Specification & learning objectives
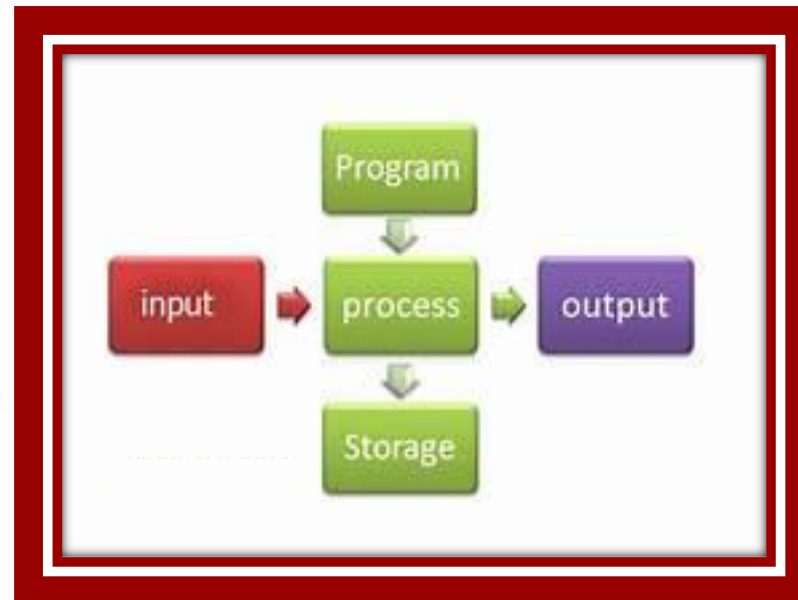
A Level	Specification point description
1.1.3a	How different input output and storage devices can be applied as a solution of different problems
1.1.3b	The uses of magnetic, flash and optical storage devices
1.1.3c	RAM and ROM
1.1.3d	Virtual storage

Resources

PG Online textbook page ref: 16-28

Hodder textbook page ref: 131-133

CraignDave videos for SLR 3

Key question: How are input, output and storage devices used in typical applications of Computer Science?

An input device is any device that allows you to enter information from the outside world into a computer system so that it can be processed and stored in a digital form. Examples include: webcams, microphones, keyboard & mouse and card readers.

An Output device is any device that is able to take data stored in a digital form and convert it into another form we humans can process such as sounds, images or vibrations. Examples include: speakers, motors, printers, monitors (VDUs) & CAM (such as 3D printers).

A Storage device is any computer hardware that allows temporary or permanent storage of data either internally or externally. Examples include: HDDs, SSDs, RAM, SD cards, USB flash drives, CDs

Key question: How do different storage devices compare in terms of cost, capacity and speed?

Magnetic

Magnetic storage devices use magnetic fields to store their data. Examples of magnetic storage devices include: tape, floppy disks and HDDs.

HDDs (Hard Disk Drives) use a stack of magnetised platters (made from aluminium/glass ceramic composite). A drive head moves a few nanometres above each one and this can detect or change magnetic field of the platter below it. The magnetic field strength of that region represents whether it's a 1 or a 0.
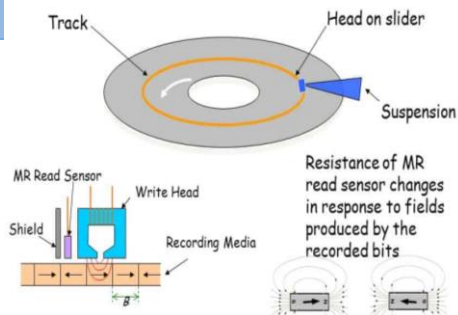
Optical

Optical storage devices use markers called pits and lands (depressed and raised areas) to store data which can be written and read using an optical laser. The computer reads the boundary between the pits and the lands as a 1 and the remaining spaces as 0. Examples of optical media are CDs, DVDs and Blu-Rays.
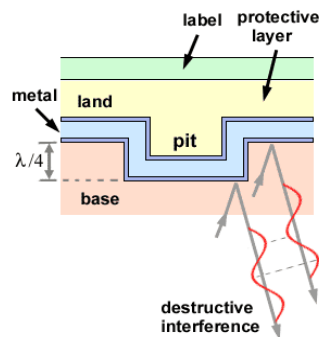
Solid State

Solid state storage devices use silicon microchips store their data (usually utilising an arrangement of floating gate transistors that resemble many NAND gates). Examples of solid state storage devices include SSDs in PCs, USB flash drives or SD cards. People often say that a SSDs limited number of writes makes them have a shorter lifespan than hard drives however this is often not true as due to a hard drive's moving parts it's subject to a lot more wear and tear than SSDs. The flash memory used is non-volatile and the data is stored in 'blocks and pages' within the microchips.

Key question: How do different storage devices compare in terms of cost, capacity and speed?

| **Magnetic**	**Optical**	**Solid state**
+ Cheap	+ Cheap	- Expensive
+ High capacity	- Limited to low capacities	+ Relatively high capacity.
- Slow access speeds	- Slow access speeds	+Very fast access speeds
- Fragile (moving parts)	+ Lightweight	-Limited number of writes
	+ Resistant	

Key question: What are the characteristics of ROM and RAM?

ROM - Read Only Memory	RAM - Random Access Memory
You cannot write to ROM, you can only read from it.	RAM allows you to both read and write data.
ROM is a type of non-volatile memory.	RAM is a type of volatile memory.
ROM chips are usually located on the motherboard or printed circuit board such as a graphics card. They are not removable as they are soldered into the motherboard. Therefore ROM is found in physically smaller packages than RAM which reside on memory sticks in a personal computer.	RAM chips are located in removable memory modules that are slotted into sockets on the motherboard. This means they can be easily removed and updated.
ROM is used to hold basic computer hardware settings and in the past it held the BIOS to boot up the computer.	RAM is used as main memory to hold both data and programs
There may be just a few megabytes of ROM in a computer.	There are usually gigabytes of RAM in a computer.

