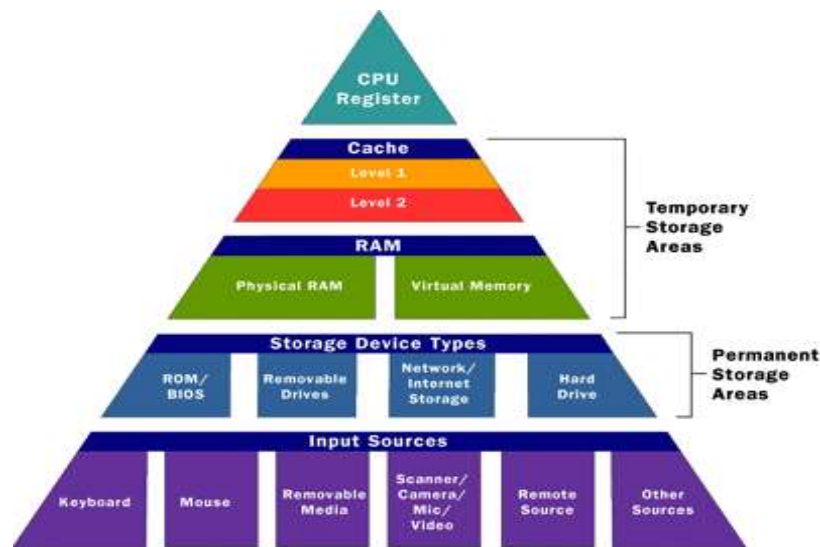# Computer Science

Chapter Three

chapter three

Memory

What is computer memory?

- You can store data on your hard disk, while data which is being processed is stored in RAM (Random Access Memory). Data which is stored on a hard disk can be permanent, while data in RAM is only temporary. Normally when people talk about memory in relation to a PC, they are talking about RAM.

Understanding different types of computer memory

The kinds of memory:-

1. *RAM(Random Access Memory):-*

The main memory in the computer, it's the location where data and programs are stored (temporally).

"RAM is volatile" means that the data is only there while the computer is turned {when the computer is shout off the content of the RAM is erased.

RAM is divided into same size location that each of them has unique address.

Note: - memory speed is measured in (MHz).

2. **ROM (Read Only Memory): -**

It's another part of the main memory, but with very small capacity to keep the instruction which make computer work when turning it on.

It's is not volatile and the computer can't write on it.

What is ROM?

- Read Only Memory (ROM) as the name suggests is a special type of memory chip which holds software which can be read but not written to. A good example is the ROM-BIOS chip, which contains read-only software. Often network cards and video cards also contain ROM chips.

What is the ROM-BIOS?

- The 'Read Only Memory Basic Input Output System' chip is a chip located on the computer's system (mother) board, which contains software. This software performs a variety of tasks. When you first switch on the computer the ROM-BIOS software performs a self-diagnostic to check that the computer is working OK. This software then loads your operating system from the disk into the RAM.

What is flash BIOS?

- Most modern computers are actually supplied with a flash BIOS rather than a ROM-BIOS. This chip contains exactly the same type of in-built software, but has the advantage that the software on the chip can be upgraded. This upgrade is achieved by simply running a small program supplied by the computer manufacturer.

3. *Cash memory: -*

 a. It's linked to C.P.U.; it has very fast chip keeps frequently used program and data, therefore it increase the speed of the computer.
 b. It reduces the gap speed of computer.

Note: - Capacity of Cash memory = 516 KB

4. *Flash memory: -*

 It's divided into blocks so it saves and erases information in fast way.
It can be used in BIOS, Mobiles portable digital camera and printers.
Note:

What is video (graphics) memory?

- The picture which you see on your screen is a form of data and this data has to be stored somewhere. The on-screen pictures are held in special memory chips called video memory chips; these chips are usually located on the video card. A modern computer will be supplied with several Megabytes of video memory.

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Understanding how computer memory is measured

- It is important to understand the following terminology:

Basic Units of Data Storage: It is important to realise that the term digital computer refers to the fact that ultimately the computer works in what is *Called Binary.*

Bit: All computers work on a binary numbering system, i.e. they process data in ones or zeros. This 1 or 0 level of storage is called a bit. Often hardware is specified as a 32-bit computer, which means that the hardware can process 32 bits at a time. Software is also described as 16 bit, 32 bit or 64 bit software.

