Lecture 5

Computer Technology

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**Lecture 5**

**Types of memory**

The memory unit can be implemented using a variety of memory chips- different speeds, different manufacturing technology, and different sizes.

**5.1 Read Only Memories (ROM)**

ROMs allow only read operation to be performed. This memory is non-volatile. Most ROMs are programmed and cannot be altered. This type of ROM is cheaper to manufacture than other types of ROM. The program that controls the standard I/O functions (called BIOS) is kept in ROM, configuration software.

**5.1.1 Other types of ROM include**

1. Programmable ROM (PROM).
2. Erasable PROM (EPROM) is read only memory that can be Re-programmed using special equipment.
3. EAPROM, Electrically Alterable Programmable ROM is a Read Only Memory that is electrically reprogrammable.

**5.2 Read/Write Memory (RAM)**

Read/Write memory is commonly referred to as Random Access Memory (RAM); it is divided into static and dynamic.

1. **Static RAM (SRAM)**: used for implementing CPU registers and used for special high speed memory called cache memory this greatly improves system performance. **Static RAM** keeps its value without having to be refreshed.
2. **Dynamic RAM (DRAM),** the bulk of main memory in a typical computer system consists of dynamic ram. DRAM is where programmed, data are kept when a program is running. It must be refreshed with in less than a millisecond or losses its contents.

The differences between RAM and ROM

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| --- | --- |
| **RAM** | **ROM** |
| * Stand for Random-Access Memory | * Stand for Read Only Memory |
| * Read / Write Memory | * Read Only Memory |
| * Sending data (writing) to RAM memory address is called destructive write because the new data erases whatever was there before. | * Sending data to ROM memory address is in effective because the contents of ROM cannot changed (write not allowed) because this memory for read only. |
| * Form of primary storage for holding temporary data and instruction | * Form of primary storage for holding permanent data and instruction |
| * Volatile :program and data are erased when the power is off | * Permanent :program and data are intact even power is off |
| * Type of RAM is * Static RAM * Dynamic RAM | * Type of ROM is * PROM * EPROM * EAPROM |

**5. 3 Cache Memory**

Many modern computer applications (Microsoft office 98, for example) are very complex and have huge numbers of instructions it takes considerable RAM capacity (usually a minimum 16MB) to store the entire instruction set. Or you may be using an application that exceeds your RAM. In that case, your computer has to go into secondary storage to retrieve the instruction. To alleviate this problem, software is often written in smaller blocks of instruction. As need, these blocks can be brought from secondary storage into RAM; this is still slow however, cache memory is the place closer to the CPU where the computer can temporarily store those blocks used most often. Those used less often remain in RAM until they are transferred to cache; those used infrequently stay stored in secondary storage. Cache memory is faster than RAM. Because, the instructions travel a shorter distance to the CPU.

**5.4 Flash memory**

Is one such device. This memory can be accessed like RAM (read and written), but is non-volatile i.e. it is a form of permanent storage. At the time of writing flash memory is available in the 512Mb to 1GB range. One disadvantage of current NVRAMs is that they cannot be written to, as quickly as ordinary RAM. However, they are much faster to access than disk storage systems and they consume less power, so that in small portable computer systems they offer an alternative low-powered option to disk storage. However, NVRAMs are more expensive than disk storage devices.

**5.5 Virtual Memory**

If your computer lacks the random access memory (RAM) needed to run a program or operation, Windows uses virtual memory to compensate. Virtual memory combines your computer’s RAM with temporary space on your hard disk. When RAM runs low, virtual memory moves data from RAM to a space called a *paging file*. Moving data to and from the paging file frees up RAM to complete its work. The more RAM your computer has, the faster your programs will generally run. If a lack of RAM is slowing your computer, you might be tempted to increase virtual memory to compensate. However, your computer can read data from RAM much more quickly than from a hard disk, so adding RAM is a better solution.

**5.5.1 Bios**

Short for (Basic Input / Output System), Bios is a chip located on all computer motherboard that contains instructions and setup for how your system should boot and how it operates. To the right is a picture of what a BIOS chip may look like in your computer. The BIOS includes instructions on how load basic computer hardware and includes a test referred to as a POST (Power On Self Test) that helps verify the computer meets requirements to boot up properly, if the computer does not pass the POST, you will receive a combination of beeps indicating what is malfunctioning within the computer.

In most PCs, the **BIOS** have four main functions:

1. **POST** Test computer hardware, ensuring hardware is properly functioning before starting process of loading operation system. Additional information on the POST can be found on our POST/Beep Code Page.
2. **Bootstrap Loader** Process of location the operating system. If capable operation system located, BIOS will pass the control to it.
3. **BIOS Software/Drives** that interface between the operating system and your hardware. When running DOS or Windows you are using complete BIOS support.
4. **BIOS/CMOS Setup** Configuration program that allows you to configure hardware setting including system setting such as computer password, time, and data.

