3.1 Storage devices and media

- Identify storage devices, their associated media and their uses, e.g.
    - Magnetic backing storage media: fixed hard disks and drives, portable and removable hard disks, portable and removable hard drives, magnetic tape drives and magnetic tapes, memory cards
    - Optical backing storage media (CD/DVD/Blu-ray): CD ROM/DVD ROM, CD R/DVD R, CD RW/DVD RW, DVD RAM, Blu-ray discs
    - Solid state backing storage: solid state drives, flash drives (pen drive/memory stick/USB stick)

- Describe the advantages and disadvantages of the above devices

3.1 Storage devices and media

What is Storage

- **Secondary Storage** devices ensures data is stored **permanently** so that it can be used **again at a later date**.

- **Storage medium** is the name given to the device that actually **holds the data**.

- Sometimes the **storage medium** is **fixed** i.e. magnetic coated disks build into hard drive.

- Sometimes the **storage medium** is **removable** from the device i.e. CD ROM that can be taken out of the drive.

Think about what we store:
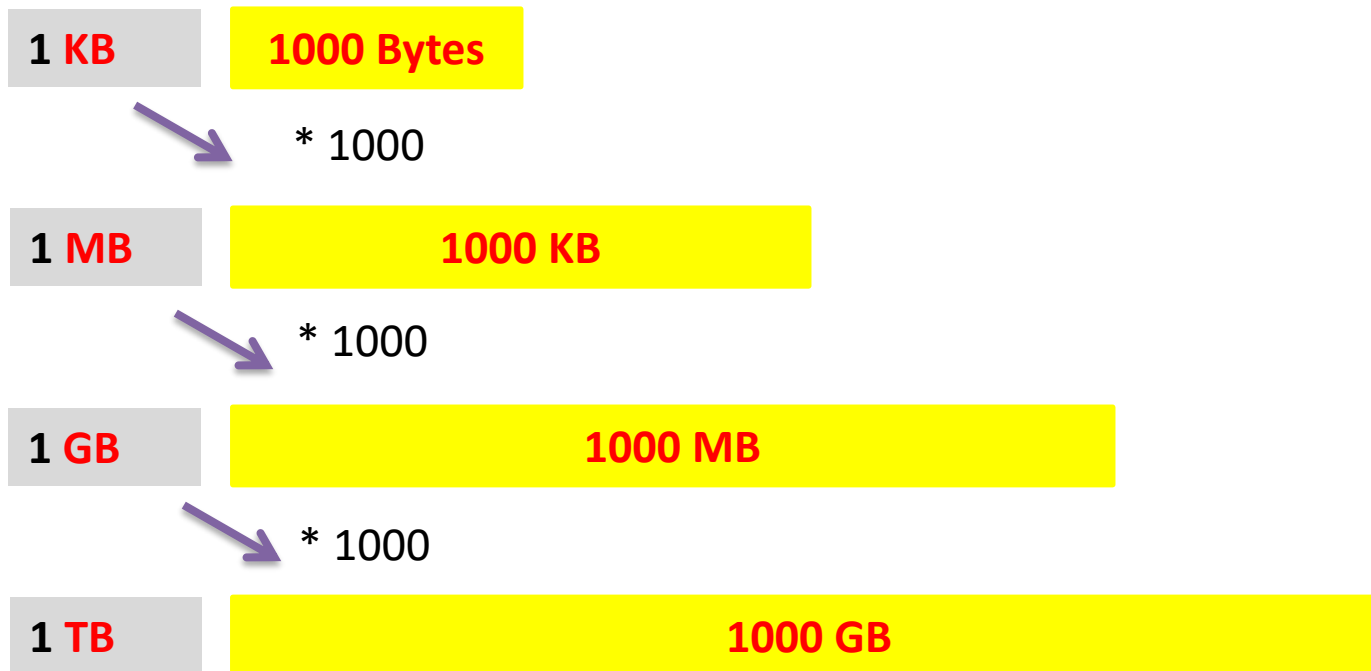**Documents, Images, Video, Music, Software, Games etc.**
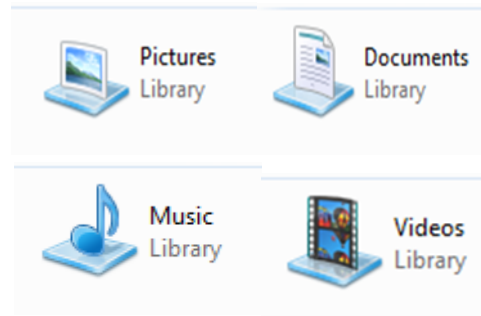
3.1 Storage devices and media

