

CAPE COMPUTER SCIENCE

SECONDARY STORAGE

Secondary storage is needed

1. because there is a limit on the size of primary memory (due to cost) and
2. because RAM is volatile and so data needed for future use must be stored somewhere else so that it can be retrieved when necessary. Secondary storage is also used for backup and archives.

When we consider secondary storage devices we must bear in mind the following characteristics of each device :

Capacity
Access speed
Access method and
portability

Floppy Disk

This is a 3.5 inch magnetic disk of flexible material which until recently was a standard feature on most microcomputers. Typically it stores 1.44 MB of data.

It's a thin plastic circle coated with a magnetic material and encased in a rigid plastic to protect it. A metal sliding access shuttle opens when the disk is in the machine allowing the read/write head access to the disk. Data can be written to and erased from a floppy disk. A write protect tab can be used to prevent accidental overwriting of data. Before data can be written to a disk, it must be formatted. This prepares the disk for use by creating a magnetic map on the disks surface. This map consists of tracks and sectors. Formatting also prepares the file allocation table (FAT). The address of a file on a floppy disk is comprised of the track number and the sector number. Floppy disks are direct access devices but they are slow compared to hard disks.

The floppies great advantage has been its use as a device to help transport small files between machines. Though the floppy drive is still on most desktop machines many laptops no longer carry floppy disks drives.

Zip Disks/ Drives

Zip drives can be internal or external and they store data on zip disks. Zip disks are durable, portable, and easy to use. They can typically store 100 MB, 250 MB or even 750 MB of data. One 750 MB disk can store the same amount as 520 floppy disks.

Zip disks are relatively inexpensive; they are read/write devices. Popularly used to back up hard drives and to transfer large files from one computer to another. Physically there are about 1 ½ times the size of a floppy disk.

Zip drives are not standard on desktops and have to be specially requested or bought as an external unit.

Hard Disks

The **hard disk** is made from rigid aluminum coated with a magnetic material. It is normally supplied as a sealed unit and will often consist of a number of disks (called platters) on a common spindle.

Each disk is divided into hundreds of concentric tracks and a number of sectors. Each sector can store between 256 and 512 bytes. The tracks are immediately above and below each other. A particular set of such tracks is called a cylinder.

Each hard drive will have a set of read/write heads that together move in and out between the platters. At any particular time the read/write heads are positioned over a cylinder.

It is now fairly standard for a PC to have a hard disk that can hold between 40 and 80 GB of data. When PC's became popular in the 80's the hard disks size was measured in MB.

The hard disk is a direct access device and all direct access devices must have memory addressing, i.e. there is a way of referring to a particular place on the disk. For hard disks the address of any particular spot on the disk is comprised from the surface number, the cylinder number and the sector number.

Hard disks also have a directory and here the list of addresses used and by what file is stored. To access a file the FAT is checked then the read/write head is moved to that address on the disk.

Hard disks come in a variety of sizes but all have a very high storage capacity compared with floppy disks. The data transfer rate is also higher than floppies. Hard disks are pretty reliable but are normally fixed inside a machine.

Optical Disks

An **optical disk** is a hard plastic disk with a mirrored surface. The data is stored by removing the mirroring with a laser beam. This creates a pit on the surface. Early optical disks could only be written once so they then become read only devices a.k.a. WORM (write once read many) disk. The most common worm disk is the **CDROM**. A typical CD holds 650 MB

CDR/W are magneto optical. They can be rewritten.

Optical disks have a larger storage capacity than floppy but less than hard disks or tapes. They also fall in the middle in terms of access time.

DVD stands for Digital Versatile Disk. They look similar to CD-R but they are capable of holding much more information because the tracks are placed closer together as compared to a CD so there are more tracks. Also some DVD's are double sided.

Typically a DVD can hold between 4.7 GB and 17 GB of data. They are direct access devices and access is very fast.

DVDs are used mainly for storing image intensive files such as movies. The quality of the sound and the video is superior to videotapes.

Optical disks are popular for permanent backup and the transport and distribution of software or information such as encyclopedias.

The CD-ROM is pretty standard on microcomputers. CD-R/W and DVD drives are also rapidly becoming standard.
DVD writers are also taking off in popularity.

Magnetic Tapes

Tape is made of flexible reels of plastic with a magnetic coating. Data is stored in tracks that run the entire length of the tape.

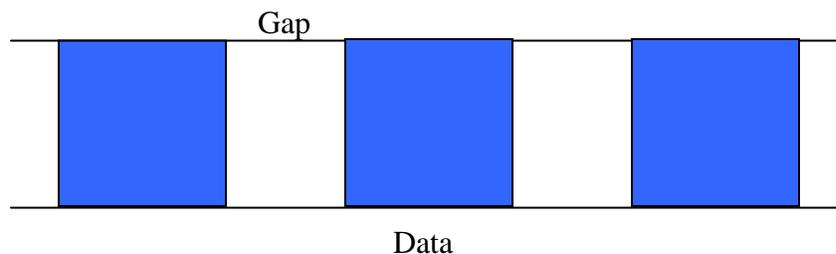
One frame represents one character. How many tracks does a tape usually have? 9 (one for parity)



Tape is an ideal medium for backup because it is fast, inexpensive and has a high storage capacity. It can be on small cartridges or small reels.



The head has to read the tape at constant speeds so the frames are grouped into blocks and an intergap block is left between blocks. This allows the head to speed up and slow down before/after it encounters data



The tape reader head uses the gap for slowing down and speeding up. One block is read at a time; large blocks and small gaps are more efficient.

DAT

Digital audio tape is a small tape cassette but its tracks run across and not along the tape. The DAT drive therefore has to operate at high speeds.

DAT can store >20 GB on one tape so it's popular for mass backup especially of pictures and sounds.

All tapes are sequential access and are therefore slow

Thumb Drive: small compact, rewriteable storage devices roughly the size of an adult thumb that interfaces with a computer via the USB port. It is therefore removable and highly portable. It's also known as pen drive, pocket drive, jump drive, USB flash drive, USB stick, etc

Random access means that all data can be accessed directly — in a form of indexing as opposed to storage systems based on seeking sequentially through the data/file. When the data has to be searched sequentially it is called serial access.