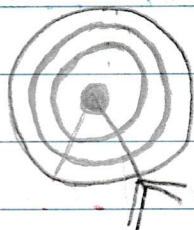


Chapter Three $\Rightarrow$ Storage devices & Media

Objectives:



- * storage devices :- Magnetic (HDD & Magnetic Tape drive), Optical (CD, DVD & Blu-ray), solid state (SSD, pen drive & Flash drive)
- * storage media :- Magnetic (disks & tapes), optical (CD, DVD & Blu-ray), Solidstate (SD, XD & CFast)

The main memories in a computer are RAM & ROM, but to permanently store large amounts of data, it is necessary to use Backing Storage

→ can either be fixed (internal such as HDD/SSD) or removable

Internal Memory	Backing Storage
• RAM contents are lost when the power is off & ROM are readable only • Smaller memories than backing storage • Data access time is extremely fast • Much more expensive per byte • Are fixed inside the computer • Can be read directly by the CPU	• Hold their contents permanently even when powered down • Have larger capacity to store data • Have much slower data access time • Much cheaper per byte • Can either be fixed or removable • Before data can be read by the CPU, it must first be moved into RAM.

1 Magnetic Media & Magnetic Storage Devices

→ **Magnetic tape drives**:- is a very thin strip of plastic which is coated in a magnetic layer. They are read from or written to by a read/write head in a magnetic tape storage device. Data is read from the tape using **serial access**.

Uses ⇒ in applications where batch processing is used. Used as a backup media where vast amounts of data need to be stored. Used in long-term archiving of data.

Advantages ⇒ Less expensive than the hard disk drive. Very robust technology. Have a huge data storage capacity & the data transfer rate is actually fast.

Disadvantages ⇒ Very slow data access times because they use serial access. When updating, another tape is needed to store the final updated version - this requires a master & transaction tapes. They are affected by magnetic fields.

→ **Hard Disk Drives (HDD)**:- Data is stored in a digital format on the magnetic surfaces of the hard disks and have more than one platter surfaces depending on its capacity.

A number of read/write heads can access all of the platter surfaces in the disk drive. Read/write heads can move from the centre of the disk to the edge (50 times a second).

Data on HDD can be read using **direct access**.

Uses $\Rightarrow$ To store the operating system, software systems & working data/files. Storing applications software. Used in real-time systems and in online systems. Used in file servers for computer networks.

Advantages $\Rightarrow$ They have a very fast data transfer rate & fast access times to data. They have very large memory capacities.

Disadvantages $\Rightarrow$ They can be easily damaged. They have many moving parts which can affect their reliability. Their read/write operation can be quite noisy.

$\rightarrow$ **Portable Hard Disk Drives:** external drives to the computer and can be connected to the computer using one of the USB ports.

Uses $\Rightarrow$ They can be used as backup systems to prevent loss of data. They can be used to transfer data/files/software between computers.

Advantages $\Rightarrow$ The data access time & data transfer rate are very fast. They have a large memory capacity. They can be used as a method of transferring information between computers.

Disadvantages $\Rightarrow$ They can be easily damaged if the user drops it or doesn't correctly shut down the drive after use. Data transfer rate is not as fast as for fixed hard drives.

2 Optical Media & Optical Storage Devices

→ **CD/DVD optical disks**: are read from or written to by optical storage devices. Optical storage devices can be built in to a computer or connected via a USB cable. They rely on the optical properties of laser light which is used to read data & to write data on the surface of the disk.

CDs and DVDs can be **R** (write once only) **RW** (written to or read from many times) **ROM** (Read Only)

CD-R and DVD-R

Uses	Advantages	Disadvantages
• Home recordings of music & films • Used to store data to be kept for later use or to be transferred to another computer.	• Cheaper medium than RW disks • Once burned, they behave like a ROM	• Can only be recorded once • Not all CD/DVD players can read them

CD-RW and DVD-RW

Uses	Advantages	Disadvantages
• Used to record TV programmes • Used in CCTV systems • Can be used as backup device for files & data	• Can be written over many times • Use different file formats • Not as wasteful as R format	• Can be expensive medium • Possible to accidentally overwrite data

CD-ROM and DVD-ROM

Uses	Advantages	Disadvantages
• They are read only memory, they cannot be written over • Used to store music files & to store software, computer games • Used to store films as they have large storage • Used in applications where there is need to prevent the deletion or overwriting of data	• They are less expensive than hard disk drive systems	• The data transfer rate / data access time is slower than for hard disks.