File Sizes

Storage devices or files sizes are measured in:

Kilobytes (KB), Megabytes (MB), Gigabytes (GB) and Terabytes (TB)

| 1 KB | 1000 Bytes |

* 1000

| 1 MB | 1000 KB |

* 1000

| 1 GB | 1000 MB |

* 1000

| 1 TB | 1000 GB |

Diagram not to scale

3.1 Storage devices and media

Data Storage Capacity

Floppy Disk
1.4MB

CD-ROM
700MB

DVD
4.7GB

Data storage devices have very different capacities. Over time the capacity has increased which has allowed for more data to be stored:

Blu-Ray
25 GB – 128GB

Increase in storage capacity

Hard Drive
8 TB

Magnetic Tape
Up to 185 TB
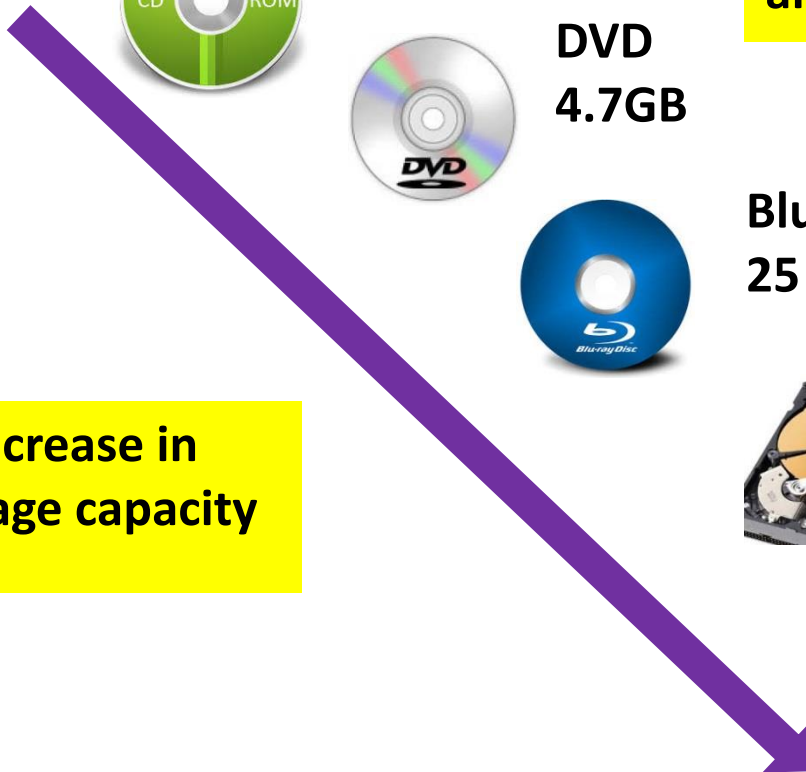
3.1 Storage devices and media
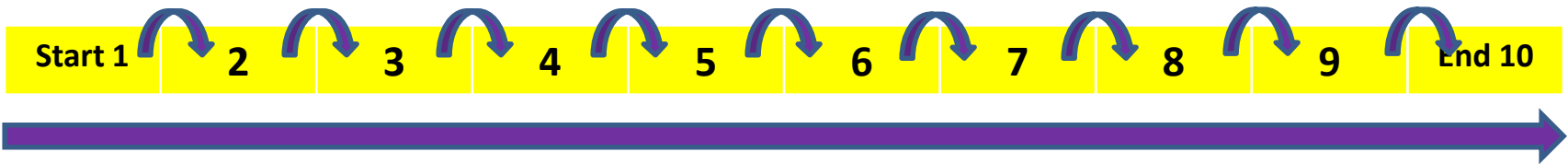
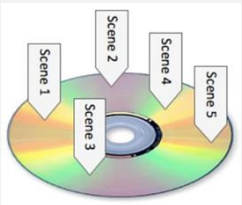**Chapter 3: Storage devices and media**