Byte: A byte consists of eight bits.

Note:

All information processed in computer is handled and stored in the computer as Binary System (1, 0) and called "Bit".

Byte: - is a memory unit which represents a character, so it's used to measure the memory capacity.

Byte: A byte consists of eight bits.

Kilobyte: A kilobyte (KB) consists of 1024 bytes.

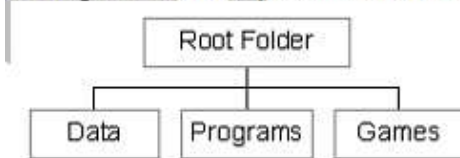**Megabyte**: A megabyte (MB) consists of 1024 kilobytes, approximately 1,000,000 bytes.

Gigabyte: A gigabyte (GB) consists of 1024 megabytes, approximately 1,000,000,000 bytes.

Terabyte: A terabyte (TB) consists of approximately 1,000,000,000,000 bytes.

In this example, we have the root folder at the top. Below this are three sub-folders called Data, Programs and Games.

Files: Data and programs are stored on your disk as files. There are different types of files, such as the files in which you store your data, the files which contain your programs and also files used to store your operating system (such as Microsoft Windows).

Directories (folders): Directories or folders are used to group files with a similar theme together. For example, you could have a folder called "Accounts" containing all your accounting related files, or a folder called "Customers" containing correspondence with your customers. Folders can also contain sub-folders to further divide files. The uppermost level folder is often referred to as the "root" folder (or directory). Sometimes you may see a diagrammatic representation of folders, as illustrated below.

```
              ┌─────────────┐
              │ Root Folder │
              └──────┬──────┘
        ┌────────────┼────────────┐
   ┌────┴───┐  ┌─────┴────┐  ┌─────┴───┐
   │  Data  │  │ Programs │  │  Games  │
   └────────┘  └──────────┘  └─────────┘
```

Records: A record is a collection of data held within a file.

Storage Devices:

Secondary storage system includes the disk and other storage media used to store data permanently to keep your software program and data permanently.

You have to save your work on storage devises before shutting the computer down.

- Kind of storage devises:-

Hard disk : -

Located within the CPU., it's the most important storage media in the computer, it keeps software and programs, it composed of several magnetic disks in single unit.
-Extra hard disk units can be added externally or internally.

Note: - capacity of typical hard disk is 120 GB.

Internal hard disks

- **Speed:** Very fast. The speed of a hard disk is often quoted as "average access time" speed, measured in milliseconds. The smaller this number, the faster the disk is.
- **Capacity:** Enormous. Measured in Gigabytes. A Gigabyte is equivalent to 1024 Megabytes.
- **Cost:** Hard disks costs are falling rapidly and normally represent the cheapest way of storing data.

External hard disks

- **Speed:** Normally slower than internal disks, but more expensive versions offer the same performance as internal hard disks.
- **Capacity**: Same as internal disks.
- **Cost:** More expensive than internal disks.

Floppy Disk: -

Is a small portable version of hard disk, it's used to transfer files from computer to another and it's slower than the hard disk.

Diskettes (floppy disks)

- **Speed:** Very slow.
- **Capacity:** Normally 1.44 Mbytes.
- **Cost:** Very cheap.

Magnetic Tape: -

Like a cassette, it was used in the old computer for many years.

Zip drives

- You can install a Zip drive into your computer and then you can insert Zip disks into that drive. The great thing about these disks is that you can remove one disk and replace it with another, in exactly the same way that you can place different diskettes in your diskette drive. They are great for backing up data and exchanging data between non-networked computers.

- **Speed:** Slower than normal hard disks but ideal for backups.
- **Capacity:** 100 or 250 Megabytes.
- **Cost:** You have to consider both the cost of the drive, plus the cost of each disk which you wish to use in the drive. Often suppliers will sell the drive plus a pack of 5 disks at a bundled discount price.

Jaz drives

- A Jaz drive is similar in concept to a Zip drive. The main difference between them is that a Jaz drive can hold a lot more data. Alas, the disks are not the same as used in a Zip drive and as a result, you cannot use a Zip disk in a Jaz drive or a Jaz disk in a Zip drive.

