

**Collins**

**Cambridge IGCSE™**

**ICT**

**STUDENT'S BOOK**

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Paul Clowrey

# 3 Storage devices and media

## Why this unit matters

Every year we save more and more information on computer systems and the need for data storage capacity keeps increasing. Data files, records, pictures, music, films, games and applications all require storage space. A few years ago, we only kept a few files on our computers, but we are now using computers at home, work and school.

*I use a high-resolution digital SLR camera for still images and a dedicated high definition video camera for video. Both of these devices capture imagery at very high resolution, providing lots of detail but creating very large computer files. I need high capacity memory cards and computer drives to store and access my work. (Professional digital photographer)*



*From high resolution X-rays to patient records and training documents, lots of information is now stored on computers, making information easier to access from anywhere in the hospital. This information must be electronically secure from unauthorized access and backed up. If any of the original computer information is lost, another copy must be made available quickly. (Hospital worker)*

*Customers are often unsure about how much storage they need and want advice on the best way to back up their files. The advice we give must be based on the needs of the user. For example, a young family with a computer full of photos, videos and games will need more storage capacity than an author writing a book using a word processor. (Computer store manager)*



## Your practical task

You work for a new international bank called Abacus. The business prides itself on using the latest technological advances and incorporating them into its high street branches all around the world. You are responsible for making sure that computer information is stored and backed up at each branch and for ensuring that all staff are kept up-to-date with the methods used. Banking information is highly confidential and the risks to security, should any data be lost, are taken very seriously. Employees must use storage and backup methods correctly, and training documents are regularly produced.

You have been asked to:

- produce a training document for staff involved with storing and backing up data; it explains the different devices, media and methods available
- create a simple spreadsheet and chart that compares the storage capacities of different devices
- create an additional leaflet explaining electronic banking methods to new employees.

# What this unit covers

## THEORY

### Sessions

- 3.1 Storage devices and media
- 3.2 The importance of data backup
- 3.3 Banking facilities today

### Theory review

## PRACTICAL

### Sessions

- 3.4 Document preparation
- 3.5 Adding text and images to a document
- 3.6 Creating a simple data model and chart
- 3.7 Final document checks and presentation

### Practical review

### By the end of this unit you will be able to:

- describe a variety of storage devices and media, together with common uses for each
- explain the advantages and disadvantages of different methods in terms of speed, access, use and cost
- understand the importance of regularly backing up data
- describe the various electronic methods and communication systems used in banking today.

### In your practical work, you will develop and apply skills in:

- communicating using document production skills
- document creation; combining text, images and graphical elements in your work
- creating and using a simple spreadsheet model
- saving, checking and printing your work
- using file compression to assist with storage and electronic transmission.

# SESSION 3.1 Storage devices and media

## Background

In this session, you will look at the many different storage devices and media used today, as well as their uses, capacities and differences.

### The difference between storage devices and media

A storage device is something that has the ability to read and write information to and from storage media, for example, a CD/DVD writer or tape drive. The components that store the information, such as CD/DVDs, hard disks and memory cards, are storage media.

### Storage technology

The technology used in modern storage devices and media comes in three varieties, each with its own characteristics.

- **Magnetic:** stores data in tiny magnetic dots on a disk or tape, organised to store binary data.
- **Optical:** uses a laser to read, and write, a binary dot pattern on a spinning disc.
- **Solid State:** uses non-volatile memory chips to store data electronically with no moving parts.

#### Activity 1

Write a list of all the things at home – not just computers – that you think can store electronic information. Compare and discuss your answers with a friend.

### Storage devices and media: their advantages and disadvantages

Description	Advantages	Disadvantages
 <p><b>Fixed magnetic hard disks:</b> found in most computers as the main storage device. Use complex magnetic components. <b>Storage device using direct access</b></p>	<ul style="list-style-type: none"> <li>● Their capacity is constantly increasing as prices are decreasing.</li> <li>● Fast access; data can be read from any part of the disk (this is known as random access).</li> </ul>	<ul style="list-style-type: none"> <li>● Due to their mechanical complexity, physical errors are extremely difficult to fix.</li> <li>● Limited life span; data should be transferred every few years.</li> <li>● Slightly slower to access than internal memory.</li> </ul>
 <p><b>Portable magnetic hard disk drives:</b> a portable version of the hard disk. Ideal for transferring data from one computer to another and also used to increase a system's storage capacity. Also known as a removable hard disk drive. <b>Storage device using direct access</b></p>	<ul style="list-style-type: none"> <li>● They can often be powered using the connecting USB cable.</li> <li>● Portable hard disk drives add extra storage capacity to a computer without having to open the computer casing.</li> </ul>	<ul style="list-style-type: none"> <li>● Similar to a larger hard disk; difficult to repair and a limited life span.</li> <li>● Slightly slower to access than internal memory.</li> <li>● Capacity is not as large as a standard hard disk.</li> </ul>
 <p><b>Magnetic tapes:</b> used most commonly for large scale data storage and backup. <b>Storage media using serial or sequential access</b></p>	<ul style="list-style-type: none"> <li>● A low cost way of storing hundreds of <b>gigabytes</b> of data.</li> <li>● Information can be set to back up overnight or outside of office hours.</li> <li>● Tapes are portable and can be stored safely.</li> </ul>	<ul style="list-style-type: none"> <li>● A special drive is required to read and write data to them.</li> <li>● Access is much slower than a normal hard drive. (Serial access, see page 112)</li> <li>● Not really practical for day-to-day storage and retrieval.</li> </ul>

