisting of computer components and recording media used to retain digital data. It is a core function and fundamental component of computers.

1. Storage hierarchy

1.1 Enterprise data storage is often classified as primary and secondary storage, depending on how the data is used and what type of media it is placed on.

1.2 Primary storage holds data in memory (sometimes called random access memory or RAM) and other built-in devices, such as the processor's L1 cache. Secondary storage commonly includes data on hard disks, tapes and other devices requiring I/O operations. Secondary storage media is often used in storage. Primary storage is much faster to access than secondary storage because of the proximity of the storage to the processor and the nature of the storage devices.

2. Types of Storage

There are many types of data storage, with various levels of capacity and speed. These include magnetic tape; magnetic disks; optical discs, such as CDs, DVDs ; flash memory; main memory and cache memory.

The main types in use today include hard disk drives (HDDs), optical storage and Solid-State Storage (SSS). HDDs are the most commonly used storage in personal computers, servers and enterprise storage systems, but are rapidly giving way to faster solid-state drives (SSDs).

Optical data storage is popular in consumer products, such as computer games and movies, and is also used in high-capacity.

Flash memory cards are commonly found in digital cameras and mobile devices, such as smartphones, tablets, audio recorders and media players.

3. Measuring storage

Bits and bytes are the basic measurements for computer storage. One single binary value (1 or 0) makes up a bit, and eight bits make up one byte. Other capacity measurements --and their abbreviations -- to know are:

Larger measures include the following:

- KiloByte (KB) equal to 1,024 bytes
- MegaByte (MB) equal to 1,024 KB
- GigaByte (GB) equal to 1,024 MB
- TeraByte (TB) equal to 1,024 GB
- PetaByte (PB) equal to 1,024 TB
- ExaByte (EB) equal to 1,024 PB

4. The benefits of data storage

The benefits of data storage can be summarized as follows:

- **Capacity**. Organizations may store the equivalent of a roomful of data on sets of disks that take small space. A simple disk for a personal computer holds the equivalent of 500 printed pages.
- **Reliability**. Data in secondary storage is basically safe, since secondary storage is physically reliable. Also, it is more difficult for illegal users access to data.
- **Convenience**. With the help of a computer, authorized people can locate and access data quickly.

- **Cost**. Together the three previous benefits refer to significant savings in storage costs. It is less expensive to store data on tape or disk. Data that is reliable and safe is less expensive to maintain than data subject to errors. But the greatest savings can be found in the speed and convenience of filing and return data.

5. Types of data storage

1. Hard disks

The hard disk drive is the main, and usually largest, data storage hardware device in a computer. The operating system, software titles, and most other files are stored in the hard disk drive.

The Hard Disk Drive is Also Known As

HDD, hard drive, hard disk, fixed drive, fixed disk, fixed disk drive.

Important Hard Disk Drive Facts

The hard drive is sometimes referred to as the "C drive" due to the fact that Microsoft Windows designates the "C" drive letter to the primary partition on the primary hard drive in a computer by default.

While this is not a technically correct term to use, it is still common. For example, some computers have multiple drive letters (e.g. C, D, E) representing areas across one or more hard drives.

- **Hard Disk Drive Description**

A mechanical hard drive has four main components that work together in the data-storing. Hard drives differ from system memory in that the devices are used to store data for a computer instead of running system processes.

1. **Disk Platter Storage**

A hard drive's platters are the physical part of the hard drive responsible for storing data. Platters are circular, thin metal disks that have a diameter that's a little smaller than the width of the device storage case. Modern hard drives can have more than one platter stacked on top of each other to expand storage capacity.

2. **Spindle Controls Motion**

The spindle is the part of the hard drive that's responsible for spinning the platters so the device's read and write arm can access and save data. Hard drive platters are stacked on top of each other on top on the spindle.

3. **Reading and Writing Heads**

The read and write arm, also called the actuator arm, is the part of the hard drive that reads data already stored on the platter and writes new data on the platter.

4. Actuator Heads

The actuator arm is connected to a part called the actuator that controls the positioning of the actuator arm relative to the disk platter. The actuator works with the spindle motor to position the actuator arm so it lines up with the platter to read and write data.

2. Floppy Disk Drive (FDD)

A floppy disk commonly came in three sizes, 8 inches, 5.5 inches and 3.5 inches, becoming smaller as the technology advanced. The newer, 3.5-inch version used more technology and held more data than previous models, while the original 8-inch floppy drive was developed to load hardware-level instructions and/or data structures. As the floppy disk advanced to a smaller 5.5- and 3.5-inch designs. For many years, the majority of PCs and notebooks had a floppy drive. Using a floppy disk to exchange data between PCs was a standard method for many computer technicians. The floppy disk was one of the most common ways to store adequate amounts of data outside of a computer's hard drive for personal use because they were inexpensive and easy to carry. As technology advanced, floppy disks were finally able to read and write. By this point, FDDs had four basic components:

1. Magnetic read/write heads (one or two)
2. A spindle clamping device that held the disk in place as it was spinning 300 to 360 rotations per minute
3. A frame with levers that opened and closed the device
4. A circuit board that contained all of the electronics.

