

STORAGE DEVICES

Main Memory

Main memory (sometimes known as internal memory or primary memory) is another name for RAM (and ROM).

The function of Main memory is to hold data and programs which are currently in use (currently running in the computer). It is a temporary storage memory. When power is switched off all of the data in the memory disappears. So it is called as volatile memory.

BACKING STORAGE

Backing storage is the name for all other permanent storage devices in a computer. It is also called as secondary storage devices or secondary memory.

Backing storage is usually non-volatile, so it is generally used to store data for a long time.

Storage medium: The part of the storage device that actually holds the data is known as the storage medium ('media' is the plural).

Storage device: The part of the device that help us to saves data onto the storage medium, or reads data from it, is known as the storage device.

Sometimes the storage medium is a fixed (permanent) part of the storage device, e.g. the magnetic coated discs in a hard drive

Sometimes the storage medium is removable from the device, e.g. a CD-ROM can be taken out of a CD drive.

ACCESSING STORED DATA

We refer to a collection of data stored in a computer system as a 'file'. Files are often organised into 'folders'. All these files are stored on storage devices to be accessed later.

There are different methods of accessing data from a storage medium

They are:

- Serial / Sequential Access
- Direct / Random Access

Serial / Sequential Access:

A serial (or sequential) access storage device is one that stores files one-by-one in a sequence. Magnetic tape is an example for serial access medium.

To access data from a serial access medium, you have to start reading from the beginning of the tape and continue reading until you find the required data. This type of access is known as serial access.

A non-computer serial access device that will be familiar to you is a VHS videotape. Because video is stored on a long piece of tape.

Direct / Random Access

A direct (or 'random') access storage device is one that stores files so that they can be instantly accessed - there is no need to search through other files to get to the one you want.

An example of a direct access device would be a DVD movie. Unlike the VHS videotape movie, you can jump to any scene on a DVD.

All parts of the DVD are directly accessible. This type of file storage is called direct access.

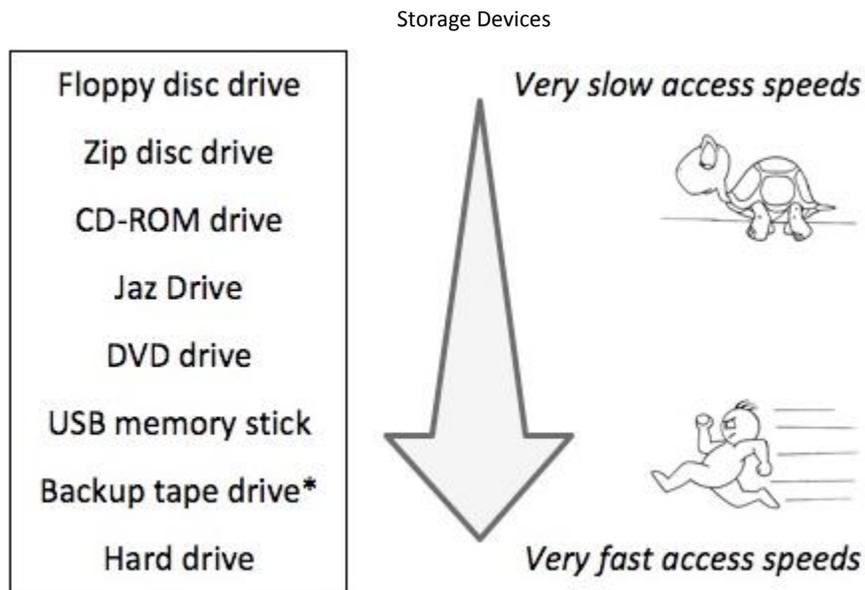
Data Storage Capacity

The storage capacity of some common storage media are given below.

Floppy disc	1.44MB
Zip disc	750MB
CD-ROM	800MB
Jaz Drive	2GB = 2,000MB
DVD	4.7GB = 4,700MB
USB memory stick	16GB = 16,000MB
Backup tape	800GB = 800,000MB
Hard drive	1TB = 1,000,000MB

Data Access Speed

Some storage devices can access data very quickly, whilst others are extremely slow...



Note: Modern back-up tapes have very fast access speeds, but only to save/read data sequentially (they are serial access devices). Tapes are very slow if you want to read files out of order, since the tape has to be rewound and fast-forwarded.