Type of Access

Serial (sequential Access)

- Files are stored **one by one** in a sequence
- Must search through the files one by one until you get to the one you want.
- **Example: VHS tape, Cassette Tape, Magnetic Tape**

Start 1 → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 9 → End 10

Direct (Random Access)

- Stores files so that they can **instantly** be accessed
- No need to search through files to get to the one you want
- **Example: DVD, CD ROM, Blu-ray, external hard drive, flash drive**

Start 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | End 10

3.1 Storage devices and media

Main Memory Vs Backing Storage

Main Memory

- Sometimes known as **Internal Memory** or **primary memory.**
- Includes **RAM** and **ROM**
- Usually used to **store data temporarily** (in the case of RAM).
- Usually used to store data while it is **being processed by the CPU**.
- Is **volatile** – means data will be **lost** if computer is turned of.

Backing Storage

- **Backing storage** some known as **secondary storage**.
- Name for all other **storage devices** which are part of a computer like hard drive.
- Usually used to **store data over a long time.**
- Usually used to store application software, operating system software, files etc.
- Is **Non-volatile** - Means data will **not be lost** of computer is turned off.

3.1 Storage devices and media

Fixed Internal Hard Drive

Magnetic Storage Devices

Use:	Main backing storage device used by all computers to store:
	• Operating Systems & System Files
	• Applications
	• Files (Documents, Images, videos, audio etc.)

Access Type: Direct (Random Access)

Advantages:	Disadvantages
• Less likely to break as fixed. • High storage capacities compared to external drives. • Fast data transfer rate.	• More moving parts compared to solid state drives. • Incorrect shut down procedure could cause hard drive to malfunction.

- **Magnetic storage media devices store data in the form of tiny magnetised dots.**

- **These dots are created, read and erased using magnetic fields created by very tiny electromagnets.**

3.1 Storage devices and media

Magnetic Storage Devices

Portable Hard Drive

Use:	This device connects to the computer using the USB Port. External Hard drives are used to store: • Personal backup data. • Transfer files between computers/devices

Access Type: Direct (Random Access)

Advantages:	Disadvantages
• Portable – transfer files between computers. • High Storage capacity compared to optical disks.	• More prone to errors than fixed hard drive. • Could be damaged if incorrectly ejected from computer.

• **Magnetic storage media devices store data in the form of tiny magnetised dots.**

• **These dots are created, read and erased using magnetic fields created by very tiny electromagnets.**

3.1 Storage devices and media

Magnetic Tapes

Magnetic Storage Devices

Use:
- **Large organisations make daily backups of their networks on to Magnetic Tapes**

- **Long-term archiving of data.**

Access Type: Serial	
Advantages:	**Disadvantages**
• Huge storage capacity compared to fixed and portable hard drives. • Stored away in a fire proof safe. • Robust – last for long time	• Slower Access **Tape reader has to start at the beginning of the tape** and continue **fast forwarding** until it gets to the piece of data that needed.

- **Magnetic storage media devices store data in the form of tiny magnetised dots.**

- **These dots are created, read and erased using magnetic fields created by very tiny electromagnets.**

3.1 Storage devices and media

CD-ROM

Optical Media

Use:	CD-ROM disks are read-only. CD-ROMs are normally used to store:
	• Audio CDs
	• Software Applications
	• Device Drivers

Access Type: Direct

Advantages:	Disadvantages
• Hold more data than floppy disks. • Cheaper than hard drives and USBs. • Compatible with audio systems.	• Data transfer rate is slower compared to other storage medium. • Not Robust - easily be damaged or scratched.