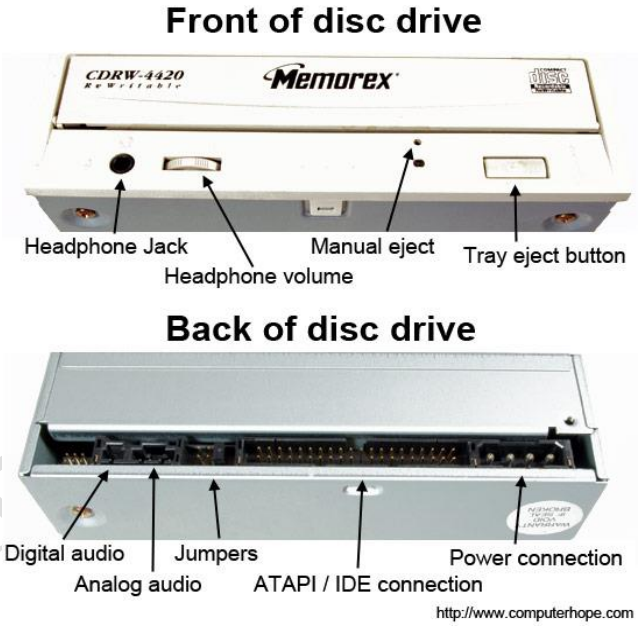
Floppy drives are mostly a hardware device of the past. Newer hardware devices have been introduced, including CDs and USB. Today, floppy drives are usually not included on a PC, notebook or laptop

3. What is CD-ROM?

Short for **Compact Disc-Read Only Memory**, a **CD-ROM** (shown right) is an optical disc which contains audio or software data whose memory is read only. A **CD-ROM Drive** or **optical drive** is the device used to read them. CD-ROM drives have speeds ranging from 1x all the way up to 72x, meaning it reads the CD roughly 72 times faster than the 1x version. Below is a picture of the front and back of a standard CD-ROM drive.

Note:

This value, 150 KiB/s, is defined as "1× speed". Therefore, for Mode 1 CD-ROMs, a 1× CD-ROM drive reads 150/2 = 75 consecutive sectors per second.



Tip: When referring to a round CD, DVD, or Blu-ray it is known as a "**disc**" and not a "disk." If you are referring to a magnetic media such as a floppy disk or a hard disk drive, it is called to as a "disk" and not a "disc."

What Are the Components of a CD-ROM Drive?

1. Optics

The lens of your CD-ROM drive is responsible for reading CD data, which it does while the disc is spinning. If the lens of your CD-ROM drive becomes dirty, it may have a tendency to skip audio CDs and misread information from data CDs. In severe cases, the information may be completely unreadable.

2. Head Actuator

The lens of a CD-ROM driver is positioned on a mechanical actuator. This moves the lens back and forth, allowing it to read data from the surface of a CD.

3. Spindle Motor

The spindle motor is responsible for spinning the CD when it is in your CD-ROM drive. The speed of a CD-ROM drive's spindle motor is dependent on the area of the CD that is currently being read. When reading data from the inside or center of a CD, the spindle motor runs faster. As the laser starts to read data near the outside edge of a CD, the spindle motor runs slower.

4. Disc Loader

Disc-loading mechanisms of CD-ROM drives vary depending on the manufacturer. The most common disc-loading mechanism in use today is the tray loader. This is a simple plastic tray that slides out of the drive, allowing you to insert the CD into the drive. The tray keeps the disc in place while it is in the drive.

5. Drive Connectors

A four-pin power connector is located on the back of every CD-ROM drive; this is the same type of connector found on hard drives and most other internal devices.

6. Outputs and External Controls

Many CD-ROM drives are equipped with a headphone jack on the face of the drive, allowing you to easily plug in a pair of headphones. Other common controls include Start and Stop buttons and volume control dials.

7. Drive Enclosure

A metal case is used to protect all of the components of a CD-ROM drive. Opening the drive enclosure may make it prone to damage

6. Types of CD ROM Drives

CD-ROMs changed the way that information can be saved from a computer. In the past, floppy discs were the media of choice, but they were quickly replaced because CD-ROM's have a higher capacity of storage; they are faster and easier to store. Instead of using multiple floppy discs to save one file, PC users can now store hundreds or even thousands of data files on one CD-ROM.

1) CD-ROM

CD-ROM stands for (Compact Disc Read Only Memory), and it is mainly used to mass produce audio CD's and computer games. Computer users can only read data and music from the discs, but they cannot burn their own information onto the discs, from their personal computers.

2) CD-R

CD-R also known as (Compact Disc Recordable) and WORM (Write Once Read Many) is a blank disc that users can put into a CD-ROM drive to burn or make a copy of their personal data, music, videos and information. CD-R's have to use special software to burn specific types of media or data. You cannot use the menu of a data disc to create an MP3 CD or vice versa. Users would select "Audio CD" to burn music or "Data" to burn documents and files.

3) CD-RW

Unlike a CD-R, the CD-RW (Compact Disc Rewritable) can be delete and returned to its original blank state. New files can then be copied onto the rewritable disk. CD-RW never became as popular as the CD-R's because they are not compatible with most disc players to listen to music. They are primarily used to move data from one computer to another, or to copy files that are only needed a few times.

4) Size

A standard CD-ROM, CD-R and CD-RW can hold up to 700MB of data. As an audio CD, it can be used to store up to 80 minutes of music. In comparison, a DVD-ROM can contain 4.7 GB of information and movies.

How Data Encoding and Reading in CD-ROM device?

The CD-ROM, like other CD adaptations, has data encoded in a spiral track beginning at the center and ending at the outermost edge of the disc. The spiral track holds approximately 650 MB of data. That's about 5.5 billion bits. The distance between two rows of pits, measured from the center of one track to the center of the next track is referred to as track pitch. The track pitch can range from 1.5 to 1.7 microns, but in most cases is 1.6 microns.

Constant Linear Velocity (CLV) is the principle by which data is read from a CD-ROM. This principal states that the read head must interact with the data track at a constant rate, whether it is accessing data from the inner or outermost portions of the disc. This is affected by change the rotation speed of the disc, from 500 rpm at the center, to 200 rpm at the outside.

http://www.computerhope.com/jargon/c/cdrom.htm

https://www.techwalla.com/articles/what-are-the-components-of-a-cd-rom-drive