Based on the technology used there are two types of storage medium.

Magnetic Storage Medium and Optical Storage Medium

Magnetic Storage Media

Magnetic storage media contains numerous tiny magnetic spots. These magnetic spots are magnetized and demagnetized and erased using magnetic fields created by very tiny electromagnets.

In the case of magnetic tape the dots are arranged along the length of a long plastic strip which has been coated with magnetic material).

In the case of magnetic discs (e.g. floppy disc or hard-drive), the dots are arranged in circles on the surface of a plastic, metal or glass disc. Their surface has a magnetisable coating.

Example for Magnetic storage media are:

- Hard Drives
- Magnetic Tape
- Floppy Disc
- Zip Disc
- Jaz Disc

Hard Drives

Hard-drives have a very large storage capacity (up to 1TB). They can be used to store vast amounts of data. Hard-drives are random access devices and can be used to store all types of files, including huge files such as movies. Data access speeds are very fast.

Data is stored inside a hard-drive on rotating metal or glass discs (called 'platters').

Fixed Hard Drive

A hard-drive built into the case of a computer is known as 'fixed'. Almost every computer has a fixed hard-drive.

Fixed hard-drives act as the main backing storage device for almost all computers since they provide almost instant access to files (random access and high access speeds).

Portable Hard Drive / External Hard Drive

A portable hard-drive is one that is placed into a small case along with some electronics that allow the hard-drive to be accessed using a USB or similar connection. They can be connected to a USB port.

Portable hard-drives allow very large amounts of data to be transported from computer to computer.

Magnetic Tape

Magnetic tape is a large capacity, serial access medium. Because it is a serial access medium, accessing individual files on a tape is slow.

Tapes are used where large amounts of data need to be stored, but where quick access to individual files is not required. A typical use is for data back-up (lots of data, but rarely only accessed in an emergency)

Tapes are also used and in some batch-processing applications (e.g. to hold the list of data that will be processed).

Removable Media - Magnetic Discs

Floppy Disc

A removable, portable, cheap, low-capacity (1.44MB) storage medium. Floppy discs are random access devices used for transfer small amounts of data between computers, or to back-up small files, etc. Access times are slow.

Almost every PC used to have a floppy disc drive. These are obsolete now, having been replaced by higher capacity technology such as CD-ROMs, DVDs and USB memory sticks.

Zip Disc

A removable and portable storage medium, similar in appearance to a floppy disk, but with a much higher capacity (100MB, 250MB or 750MB).

Zip discs are random access devices. Another obsolete storage device, zip discs were a popular replacement for floppy discs for a few years, but they were superseded by cheaper media like CD-ROMs and CD-Rs

Jaz Disc

A removable and portable storage medium based on hard-drive technology, with a large capacity (1GB or 2GB).

Jaz discs are random access devices which were used for data back-up or moving large files between computers.

Discs were expensive to buy and not very reliable.

OPTICAL STORAGE DEVICES

Optical storage devices save data as patterns of dots that can be read using light. A laser beam is the usual light source.

The data on the storage medium is read by bouncing the laser beam off the surface of the medium. If the beam hits a dot it is reflected back differently to how it would be if there were no dots. This difference can be detected, so the data can be read.

Dots can be created using the laser beam (for media that is writable such as CD-Rs). The high intensity laser beam is used for making dots on the surface of the medium. This process is known as 'burning' data onto a disc.

Read-Only Optical Discs

Read-only optical discs have data written onto them when they are manufactured. This data cannot be changed.

CD-ROM

Compact Disc - Read-Only Memory (CD-ROM) discs can hold around 800MB of data. The data cannot be altered (non-volatile), so cannot be accidentally deleted. CD-ROMs are random-access devices.

CD-ROMs are used to distribute all sorts of data: software, games, music, electronic books. Etc.

DVD-ROM

Digital Versatile Disc - Read-Only Memory (DVD-ROM) discs can hold around 4.7GB of data (a dual-layer DVD can hold twice that). DVD-ROMs are random-access devices.

DVD-ROMs are used in the same way as CD-ROMs. But since they can hold more data, they are also used to store high-quality video.