Key question: What are the benefits and drawbacks of virtual storage?

Virtual storage refers to any method of storing data over the internet or within a network or system where there is an abstraction between the logical storage the user sees and the actual physical storage. Examples include: RAID, network file servers and 'cloud' storage.

Virtual Storage — Users only see this

Virtual Storage Controller

Commodity storage devices
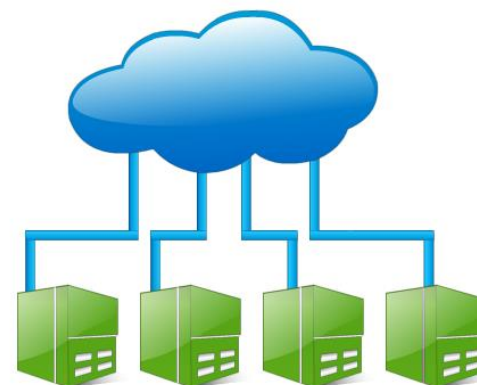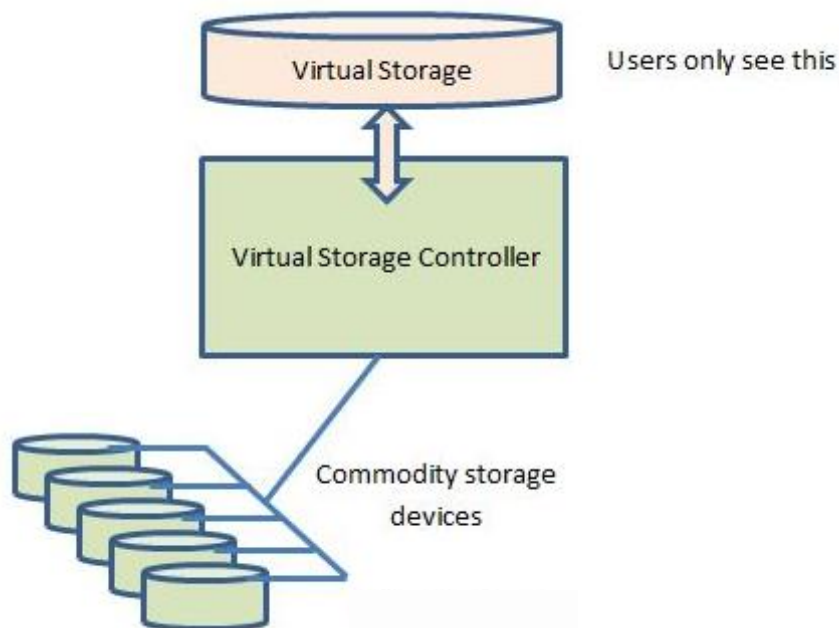
Advantages	Disadvantages
-Data stored in 'the cloud' can be accessed anywhere. -Price of cloud virtual storage is becoming cheaper with increasing competition.	-Cloud storage becomes expensive when storing large amounts of data. -Low access speeds or no access in areas with poor internet connections.

Typical exam questions

1. Two forms of primary memory are RAM and ROM. Explain the main differences between and uses of RAM and ROM. **[4]**

2. A supermarket checkout uses a variety of input, output and storage devices. State one device of each type which would typically be used, describe the purpose of the device and why you have chosen it. **[6]**

Input:

Output:

Storage:

3. Explain why a smartphone company might choose to use a solid-state storage device in its mobile devices over a magnetic storage device. **[2]**

Component 1 | 1.1.3 | Input, output and storage

Target: [ ]   Overall grade: [ ]

Minimum expectations & learning outcomes

☐	Terms 27-35 from your A Level Key Terminology should be included and formatted.
☐	You must include a clear comparison which shows the differences between RAM & ROM.
☐	You must illustrate an understanding of the differences between magnetic, flash and optical medium including their characteristics and typical situations where they are used.
☐	You must provide a clear explanation of how virtual storage works including its advantages and disadvantages.
☐	Answer the exam questions.

Feedback

Breadth	Depth	Presentation	Understanding
☐ All	☐ Analysed	☐ Excellent	☐ Excellent
☐ Most	☐ Explained	☐ Good	☐ Good
☐ Some	☐ Described	☐ Fair	☐ Fair
☐ Few	☐ Identified	☐ Poor	☐ Poor

Comment & action required

Reflection & Revision checklist

Confidence	Clarification
☹ ☺ ☺	Candidates need to have an understanding of a range of input, output and storage devices.
☹ ☺ ☺	Candidates do not need to understand how the input and output devices work, but must be able to recommend appropriate devices for specific situations and be able to justify choices made.
☹ ☺ ☺	Candidates need to understand that there are different types of storage device. They need to know about the characteristics of each type (magnetic, optical and flash) and understand the benefits and drawbacks of each, and be able to recommend an appropriate type of device for a given situation and justify the choice.
☹ ☺ ☺	Candidates need to understand the purpose of ROM and RAM within a computer system, their characteristics, and the role they play in the running of a range of different computers e.g. mobile devices, embedded systems etc.
☹ ☺ ☺	Candidates need to understand why there is a need for virtual storage, how virtual storage works and the benefits and drawbacks of using virtual storage. Virtual storage would be that which may appear to be local but is physically located elsewhere on the network/remotely/in the cloud.