

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

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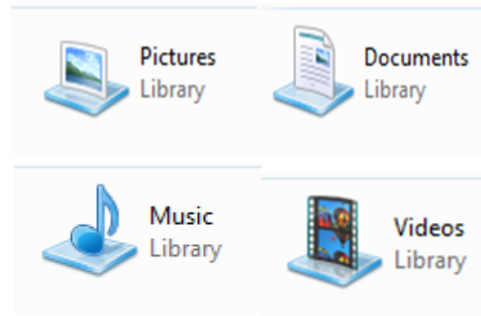
3.1 Storage devices and media

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.
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- 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.



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File Sizes

Storage devices or files sizes are measured in:
Kilobytes (KB), **Megabytes (MB)**, **Gigabytes (GB)** and **Terabytes (TB)**

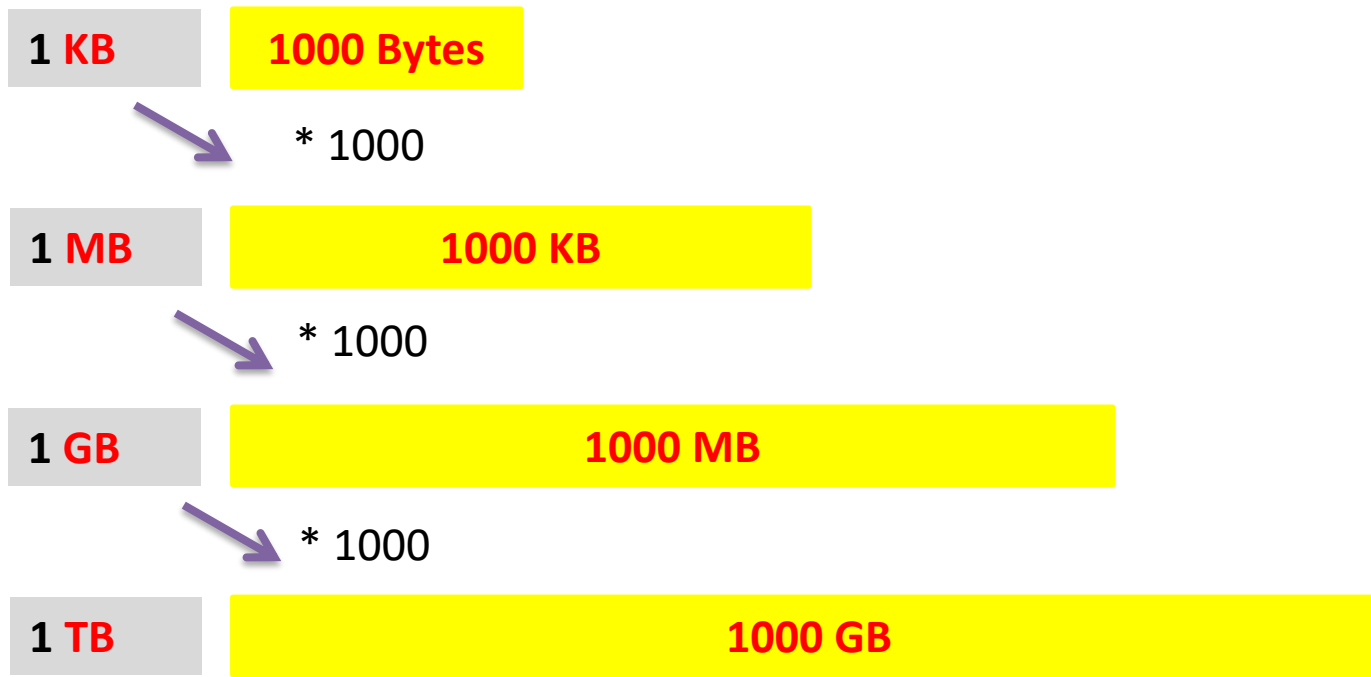


Diagram not to scale

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Data Storage Capacity



Floppy Disk
1.4MB



CD-ROM
700MB



DVD
4.7GB



Blu-Ray
25 GB – 128GB



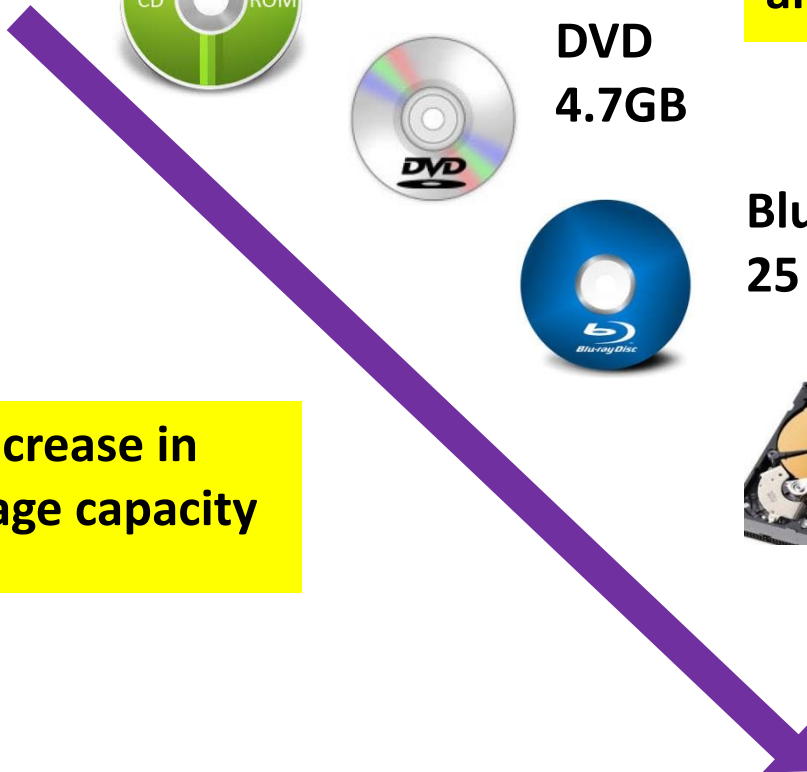
Hard Drive
8 TB



Magnetic Tape
Up to 185 TB

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

Increase in storage capacity



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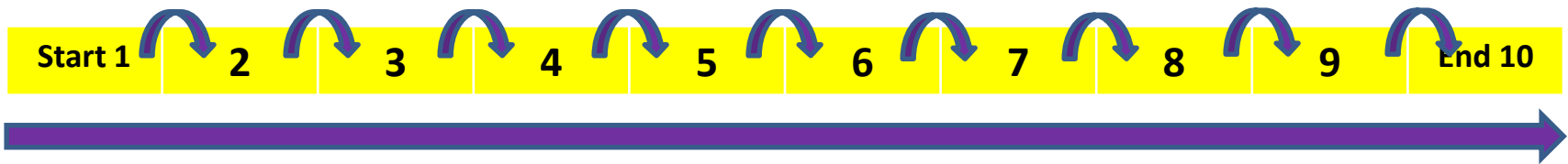
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Type of Access

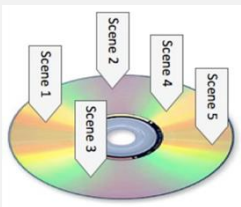
Serial (sequential Access)



- 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**



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**



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 off.

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** if computer is turned off.

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
<ul style="list-style-type: none">• Less likely to break as fixed.• High storage capacities compared to external drives.• Fast data transfer rate.	<ul style="list-style-type: none">• More moving parts compared to solid state drives.• Incorrect shut down procedure could cause hard drive to malfunction.

Fixed Internal Hard Drive



- 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.

Magnetic Storage Devices

- 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
<ul style="list-style-type: none">• Portable – transfer files between computers.• High Storage capacity compared to optical disks.	<ul style="list-style-type: none">• More prone to errors than fixed hard drive.• Could be damaged if incorrectly ejected from computer.

Portable Hard Drive



- 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.

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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:**

- Huge storage capacity compared to fixed and portable hard drives.
- Stored away in a fire proof safe.
- Robust – last for long time

Disadvantages

- 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 Tapes



- 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

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:

