1.1.3 Input, Output & Storage

Input & Output

Input devices send data or control signals to a computer, while output devices receive data from a computer and present or produce a result.

Examples of input and output methods/devices

Input	Output
Keyboard / Mouse	Monitor
Touchscreen / Buttons	Speaker
Microphone	LEDs
Camera	
Barcode Reader	

Magnetic, Flash, Optical and Other Storage

Hard Disk Drives (HDD)

A hard disk drive (HDD) uses one or more rapidly rotating magnetic disks, typically spinning at around 5,400 or 7,200 RPM, although some specialised drives operate at higher speeds.

The disks are coated with magnetic material that are polarised to represent 0s and 1s.

The disks are divided into tracks in concentric circles which are again divided into sectors. A read/write head moves across the disk as it rotates to read data from and write data to the disk.

Pros

- Large amounts of cheap storage compared to SSD.

Cons

- HDDs have moving parts prone to damage if dropped make them not fit for phones and tablets.
- Moving parts as make HDDs noisier.

Solid State Drives

A solid-state drive (SSD) stores data electronically using NAND flash memory. It has no moving parts and uses a controller to manage the storage of data.

Pros

- Much faster than an HDD.
- No moving parts, making it more resistant to physical damage.
- Quieter and generally uses less power than an HDD.

Cons

- More expensive the HDD for comparable amount of storage capacity.

Often contemporary PCs will use a mixture of HDD and SSD .

Optical Drives

Optical discs contain a spiral track made up of pits and lands. A laser detects changes between pits and lands as the disc rotates, allowing the stored binary data to be read.

The disks spin fast at speeds between 200 to 4000 RPM while a laser is used to read data from an optical disc. For recordable discs, a laser changes the properties of the recording layer to store data.

Pros

- Cheap

Cons

- Larger and less durable than flash drives
- Need optical disk drive to read

Flash Drives

Flash drives use flash memory to store data electronically and have no moving parts. They are highly portable and are commonly used to transfer files and back up data.

Pros

- Very small and portable
- Faster than optical disks
- Not moving parts

Cons

- Usually more expensive per gigabyte than HDDs.
- Can be lost or damaged because of their small size.

Cloud Storage

Cloud storage allows data and files to be stored on remote servers and accessed over a network, usually the internet.

Pros

- Can access files from any computer connected to the internet

Cons

- Must be connected to the internet to access files
- Speed of data depends on traffic on the server
- Data may be vulnerable to unauthorised access if security measures are inadequate

RAM & ROM

Random Access Memory (RAM)

RAM is volatile main memory that provides fast access to programs and data currently being used by the computer. However, it is volatile memory so when electricity is cut the data is lost.

When a program is run, the program instructions and the data currently being used are loaded into RAM. If you are using word processor, both the program and the file you are working on are held in the RAM as well as any other programs you have running in the background.

Read Only Memory (ROM)

ROM is non-volatile memory, so its contents are retained when power is removed. It stores a limited amount of permanent firmware such as BIOS and bootstrap instructions used when the computer starts.

Virtual Storage

Virtual memory uses part of secondary storage, such as an HDD or SSD, as an extension of RAM when there is insufficient physical RAM available.

When RAM becomes full, data or programs that are not currently being used can be temporarily moved to virtual memory. When they are needed again, they are transferred back into RAM.

Virtual memory is significantly slower than RAM because secondary storage has slower access speeds.

Storage Comparisons

Storage	Technology	Advantages	Disadvantages
HDD	Magnetic	High capacity, low cost per GB	Moving parts, slower
SSD	Flash	Fast, durable, no moving parts	More expensive per GB
Optical	Optical	Cheap, useful for distribution/archiving	Lower capacity, requires optical drive
Flash Drive	Flash	Small, portable, no moving parts	Easy to lose, limited capacity compared with HDDs
Cloud	Remote Servers	Accessible from multiple devices	Internet/network required, security concerns