**5.6 Secondary Storage (Backing Storage)**

Secondary storage is designed to store very large amounts of data for extended periods of time .secondary storage can have memory capacity of gigabyte or more; only small portions of the data are placed in primary storage at any one time. Secondary storage **has the following Characteristics:**

1. it is non-volatile
2. it takes much more time to retrieve data from secondary storage than it does from RAM
3. it much more cost-effective than primary storage
4. it can take place on a variety of media each with its own technology, as is cussed below:
5. **Magnetic tape**
6. **Magnetic disc**
7. **Magnetic diskette (floppy disc)**
8. **Optical discs**

**5.6.1 Features of the Magnetic tapes**

1. It is 1/4 inch wide and 300, 1200, 2400, or 3600 feet long.
2. It has a plastic base, coated with magnetic able material on one side.
3. Data is stored in tracks; there are 7 or 9 tracks (depending on the tape unit) which run the length of the tape. The data is recorded so that one character is recorded across the 7 or 9 tracks.
4. The density of recording can vary between 2
5. It is serial access device.
6. The tape is reusable i.e. it can be overwritten
7. The same tape can be used for input and output. The tape can be writing protected.

**5.6.2 Features of magnetic disks (hard disks)**

1. Disks are randomly accessed.
2. Disks are of size and shape similar to a long-playing record
3. The surfaces of each disk are of magnetic able material.
4. Each disk surface is divided into a number of concentric tracks (typically 200).
5. Disks are placed on pack and each pack may have 6 or 11 disks and is used as a single unit.
6. The latest models of disk packs can store many hundreds of megabytes of data (i.e. hundreds of millions of characters).

**5.6.3 Features of floppy disks**

1. A pliable disk permanently sealed with a rigid, protective plastic envelope
2. They have random access facility.
3. Data are stored in concentric tracks
4. The floppy disks sizes are 8, 5 1/4, 3 1/2 inch.
5. Storing capacity of 3 1/2 inch disks is 1.44 megabytes i.e. one million four hundred thousand characters.



Floppy Disk (1.44MB)

**5.6.4 Features of optical disks**

1. This is a random access device.
2. Data is written into the disk by burning a permanent pattern into the surface of the disk by means of high precision laser beam.
3. Data is read by using the laser at lower intensity and detecting the pattern reflected from its beam by the surface of the disk there are many types of optical disks:
4. Compact disk read-only memory (CD-ROM) storing devices feature high capacity, low cost. It has become popular for recorded music as well as information (such as books) a variant is the digital video disk (DVD), used for movies.
5. Write once, read many (WORM) disk can be written.
6. Rewritable CD is a less common technology that allows the disk to be written upon and written up to 1.000 times.

**5.6.5 Hard Disk Performance**

Several basic parameters determine the performance of a given hard disk drive. A seek operation is the movement of the read/write head to the desired track.

1. **Seek Time:** A seeks time is the movement of the read\write head to the desired track. The seek time is the average time for this operation to be performed. Typically, hard disk drives have an average seek time of several milliseconds, depending on the particular drive.
2. **Latency Time:** The latency period is the time takes for the desired sector to spin under the head once the head is positioned over the desired track. Latency time depend on the constant rotational speed of the disk.

The sums of average seek time and the average latency time is the access time for the disk drive.



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**Figure (5): Hard Disk**

**5.6.5.1 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.

**5.6.6 CD-ROM (Compact Disk Read-Only Memory)**

It is another form of secondary storage that is increasing in popularity. It is a low-cost storage medium with a very large capacity. Unlike disk storage, CD-ROM is a **WORM** (Write Once Read Many times) device i.e. it is a **read only** storage device. This means that like ROM, the disk comes with information already stored on it. Thus one of the main uses of CD-ROM is to disseminate information such as library catalogues, reports, manuals, journals, directories and software. It has also become a very popular medium for computer games. Many software vendors and computer manufacturers such as Sun and Apple distribute their software and manuals on CD-ROM. Many publishers now use CD-ROM especially for educational material and it is possible to buy encyclopedia and history texts in CD-ROM form. The CD-ROM has sufficient capacity not only to store the written text, but also video and audio material which require large amounts of storage, for example, a digital version of a passport size photograph requires up to a megabyte of storage.

CD-ROM uses the same technology as the compact audio disk or CD and such disks can also be used in a CD-ROM drive. Optical scanning techniques, using lasers, are employed with CD-ROMs, which allow massive amounts of data to be stored in a compact area. A CD-ROM drive is about the same size as a floppy disk drive. CD-ROM is currently more reliable and durable than magnetic media (disks and tapes). In terms of capacity, a single CD-ROM may store up to600 megabytes. In terms of text this is equivalent to about 200 books of 1000 pages each.

A disadvantage of CD-ROM is that it takes longer to access information compared to a hard disk. However, clever software tailored for particular applications often means that this is not a serious problem. **Video Disks** are similar to CD-ROM (but have a larger capacity) and are used for similar applications.

**Rewritable CD** storage (CD-R) is now becoming more widely used. This storage combines there liability and storage capacity of CD-ROM with the flexibility of magnetic disks in that user can store their own information on them. They are still slower to access than conventional hard disks. **Magneto-optical (MO)** disks combine the use of magnetic and optical principles to store information. MO disks have a smaller capacity than CD-ROMs (e.g. a 3.5 inch MO disk stores128Mb) and are quite expensive in comparison to conventional hard disks.

CD-ROMs are now being replaced by **DVD-ROMs** (Digital Versatile Disks). DVD-ROM capacity ranges from 4.7 GB upward (4.7x 2 or 4.7 x 4 GB). These are also used for distributing films as a rival to video tapes. A current PC will typically have (DVD) drives which are also capable of reading conventional CDs. DVD-ROMs are also available which allow users to store files.



CD-ROM = 640 Mb

DVD-ROM = up to 8.5 GB