- Hold more data than floppy disks.
- Cheaper than hard drives and USBs.
- Compatible with audio systems.

Disadvantages

- Data transfer rate is slower compared to other storage medium.
- Not Robust - easily be damaged or scratched.

CD-ROM



- Optical storage devices save data as **patterns or dots**.
- Data is read by **bouncing the laser beam off the surface** of the medium.

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
<ul style="list-style-type: none">• Hold more data than CD-ROMS.<ul style="list-style-type: none">• Can store larger applications.• Videos is higher resolutions.	<ul style="list-style-type: none">• Data transfer rate is slower compared to other storage medium.• Have to buy a separate DVD player.

DVD-Rom



- Optical storage devices save data as **patterns or dots**.
- Data is read by **bouncing the laser beam off the surface** of the medium.

Optical Media

Use: Blu-Ray disks use a blue laser instead of the red laser used with CD/DVD ROMs. Blu-Ray disks are normally used to store:

- HD Movies
- Large Software/Game Applications
- In camcorders in cartridge form.

Access Type: Direct

Advantages:	Disadvantages
<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• More expensive compared to other optical media.• Separate player required – more expensive.• Not all movie titles available on Blu-Ray.

Blu-Ray



- Optical storage devices save data as **patterns or dots**.
- Data is read by **bouncing the laser beam off the surface of the medium**.


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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 . <ul style="list-style-type: none">• Backup of data• Audio CDS	CD-RW and DVD-RW allows for data to be written, erased and rewritten many times . <ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Cheaper than RW disks.	<ul style="list-style-type: none">• Can be reused many times.	Long life, large capacity, and can be rewritten many times.
Disadvantages	<ul style="list-style-type: none">• Not compatible with all players.• If disk has a burn error it can not be used again.	<ul style="list-style-type: none">• Can be expensive.• Data could be overwritten.	Not compatible with all playback formats. Can be expensive.



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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	<ul style="list-style-type: none">• Portable & Small• Robust• large capacities• No need for additional drivers/software	<ul style="list-style-type: none">• Very small and can be removed and placed in other devices.• Robust
Disadvantages	<ul style="list-style-type: none">• Easy to loose• USB could be damaged if not ejected correctly.	<ul style="list-style-type: none">• 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)