- **Speed:** Slower than normal hard disks but ideal for backups

- **Capacity:** Around 2 Gigabytes (2048 Megabytes).
- **Cost:** You have to consider both the cost of the drive, plus the cost of each disk which you wish to use in the drive. Often suppliers will sell the drive plus a pack of 5 disks at a bundled discount price.

CD Rom (Compact Disk):-

It's an important disk which was a LASER to read the information it's suitable for storage programs that mix of (Text \, graphic and audio) it capacity around 650 MB.

DVD (Digital Versatile Disk):-

 It's a high capacity development of CD Rom; it can store a GB of information it's used to store high quality films and videos.
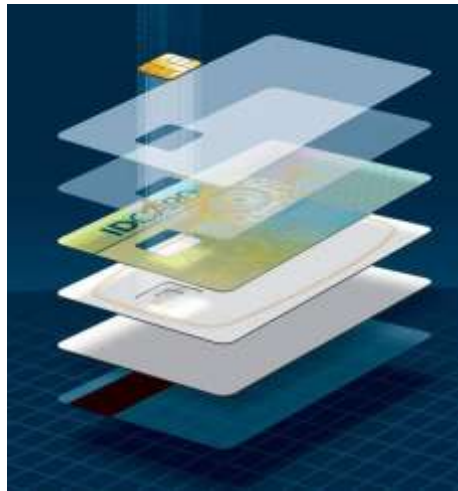*Note: -* It capacity is between 4.7→17 GB

Smart Card: -

 Contain computer circuits that can save and process data.
Smart cards are defined according to
 1. How the card data is read and written
 2. The type of chip implanted within the card and its capabilities. There is a wide range of options to choose from when designing your system.

What is the difference between internal and external hard disks?

- Internal hard disks are located inside your main computer unit, while external hard disks are joined to the main computer unit via a lead which you plug into the back of your computer unit. Some external hard disks will plug into the USB port (connector) located at the back of your computer. Other external hard disks require the installation of a special card within your

computer which allows the connection of the external hard disk to the computer unit.

Understanding the purpose of formatting a disk

Why format a disk?

- Originally when you purchased a pack of floppy disks (diskettes), you had to format them prior to use. Today, most floppy disks are supplied pre-formatted.

  Formatting a disk is like putting lines on a blank sheet of paper, so that you can write on that paper. Formatting allows the operating system (i.e. Windows) to read information stored on the disk and also to store information on the disk.

  The manufacturer will have formatted your hard disk for you prior to delivering the PC to you. You should be very careful about formatting a disk, as any data on the disk will be lost after re-formatting. You would not normally format a hard disk, this should only be done by a qualified person. You do not even need to know how to format a hard disk!

Computer performance:

Means the factors that affect the speed of *CPU* Processing .

1. *Clock speed: -*

The faster clock speed the more instruction will be executed in one second. So the more efficient the computer will be, it measure by MHz.

2. *Memory capacity: -*

If memory doesn't have enough space the computer will have to use a part of hard disk as a virtual memory.
The hard disk is slower than memory so the computer will be slow.

3. *Hard disk speed: -*

Because 90% of our needs are stored in hard disk, the access speed of data and software will affect computer performance.

4. *Bus speed: -*

Bus transfer data control the signal and the instruction between computer parts; the faster it is the more efficient the computer will be.

5. *Graphic Accelerator: -*

Speed of computer increase according to the type of acceleration card. {It has processer and memory of its own}.

Summary:

Computer performance is characterized by the amount of useful work accomplished by a computer system compared to the time and resources used.

Depending on the context, good computer performance may involve one or more of the following:

- Short response time for a given piece of work
- High throughput (rate of processing work)
- Low utilization of computing resource(s)
- High availability of the computing system or application
- Fast (or highly compact) data compression and decompression
- High bandwidth / short data transmission time

Computer Memory Basics

Although memory is technically any form of electronic storage, it is used most often to identify fast, temporary forms of storage. If your computer's CPU had to constantly access the hard drive to retrieve every piece of data it needs, it would operate very slowly. When the information is kept in memory, the CPU can access it much more quickly. Most forms of memory are intended to store data temporarily.

As you can see in the diagram above, the CPU accesses memory according to a distinct hierarchy. Whether it comes from permanent storage (the hard drive) or input (the keyboard), most data goes in random access memory (RAM) first. The CPU then stores pieces of data

it will need to access, often in a cache, and maintains certain special instructions in the register. We'll talk about cache and registers later.