High Capacity Optical Discs

Blu-Ray

Blu-Ray disks are a recent replacement for DVDs. A Blu-Ray disc can hold 25 - 50GB of data (a dual-layer Blu-Ray disc can hold twice that). Blu-Ray discs are random-access devices.

Blu-Ray discs are used in the same way as DVD-ROMs. But, since they can hold more data, they are also used to store very high-quality, high-definition (HD) video.

HD DVD

High-density DVD (HD-DVD) discs can hold around 15GB of data (a dual-layer HD-DVD can hold twice that). HD-DVDs are random-access devices.

HD-DVD discs are used in the same way as DVD-ROMs. But, since they can hold more data, they are also used to store very high-quality, high-definition (HD) video.

Recordable Optical Discs

Recordable optical discs can have data written onto them ('burnt') by a computer user using a special disc drive (a disc 'burner').

CD-R and DVD-R

CD-Recordable (CD-R) and DVD-recordable (DVD-R) discs. You can burn data onto them, but not erased. You can keep adding data until the disc is full, but you cannot remove any data or re-use a full disc.

CD-RW and DVD-RW

CD-ReWritable (CD-RW) and DVD-ReWritable (DVD-RW) discs, unlike CD-Rs and DVD-Rs, can have data burnt onto them and also erased so that the discs can be re-used.

DVD-RAM

DVD-Random Access Memory (DVD-RAM) discs are a type of re-writable DVD. They often come in a floppy-disc style case (to protect the disc).

DVD-RAM discs have a similar capacity to a normal DVD, holding 4.7GB of data. DVD-RAM discs are random-access devices. They are much faster than normal DVDs , so they are used in many camcorders (video recording cameras).

The discs are much higher quality and reliable than normal DVD-RWs. They can store data for up to 30 years. This means that they are often used for video and data back-up and archiving.

Solid-State Storage Devices

The term 'solid-state' essentially means 'no moving parts'.

Solid-state storage devices are based on electronic circuits with no moving parts (no reels of tape, no spinning discs, no laser beams, etc.)

Solid-state storage devices store data using a special type of memory called flash memory...

Examples for solid state storage device are Memory sticks/pendrives, memory cards, memory stick etc.

Flash Memory

Flash memory is a type of Electronically-Erasable Programmable Read-Only Memory (EEPROM). Flash memory is non-volatile (like ROM) but the data stored in it can also be erased or changed (like RAM).

Flash memory can be found in many data storage devices...

USB Memory Sticks

Memory sticks (or 'thumb-drives') have made many other forms of portable storage almost obsolete (why burn a CD or DVD when you can more easily copy your files onto a memory stick?).

Memory sticks are non-volatile, random-access storage devices.

Each of these small devices has some flash memory connected to a USB interface. Plug it into your computer and it appears as a drive. You can then add files, erase files, etc. You can use it to move any type of file between computers.

Flash memory used to be very expensive, but in recent years it has become very cheap

Memory Cards

Many of our digital devices (cameras, mobile phones, MP3 players, etc.) require compact, non-volatile data storage. Flash memory cards provide this and come in a variety of shapes and sizes.

One of the most common formats used by digital cameras is the SD Card. The cards store the digital images taken by the camera.

Mobile phones contain a Subscriber Identity Module (SIM) card that contains the phone's number, the phonebook numbers, text messages, etc.

Many phones also have extra memory cards to store music, video, photos, etc. (e.g Tiny Micro-SD cards).

Smart Cards

Many credit cards (e.g. 'chip-and-pin' cards), door entry cards, satellite TV cards, etc. have replaced the very limited storage of the magnetic strip (the dark strip on the back of older cards) with flash memory. This is more reliable and has a much larger storage capacity.

Cards with flash memory are called smart cards.

BACKING UP DATA

Why Backup Your Data?

If you delete a file by accident, your computer breaks, your laptop is stolen, or your business burns to the ground, having a backup copy means that you have not lost your precious data. You can recover your lost files and continue working.

Most businesses and institutions use computers to store very important data (customer records, financial information, designs for products, etc.) If this data is lost, the business could possibly have to close. Backing-up business data is essential.

How Are Backups Created?

Personal backups of the data on your hard-drive can be made by...

- Burning files to a CD-R

- Copying files to an external hard-drive

- Copying the files to another computer on a network

Businesses backup essential data by...

- Making copies of data very regularly

- 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)