- **Optical storage devices save data as patterns or dots.**

- **Data is read by bouncing the laser beam off the surface off the medium.**

DVD-Rom

3.1 Storage devices and media

Optical Media

Use:	DVD-ROMs disks are read-only. DVD-ROMs are normally used to store: • DVD Movies • Software Applications • Computer Games

Access Type: Direct

Advantages:	Disadvantages
• Hold more data than CD-ROMS. 　• Can store larger applications. 　• Videos is higher resolutions.	• Data transfer rate is slower compared to other storage medium. • Have to buy a separate DVD player.

- **Optical storage devices save data as patterns or dots.**

- **Data is read by bouncing the laser beam off the surface off the medium.**

3.1 Storage devices and media

Blu-Ray

Optical Media

Use: **Blu-Ray disks uses a blue laser instead of red laser used with CD/DVD ROMs. Blu-Ray disks are normally used to stored:**
- HD Movies
- Large Software/Game Applications
- In camcorders in cartridge form.

Access Type: Direct

Advantages:	Disadvantages
- Large storage capacity used to store HD video content. - Access Speeds are greater than other optical medium. - Secure Encryption System to minimise chance of copyright.	- More expensive compared to other optical media. - Separate player required – more expensive. - Not all movie titles available on Blu-Ray.

- **Optical storage devices save data as patterns or dots.**

- **Data is read by bouncing the laser beam off the surface off the medium.**

3.1 Storage devices and media

Optical Media

R – Write once only
RW – Can be written to or read many times.

	CD-R and DVD-R	CD-RW and DVD-RW	DVD RAM
Overview	CD-R and DVD-R are only **recordable once**. Once the process has been **finalised** then the disks become **Read Only**. • Backup of data • Audio CDS	CD-RW and DVD-RW allows for data to be written, erased and rewritten **many times**. • Used in CCTV • Record television programs	DVD RAMS are used when data **constantly needs to be re-written**. DVD RAMS can hold up to 10GB of data and commonly used in recording equipment.
Advantages	• Cheaper than RW disks.	• Can be reused many times.	Long life, large capacity, and can be rewritten many times.
Disadvantages	• Not compatible with all players. • If disk has a burn error it can not be used again.	• Can be expensive. • Data could be overwritten.	Not compatible with all playback formats. Can be expensive.

3.1 Storage devices and media

Solid 'state'

- **Solid-state storage devices are based on electronic circuits with no moving parts.**
- **Solid-state storage devices store data using a special type of memory called flash memory.**
- **USB/Memory Cards use Direct Access**

Examples	USB Memory Stick	Memory Card
Uses:	Used to transfer files/backup (work) between computers.	Used to store files on digital cameras, mobile phones and mp3 players.
Advantages	• Portable & Small • Robust • large capacities • No need for additional drivers/software	• Very small and can be removed and placed in other devices. • Robust
Disadvantages	• Easy to loose • USB could be damaged if not ejected correctly.	• Smaller storage capacities. • Quite expensive.

3.1 Storage devices and media

Backup

Backup means making one or more copies of your data in a different storage medium.

Why?

- You could **delete** a file by accident
- Your computer could **break down**
- Your computer could get infected by a virus which could **edit data**
- Your laptop is stolen or becomes damaged.
- Data could be **corrupted** by hackers.

- **Most businesses use computers to store very important data (customer records, financial information, designs for products, etc.)**

- **If this data is lost, then this would cause disruption to the business. Backing-up business data is essential.**

3.1 Storage devices and media

How are Backups created

Personal Backups:

- Burning files to a **CD-R**
- Copying files to an **external hard-drive**
- Copying files to a **USB**
- Copying the files to **another computer** on a network

Business Backups:

- Making copies of data **very regularly (daily).**
- Using large-capacity media such as **magnetic tape**
- Keeping **old copies** of backups, just in case.
- **Automating** the system so that nobody forgets to do it!
- Keeping backup media **off-site** (in case of fire or theft)