SECTION 3

SECTION 3 – Storage Devices & Media

In this section we will first, identify common backing storage media and their associated devices, second identify typical uses of those storage media, including types of access (e.g. serial/sequential, direct/random) and access speeds, and third describe the comparative advantages and disadvantages of using these different backing storage media.

A Storage device is an apparatus for recording computer data in permanent or semi permanent form. When a distinction is made between primary (main) storage devices and secondary (backing) storage devices, the former refers to random access memory (RAM) and the latter refers to disk drives and other external devices. Storage media are the various types of physical material on which data bits are written and stored, such as hard disks, tape, flash memory and optical discs.

Types of storage devices

Magnetic storage

Magnetic storage and magnetic recording are terms from engineering referring to the storage of data on a magnetized medium. Magnetic storage uses different patterns of magnetization in a magnetizable material to store data and is a form of non-volatile (does not lose its contents when switched off) memory. The information is accessed using one or more read/write heads.

Hard discs (fixed)

A hard disk drive (HDD), commonly referred to as a hard drive, hard disk, or fixed disk drive, is a non-volatile storage device which stores digitally encoded data on rapidly rotating platters with magnetic surfaces. Strictly speaking, "drive" refers to a device distinct from its medium, such as a tape drive and its tape, or a floppy disk drive and its floppy disk.

Originally, the term "hard" was temporary slang, substituting "hard" for "rigid", before these drives had an established and universally-agreed-upon name. A HDD is a rigid-disk drive although it is rarely referred to as such. By way of comparison, a so-called "floppy" drive (more formally, a diskette drive) has a disc that is flexible.

Application use

- Used to store operating systems, software and working data. Any application which requires very fast access to data for both reading and writing to.
- Not for applications which need portability.
- Used for on-line and real time processes requiring direct access.
- Used in file servers for computer networks.
- **Its type of access is direct / random.**

Advantages

- Holds large amounts of data, which can be read and written to.
- More reliable than floppy disks.
- Can access data very quickly.
- Data can be read from any part of the disk.

Disadvantages

- Data loss can occur if dropped.
- Slows down when too much data is stored on it.

Hard discs (portable)

An external hard disk drive is a type of hard disk drive which is externally connected to a computer, and may be portable. External hard disk drives are connected to the computer using some form of cable.

The internal structure of external hard disk drives is similar to normal hard disk drives; in fact, they include a normal hard disk drive which is mounted on a disk enclosure. For the same reason, high capacity external hard disk drives (which weigh more) were for a time less common, although external hard disk drives with more than 500 GB to 1 Terrabyte of storage capacity are now commonly manufactured.

Although external hard disk drives are intended to be portable, the data cannot be secured on them due to their insufficient shock protection especially compared to digital portable media storage devices such flash memories and memory cards. Nonetheless, external hard disk drives cost less than memory cards or flash memories of the same storage, and are the only portable media storage options available in the size of hundreds of gigabytes.

Application use

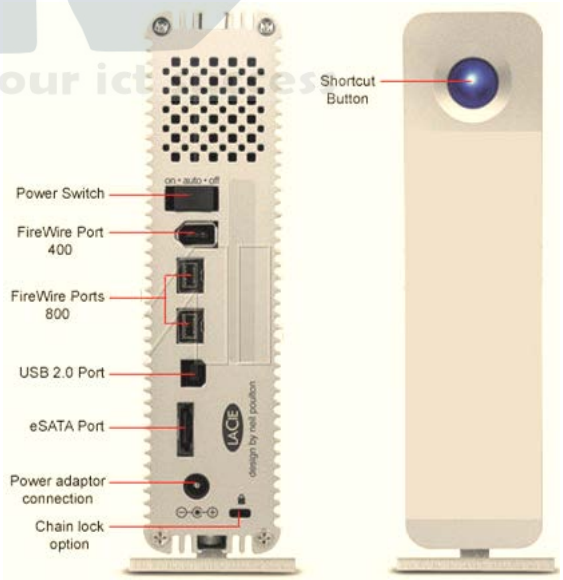
- Used to store very large files which need transporting from one computer to another and price is not an issue.
- More expensive than other forms of removable media.
- **Its type of access is direct / random.**

Advantages

- Holds large amounts of data, which can be read and written to.
- More reliable than floppy disks.
- Can access data very quickly.
- Data can be read from any part of the disk.

Disadvantages

- Data loss can occur if dropped.
- Slows down when too much data is stored on it.



CD ROMs

CD-ROM (an abbreviation of "Compact Disc read-only memory") is a Compact Disc that contains data accessible by a computer. CD-ROMs are popularly used to distribute computer software, including games and multimedia applications, though any data can be stored (up to the capacity limit of a disc). Some CDs hold both computer data and audio with the latter capable of being played on a CD player, whilst data (such as software or digital video) is only usable on a computer (such as PC CD-ROMs). These are called Enhanced CDs. **All Optical storage has a type of access of direct/random**

CD-Rs

COMPACT disc Recordable

A CD-R (Compact Disc-Recordable) is a variation of the Compact Disc invented by Philips and Sony. CD-R is a Write Once Read Many (WORM) optical medium (though the whole disk does not have to be entirely written in the same session).

Application use

Applications which require a single copying (burning) of data, e.g. CDs - recording of audio downloads from the Internet, recording of audio from MP3 format, recording of data for archiving or backup purposes. DVDs – recording of documentary film movies and television programs.