All of the components in your computer, such as the CPU, the hard drive and the operating system, work together as a team, and memory is one of the most essential parts of this team. From the moment you turn your computer on until the time you shut it down, your CPU is constantly using memory. Let's take a look at a typical scenario:

You turn the computer on.

The computer loads data from read-only memory (ROM) and performs a power-on self-test (POST) to make sure all the major components are functioning properly. As part of this test, the memory controller checks all of the memory addresses with a quick read/write operation to ensure that there are no errors in the memory chips. Read/write means that data is written to a bit and then read from that bit.

The computer loads the basic input/output system (BIOS) from ROM. The BIOS provides the most basic information about storage devices, boot sequence, security, Plug and Play (auto device recognition) capability and a few other items.

The computer loads the operating system (OS) from the hard drive into the system's RAM. Generally, the critical parts of the operating system are maintained in RAM as long as the computer is on. This allows the CPU to have immediate access to the operating system, which enhances the performance and functionality of the overall system.

When you open an application, it is loaded into RAM. To conserve RAM usage, many applications load only the essential parts of the program initially and then load other pieces as needed.

After an application is loaded, any files that are opened for use in that application are loaded into RAM.

When you save a file and close the application, the file is written to the specified storage device, and then it and the application are purged from RAM.

In the list above, every time something is loaded or opened, it is placed into RAM. This simply means that it has been put in the computer's temporary storage area so that the CPU can access that information more easily. The CPU requests the data it needs from RAM, processes it and writes new data back to RAM in a continuous cycle. In most computers, this shuffling of data between the CPU and RAM happens millions of times every second. When an application is closed, it and any accompanying files are usually purged (deleted) from RAM to make room for new data. If the changed files are not saved to a permanent storage device before being purged, they are lost.
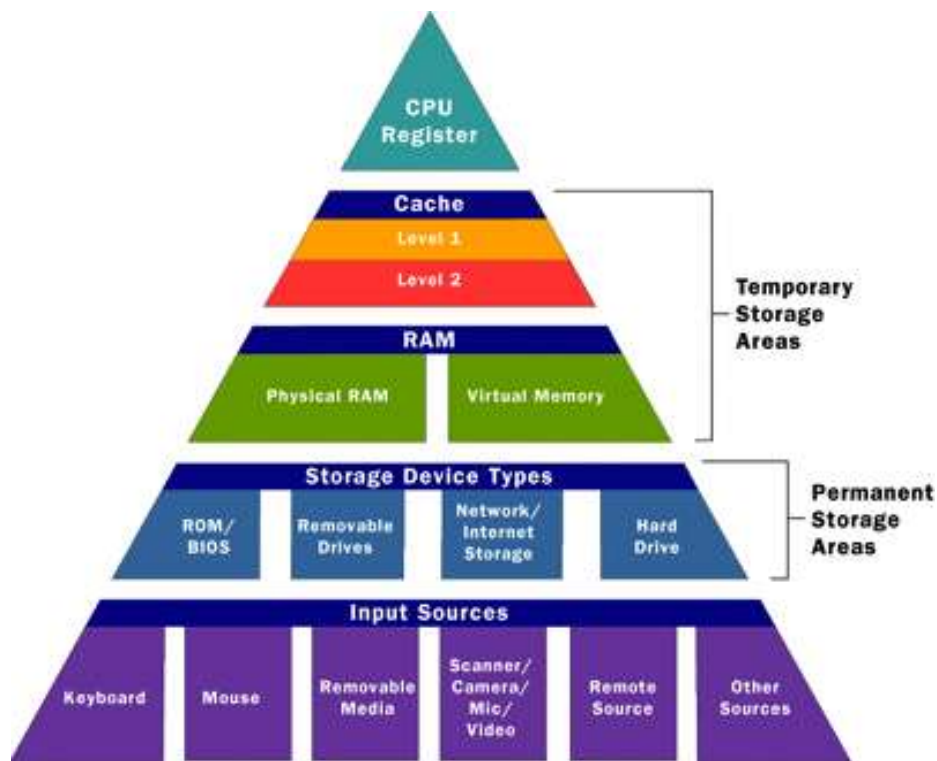

Fig: Computer memory works