Description	Advantages	Disadvantages
 <p><b>Optical CD/DVD:</b> optical disk, normally used in retail for music releases and films to be played on home entertainment systems.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Low cost due to mass production.</li> <li>• A world-wide standard; both CD and DVD players are widely available.</li> <li>• No moving parts and require no power supply.</li> <li>• Long lifespan if stored carefully.</li> </ul>	<ul style="list-style-type: none"> <li>• Scratches can make them unreadable.</li> <li>• Information is read-only.</li> </ul>
 <p><b>CD/DVD-ROM:</b> optical disk, used to store commercial computer software such as an encyclopaedia, game or installation disk.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Similar to that of CD/DVD disks.</li> <li>• Large software packages can be easily distributed.</li> </ul>	<ul style="list-style-type: none"> <li>• Similar to that of CD/DVD disks.</li> <li>• If damaged, software must usually be purchased again.</li> </ul>
 <p><b>CD/DVD-R (Media):</b> optical disk that can be written with data or media files once only. Used for backups and writing music CDs.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Low cost due to mass production.</li> <li>• Most computers have the ability to read and write disks.</li> <li>• A long lifespan; some manufacturers claiming at least 50 years.</li> <li>• Disks can be left open and added to until they are full.</li> </ul>	<ul style="list-style-type: none"> <li>• Similar to that of CD/DVD disks.</li> <li>• Errors can occur during writing, making the disk unusable.</li> <li>• Data cannot be erased.</li> </ul>
 <p><b>CD/DVD-RW:</b> optical disk that can be written with computer or media files, erased and used again.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Similar to that of CD/DVD-R disks.</li> <li>• Each part of the disk can be erased and rewritten hundreds of times.</li> </ul>	<ul style="list-style-type: none"> <li>• Lifespan is thought not to be as long as other optical disks.</li> <li>• Disks may stop working due to repetitive erasing and rewriting.</li> <li>• Not all disk players can play rewritable disks.</li> </ul>
 <p><b>DVD-RAM:</b> similar to a DVD-R but designed to be more robust, with quicker access.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Rewritable and protected from damage in a plastic case.</li> <li>• Designed and manufactured to a higher standard than standard CD/DVD-RW to last longer.</li> </ul>	<ul style="list-style-type: none"> <li>• More expensive than standard optical disks.</li> <li>• Less compatible with household players.</li> <li>• Slower to write than standard writable disks.</li> </ul>
 <p><b>Blu-ray:</b> a high-capacity optical disk used for high-definition movies, computer and console games, and data backup.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Able to store full-length high-definition films and modern computer and console games.</li> <li>• Up to 10 times the capacity of DVD disks.</li> <li>• Disks very difficult to copy, preventing piracy.</li> </ul>	<ul style="list-style-type: none"> <li>• Writable Blu-ray disks are expensive and require a Blu-ray compatible drive.</li> <li>• Commercial usage limited to entertainment media.</li> <li>• Blu-ray content more expensive than standard DVDs.</li> <li>• Already being replaced by Ultra HD Blu-ray.</li> </ul>

Description	Advantages	Disadvantages
 <p><b>Solid state memory:</b> uses microchips to store information with no moving parts; found in portable drives and memory cards.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Less susceptible to shock and damage.</li> <li>• Silent.</li> <li>• Faster read and write times than standard hard disks.</li> <li>• Used as a high-speed replacement for magnetic storage.</li> <li>• Ideal for portable devices.</li> </ul>	<ul style="list-style-type: none"> <li>• Practically impossible to repair if damaged.</li> <li>• Lower storage capabilities than hard disks.</li> <li>• Price per gigabyte of storage is higher than hard disks.</li> <li>• Vulnerable to electrical or magnetic interference.</li> </ul>
 <p><b>Pen drives:</b> extremely portable solid state memory storage devices; designed to plug into the widely used USB port.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Ideal for pocket and key-ring size devices.</li> <li>• USB sockets are found on the majority of computers.</li> <li>• Require no additional power.</li> </ul>	<ul style="list-style-type: none"> <li>• Similar to that of all solid state drives.</li> <li>• Can be easily misplaced or lost.</li> </ul>
 <p><b>Flash memory cards:</b> used to expand storage in smart devices, games consoles and digital still/video cameras.</p> <p><b>Storage media using direct access</b></p>	<ul style="list-style-type: none"> <li>• Thumbnail-sized cards becoming common place.</li> <li>• Cost-effective way of adding additional storage to devices with limited storage.</li> <li>• Common standards include SD, MicroSD, xD and CFast.</li> </ul>	<ul style="list-style-type: none"> <li>• Smaller micro-style cards are easy to lose.</li> <li>• Many different models, each with slightly different connectors.</li> </ul>

## Describing storage devices and media

Different devices access and use memory in different ways. The following terms may be referred to when describing storage devices and media.

