

Introduction

Auxiliary storage device, also known as secondary memory is the supplementary memory to the main memory. It is permanent in nature retains its contents when the computer is switched off. It can be used to hold data and programs for future reference and they function as a back up storage media as well. Back ups assist to recover data in cases of accidental erasure, virus infiltration or major system crashes. They are not directly connected to the processor and hence the access time is slower than that of the main memory. The content in it must first be copied into the primary storage RAM for the CPU to process. The most common types of auxiliary storage devices are magnetic tape, hard disks, floppy disks, optical disks etc.

Auxiliary devices can be categorized into two types based on the data access.

1. Sequential Access
2. Random Access

Sequential Access	Random Access
Data are accessed sequentially step by step.	Data can be accessed randomly on any location.
Data access time is more as to read a particular piece of data all the data preceding it must be read.	Data access time is less as data on any location can be accessed directly.
Reading data sequentially involves a lower number of seek operations than does random reading; sequential reads deliver a higher rate of throughput	Random reads deliver a lower rate of throughput
Eg. Magnetic Tape, Tape drive	e.g. Magnetic Disks, Floppy Disk, Optical Disk

Magnetic Tape

- is a medium for magnetic recording generally consisting of a thin magnetizable coating on a long and narrow strip of plastic.
- originally developed in Germany, based on the concept of magnetic wire recording.
- device that stores computer data on magnetic tape can be called a tape drive, a tape unit, or a streamer.
- are sequential access device and are slower in performance as their data access time is more.
- are cheap and allow massive amounts (Kbs to Gbs) of data to be stored in computers for long periods of time.
- Modern magnetic tapes for hard disk backup come in cassette form. These are called cartridge tapes
- DAT (Digital Audio Tape) is the latest addition to the magnetic tape, the tape length is 60 or 90 meters, capacity up to 4 GB and data transfer rate 366 KB/sec

Uses

Magnetic tapes are often used to make a copy of hard discs for back-up reasons. This is automatically done overnight on the KLB network and the tapes are kept in a safe place away from the server.

Advantages

Magnetic tape is relatively cheap and tape cassettes can store very large quantities of data (typically 26 GB).

Disadvantages

Accessing data is very slow and you cannot go directly to an item of data on the tape as you can with a disc. It is necessary to start at the beginning of the tape and search for the data as the tape goes past the heads (serial access).

Winchester Disk

- The term Winchester comes from an early type of disk drive developed by IBM that stored 30 MB and had a 30-millisecond access time; so its inventor named it a Winchester in honor of the 30-caliber rifle of the same name.
- They have the same technology of the modern day hard disk with less speed and capacity

Magnetic Disk

- Diskette drive and hard disk drives are the most commonly used storage devices.

Hard Disk	Floppy Disk
1. They are the mass storage device with enormous capacity to store data.	1. They have limited storage capacity upto 1.44 MB.
2. Data access time is less.	2. Data access time is more.
3. Relatively expensive	3. Relatively cheap
4. Are fixed disk and usually built into the computer	4. Are portable.
5. They last long	5. They have a short life.

Hard Disk

- Mass storage random access device that can store GBs of data. As of July 2008, the highest capacity HDDs are 1.5 TB.
- A typical mobile HDD spins at 5,400 rpm, with 7,200 rpm models available for a slight price premium
- The fastest “enterprise” HDDs spin at 10,000 or 15,000 rpm, and can achieve sequential media transfer speeds above 1.6 Gbit/s and a sustained transfer rate up to 125 MBytes/second. Drives running at 10,000 or 15,000 rpm use smaller platters because of air drag and therefore generally have lower capacity than the highest capacity desktop drives.
- Data is stored by magnetizing the surface of flat, circular plates called platters which have a surface that can be magnetized. They constantly rotate at very high speed. A read/write head floats on a cushion of air a fraction of a millimeter above the surface of the disc. The drive is inside a sealed unit because even a speck of dust could cause the heads to crash.
- Programs and data are held on the disc in blocks formed by tracks and sectors. These are created when the hard disc is first formatted and this must take place before the disc can be used. Disc are usually supplied pre-formatted.

Uses:

- The hard disc is usually the main backing storage media for a typical computer or server.

Advantages:

- Stores and retrieves data much faster than a floppy disk or CD-ROM
- Very fast access to data as data seek time is less.
- Data can be read directly from any part of the hard disk. The access speed is about 1000 KB per second.
- Usually fixed inside the computer so cannot get mislaid.
- Cheap on a cost per megabyte compared to other storage media.

Disadvantages:

- Hard disks eventually fail which stops the computer from working.
- Regular 'head' crashes can damage the surface of the disk, leading to loss of data in that sector.
- The disk is fixed inside the computer and cannot easily be transferred to another computer.

Floppy Disk

- A floppy disk is an obsolescent data storage medium that is composed of a disk of thin, flexible magnetic storage medium encased in a square or rectangular plastic shell.
- Floppy disks are read and written by a floppy disk drive
- Invented by IBM, floppy disks in 8-inch, 5¼-inch, and the newest and most common 3½-inch formats enjoyed many years as a popular and ubiquitous form of data storage and exchange, from the mid-1970s to the late 1990s. They have now been superseded by flash and optical storage devices.

Uses:

- Moving files between computers that are not connected through network or communication hardware
- Loading new programs onto a system
- Keeping a back-up of small files.

Advantages:

- They are very cheap to buy and floppy disk drives are very common.