→ **Blu-ray discs** : they are different to DVDs in their construction and in the way they carry out read/write operations.

The main differences between DVD & Blu-ray are:-

- A blue laser is used to carry out read & write operations
- Using blue laser light means that the pits & lands can be much smaller
- Come with a secure encryption system which helps to prevent piracy & copyright-infringement
- The data transfer rate for a DVD is 10 Mbps and for a Blu-ray disc it is 36 Mbps

Comparison of the capacity & interactivity of DVDs & Blu-rays

- * A standard single-layer DVD has a storage capacity of 4.7 GB
- * A single-layer Blu-ray disc has a storage capacity of 27 GB
- * A dual-layer Blu-ray disc has a storage capacity of 50 GB
- * Blu-ray devices allow greater interactivity than DVD devices:
 - record high definition TV programmes
 - skip quickly to any part of the disc
 - create playlists
 - edit or re-order programmes recorded
 - automatically search for empty space to avoid over-recording
 - access websites & download subtitles & other features

Uses	Advantages	Disadvantages
• Home video consoles	• Very large storage capacity	• Expensive discs
• Storing & playing back movies	• Very fast data transfer rate	• Encryption problems when used to store video
• Computers can use this technology for data storage or backing up hard drives	• Data access speed is also greater	• HD DVD players have reduced the advantages of Blu-ray
• Camcorders can use this media to store movies	• Automatically come with a secure encryption system.	

[3] Solid-state Media & Solid-state Storage Devices

→ **Solid-state drives:** they use solid-state media and can be used in the same way as HDD. They have enabled laptop computers to become thinner & much lighter. Smartphones & Tablets without solid-state would not exist.

Advantages ⇒

- No moving parts (they are more reliable)
- They are lighter
- They don't have to 'get-up-to-speed' before they work.
- They run much cooler than HDDs
- No moving parts so they are very thin
- SSD data access time is only 0.1 milliseconds (HDD 10 milliseconds)
- Data transfer speed for SSDs is much faster than for HDDs

Disadvantages ⇒ The main drawback is the longevity of the technology. Most solid-state storage devices are rated at only 20GB write operations per day over a three-year period, for this reason they are still not used in all servers.

→ **Pen Drives:** are small portable devices that make use of solid-state technology. They connect to the computer through a USB port.

Note ⇒ The terms pen drive (memory stick) and Flash drive are incorrectly used to mean the same thing. Pen drive is a Flash drive with a USB connector, Flash drives can be used inside many devices to carry out a number of different tasks.

Uses	Advantages	Disadvantages
• Transporting files between computers	• Very compact and portable media	• Cannot make the files or data read-only
• Using them as a backing store	• Very robust	• Easy to lose
• Used as a security device to prevent software piracy	• Does not need additional software to work	• The user needs to be very careful when removing a memory stick
	• Not affected by magnetic fields	

→ Memory Cards: They can be inserted into a device which can read the card or allow data to be written to the card. They come in various sizes. There are many formats such as:

• SD cards (secure digital card) ⇒ very small card with a very high capacity, used in portable devices such as video recorders, digital cameras, audio players, smartphones & tablets

• XD cards (extreme digital card) ⇒ removable memory card designed for use in digital cameras. They can be written to or read from.

• CFast card (compact fast card) ⇒ allow solid-state technology to be used in a very small portable device. It has no moving mechanical parts and does not need a battery to retain data.

Uses ⇒

- Storing photos on digital cameras
- Used as mobile phone memory cards
- Used in MP3 players to store music files
- Used as a backing store in hand-held devices

Advantages ⇒

- Very compact - can be easily removed & used in another device
- They are very durable because they are solid-state memories
- They can hold large amounts of data
- Digital devices are able to read & write to memory cards

Disadvantages ⇒

- Expensive per gigabyte when compared to HDD
 - Have a lower storage capacity than hard disks
 - Have a finite life (number of read from or written to times)
 - More likely to be lost, stolen or damaged (specifically micro SD)
 - Not all computers come with memory card readers built in
- N -- N -- N --