**Main or internal memory:** Memory used by a computer system when processing or storing information. Random Access Memory (RAM) can be read and written to while using programs; the more RAM a system has, the faster it will run. Read Only Memory (ROM) holds permanent data that cannot be changed; it is normally used to store the essential program drivers (or firmware) needed to start your computer.

**Backing storage:** Any type of data storage device apart from RAM or ROM. This includes the hard disk drive found inside most PCs and normally used to store data permanently, even when the computer is turned off.

**Serial or sequential access:** Data is stored in a sequential sequence so that information stored can only be accessed by scanning through the data to that point. Tapes are an example of this type of storage.

**Direct/random access:** Any piece of information stored on a random access device can be accessed without having to scan through its whole contents. This is much faster than serial access.

**Connectivity:** Many computers may use an internal drive to read storage media, but external devices can also be connected by USB, USB-C, FireWire, Ethernet cables or by using Wi-Fi networking.

**Access speeds:** This is how quickly a user can access the information on any storage device. Access speeds are measured in 'bytes per second' (Bps) with slower devices measured in thousands (KBps) and faster devices using millions (MBps). A user's choice of device may depend on how quickly they need to access data. Individual device speeds vary but generally speaking the following is true:

- **Magnetic tape drives:** Slow to access as the drive has to fast-forward or rewind to the required section.
- **Optical storage:** A modern compact disk will have an access speed of about 8 MBps, DVD about 20 MBps and Blu-ray disks 18 MBps.

### Real world

The lifespan of any new technology is notoriously difficult to predict, as long-term tests are rarely done before it is put on sale. If a device has only been around for a few years, it is not certain how long it will work or keep the information that it stores. One thing that is agreed upon is that no one method should be relied upon as a permanent solution. A DVD-R can hold seven times the amount of data as a CD-R, and Blu-ray disks can store 10 times that of a DVD. Who knows what the next development will be?

- **Magnetic hard disk storage:** Modern drives can have access speeds of around 200 MBps.
- **Solid state based storage:** As there are no moving parts and flash based memory is much quicker to read and write, access speeds of over 500 MBps are possible.

## Storage capacity

The table below provides some typical capacities, but it should be noted that hard disks and solid state drives are constantly increasing in storage capacity.

Storage device or media	Typical capacities (at the time of publication)
CD*	700 megabytes (MB)
DVD*	4.7 or 8.54 gigabytes (GB) (single or dual layer)
DVD RAM*	4.7 or 9.4 GB (single or dual layer)
Blu-ray*	25 or 50 GB (single or dual layer)
Pen drive**	2–64 GB
Flash memory cards**	2–64 GB
Portable disk drive**	320 GB–4TB
Solid state drive**	500 GB–2 TB
Magnetic disk drive**	1–8 TB
Magnetic tape**	500 GB to 5 TB

\* Generally fixed manufacturing standards

\*\* These capacities are constantly being increased as manufacturing techniques develop.

### Real world

Every year we increase the amount of data we store; documents, photos, videos, games and music. This means file compression, using ZIP and RAR utilities is increasingly useful for storing and archiving files or reducing file sizes when emailing.

### Language

Pen drives are sometimes referred to as **USB** or memory sticks.

## File sizes

When matching usage to storage devices, it is important to consider approximate sizes for different types of files.

8 bits	1 byte	Word processed document	100 KB
1024 bytes	1 kilobyte (KB)	eBook	500 KB
1024 kilobytes	1 megabyte (MB)	Mp3 track	5 MB
1024 megabytes	1 gigabyte (GB)	Digital photo	3 MB
1024 gigabytes	1 terabyte (TB)	Film	1.2 GB

### Real world

There are many types of memory cards available today, and different manufacturers often create their own for a specific type of device. Look at the devices that you and your friends own, from cameras to mobile phones and portable gaming machines – how many different types of memory card do you use?

### Activity 2

- 1 Create a short survey and ask classmates or friends to estimate how many of each of the following types of files they own electronically:  
music tracks, **eBooks**, films, digital photos, office documents.
- 2 Combine your survey results with the approximate sizes above to estimate how much information the people you surveyed own. Which devices would be the most appropriate to store the data they own?