Advantages

- Can be carried around easily and without damage (once in a case/sleeve).
- CD's can store a lot of personal data, software, films and audio files.
- CD ROM drives come as standard in computers.
- Can read the data faster than from a floppy drive and even the internet.

Disadvantages

- Once the data is written it can't be erased.
- It is expensive if bought as an external drive.
- The media can be unreadable if scratched.

CD-RWs

COMPACT disc ReWritable

Compact Disc Rewritable (CD-RW) is a rewritable optical disc format. Known as CD-Erasable (CD-E) during its development, CD-RW was introduced in 1997. While a prerecorded compact disc has its information permanently written onto its polycarbonate surface, a CD-RW disc contains a phase-change alloy recording layer composed of a phase change material.

Application use

- Applications which require the updating of information and ability to record over old data.
- Not suitable for music recording but is very useful for keeping generations of files.

Advantages

- You can write data on it and then erase it.

Disadvantages

- The drive and media are usually more expensive than standard CD's/DVD's.
- DVD-RWs have between five and ten times the capacity of CDs.
- Takes longer time to write the data to disc.

DVD ROMs

DVD (or "Digital Versatile Disc" or "Digital Video Disc") is a popular optical disc storage media format. Its main uses are video and data storage. Most DVs are of the same dimensions as compact discs (CDs) but store more than six times as much data.

Application use

- Applications which require the prevention of deletion of data, accidental or otherwise.
- CDs used by software companies for distributing software programs and data; by Music companies for distributing music albums and

DVD-Rs

DVD-R is a DVD recordable format. A DVD-R typically has a storage capacity of 4.71 GB. There is also a 8.54 GB dual layer version, DVD-R DL. Data on a DVD-R cannot be changed, whereas a DVD-RW (DVD-rewritable) can be rewritten multiple (1000+) times. DVD-R(W) is one of three competing industry standard DVD recordable formats; the others are DVD+R(W) and DVD-RAM **(see page 8)**.

Application use

- Applications which require a single copying (burning) of data, e.g. backup purposes and DVDs recording of film movies and television programs, used by film distributors.
- Used by book publishers for distributing encyclopaedias with audio and video, reference books etc.

Advantages

- Can be carried around easily and without damage once in a case or sleeve.
- DVD's can store a lot of personal data, software, films and audio files.
- Can read the data faster than from a floppy drive and the internet.

Disadvantages

- Once the data is written it can't be erased.
- It is expensive if bought as an external drive.
- The media can be unreadable if scratched.

DVD-RWs

DVD+RW is the name of a standard for optical discs: one of several types of DVD, which hold up to about 4.7 GB per disc and are used for storing films, music or other data. DVD+RW supports random write access, which means that data can be added and removed without erasing the whole disc and starting over (up to about 1000 times).

Application use of DVD-RW's

- Applications which require the updating of information and ability to record over old data.
- Not suitable for music recording but is very useful for keeping generations of files. DVDs have between five and ten times the capacity of CDs.

Advantages of DVD-RW's

- You can write data on it and then erase it like a hard disc.
- Good for short-term backup.

Disadvantages of DVD-RW's

- The drive and media are usually more expensive than standard DVD's.
- Takes longer time to write the data to disc.

Comparison with hard disk drives

Advantages of solid state media

- Faster start-up time – as no spin-up is required. (RAM & Pen drives)
- Typically fast random access for reading – as there is no read/write head to move. (RAM & Pen drives)
- No noise: a lack of moving parts makes SSDs completely silent, unless, as in the case of some high-end and high-capacity models, they have cooling fans attached. (RAM & Pen drives)
- For low-capacity flash SSDs, it has low power consumption and heat production when in active use - although high-end SSDs and DRAM-based SSDs may have significantly higher power requirements. (Pen drives)
- High mechanical reliability – the lack of moving parts almost eliminates the risk of mechanical failure. (RAM & Pen drives)
- Ability to endure extreme shock, high altitude, vibration and extremes of temperature: once again because there are no moving parts. This makes SSDs useful for laptops, mobile computers, and devices that operate in extreme conditions. (Pen drives)
- For low-capacity SSDs, lower weight and size: although size and weight per unit storage are still better for traditional hard drives and microdrives allow up to 20 GB storage in a CompactFlash form-factor.

Disadvantages of solid state media

- Price – as of mid-2008, flash memory prices are still considerably more costly per gigabyte than are comparable conventional hard drives.
- Capacity – although currently far lower than that of conventional hard drives, SSD capacity is predicted to increase rapidly, with experimental drives of up to 1 TeraByte in test.
- Lower storage density – hard disks can store more data per unit volume than DRAM or Pen drive SSDs, except for very low capacity/small devices.

Backups

Now it is important to be able to define the term backup and describe the need for taking backups.

In information technology, a backup file is a copy of a file or set of files which is being kept in case anything happens to the original file. Backups are useful primarily for two purposes. The first is to restore a state following a disaster (called disaster recovery). The second is to restore small numbers of files after they have been accidentally deleted or corrupted.

Advice

- The more important the data that is stored on the pc the greater the need is for backing up this data.
- A backup is only as useful as its associated restore strategy.
- Storing the copy near the original is unwise, since many disasters such as fire, flood and electrical surges are likely to cause damage to the backup at the same time.
- Automated backup and scheduling should be considered, as manual backups can be affected by human error.
- Store backup data in a physically separate location.