Disadvantages:

- They are easily physically damaged if unprotected and magnetic fields can damage the data.
- They are relatively slow to access because floppy disk rotates far more slowly than hard disks. The access speed is about 36 KB per second.

Two types of Floppy Disk

- 8" inch disk →
- 5.25" inch disk → mini floppy
- 3.5" inch disk → micro floppy
- Also depends upon the density of the disk
 - Density of the disk is measure of the capacity of the disk surface: the higher the density the more closely the iron – oxide particles are placed and the more data the disk can store.
 - Double Density (DD)
 - High Density (HD)
 - Extra High Density (ED)

Disk Capacity Determination

Disk capacity = NT x NS x NB x S
NT → No. of Tracks per surface
NS → No. of Sectors per tracks
NB → No. of Bytes per sectors – 512 bytes
S → No. of Sides

Disk	Type	Tracks	Sectors/Tracks	Sectors	Bytes/Sectors	Total bytes	KB	MB
5.25"	DD	40	9	750	512	368640	360	.36
5.25"	HD	80	15	2400	512	122800	1200	1.2
3.5"	DD	80	9	140	512	737280	720	.7
3.5"	HD	80	18	2880	512	1474560	1440	1.44
3.5"	ED	80	36	5760	512	2949150	2880	2.88

Example:

5.25" DSDD Capacity = NT x NS x NB x S = 40 x 9 x 512 x 2 = 368640 bytes = 360 KB	3.5" DSHD Capacity = NT x NS x NB x S = 80 x 18 x 512 x 2 = 1474560 bytes = 1440 KB = 1.44 MB
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Optical Disk

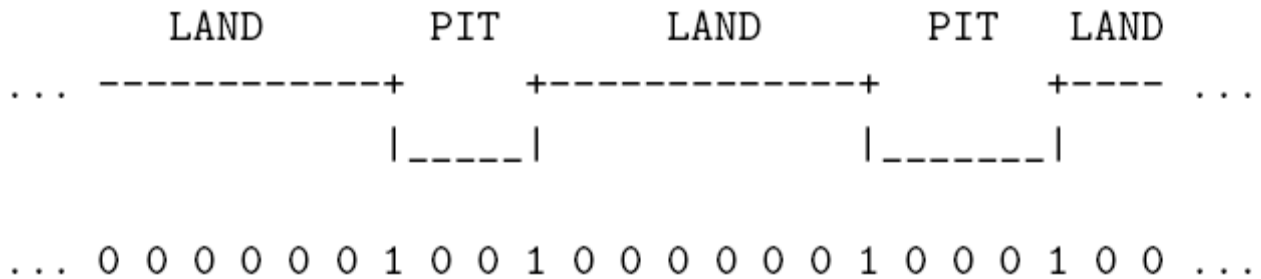
- Alternatives to magnetic storage systems.
- Most widely used type of optical storage medium is the compact disk (CD), CD – ROM, DVD – ROM, CD – Recordable, CD – Rewritable
- These devices fall into the category of optical storage because they store data on a reflective surface. So it can be read by a beam of laser light.
- A laser uses a concentrated, narrow beam of light, focused and directed with lenses, prisms and mirrors.
- The light focus of the laser beam is possible because all the light is the same wavelength.

CD-ROM (Compact Disk Read Only Memory)

- Is read only optical storage medium
- They are capable of holding above 700MB of data , 74 minutes of audio or video
- Accessing data from a CD-ROM is quite a bit faster than floppy disk but considerably slower than a modern hard disk
- The disk is made of a polycarbonate wafer, 120mm in diameter and 12mm thick with a 15 mm hole in the center.
- The wafer is coated with metallic film, usually an aluminum alloy.
- The aluminum film is the portion of the disk that the CD-ROM drive reads for information.
- The aluminum film is covered by a plastics polycarbonate coating that protects the underlying data.
- CD-ROM is single sided.
- Data is laid out on a CD-ROM disk in a long, continuous spiral that starts at the outer edge and winds inward to the center.
- Data are stored in the form of lands which are flat area on the metal surface and pits, which are depressions or hollows.
- Land reflects the laser light into the sensor (indicating a data bit of 1)
- Pit scatter light (indicating a data bit of 0)
- Reading the information back is a matter of reflecting a lower – powered laser off the aluminum film.
- A receiver or light receptor notes where light is strongly reflected or when it is absent or defused.

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- Diffused or absent light is caused by the pits made that is called land.
- Data transfer rate is around 150 KBps , 300KBps now a days 7800KBps



WORM (Write Once Read Many)

- is a data storage technology that allows information to be written to a disk a single time and prevents the drive from erasing the data.
- The discs are intentionally not rewritable, because they are especially intended to store data that the user does not want to erase accidentally.
- Because of this feature, WORM devices have long been used for the archival purposes of organizations such as government agencies or large enterprises.
- The discs have varied in size from 5.25 to 14 inches wide, in varying formats ranging from 140MB to more than 3 GB.

EO disks (Erasable Optical Disks)

- Data in EO disks can be erased and loaded with new data just like the magnetic disk
- eg. CD RW, DVD RW, Magneto Optical Disk

Magneto Optical Disk

- Incorporates the combined features of magnetic disk and CD-ROMs
- They can be read and written into and are portable as well.
- Storage capacity more than 200 megabytes
- Data access speed is faster than floppies and CD-ROMs but not as fast as hard disks