Unit-II.

Computer Memory and storage:

Computer Memory :-

The data contained in computer memory is transferred to the processor through the data bus. Memory is a semiconductor storage device for holding programs or data. There are three basic forms of memories.

i) Dynamic storage in which data must be constantly refreshed and in which data are erased when power is no longer applied to the cell.

ii) Non-valatile memory in which data remains permanently in the cell even when power is not applied, and

iii) Static memory which does not need to be refreshed but which loses its data when power is no longer applied to the cell.

Normally, "Memory" refers to primary, semiconductor-based storage.

Type of storage can be categorised.

primary storage::

primary storage contains data that are actively being used. It is typically high-speed, relatively small, is often volatile. It is sometimes referred to as "Main Memory".

Secondary Storage:

Secondary storage, also known as peripheral storage, is where the computer

Stores information that is not necessarily in current use. It is typically slower and higher capacity always non-volatile.

Volatile Storage :-

Volatile storage loses its contents when it loses power, non-volatile storage does not.

Memory Hierarchy

The hierarchycal arrangement of storage in current computer architectures is called the memory hierarchy.

The memory hierarchy in most computers is :-

i) Processor registers - fastest possible access only hundreds of bytes in size. This memory is used for temporary storage of data.

ii) Level 1 cache - often accessed usually tens of kilobytes.

iii) Level 2 cache - higher latency often 2048 kB or more.

iv) Level 3 cache - higher latency often 512 kB or more.

v) Main memory - hundreds of cycles latency but can be multiple gigabytes.

vi) Disk Storage - Millions of cycles latency.

vii) Tertiary Storage - several seconds latency can be huge.

Random Access Memory :-

Random access memory or RAM

most commonly refers to computer chips that temporarily store dynamic data. By storing frequently used or active files in random access memory, the computer can access the data faster than if it to retrieve it from the far-larger harddrive. Random access memory is volatile memory.

Random access memory is categorized by architecture and speed. RAM must to be matched to a compatible motherboard.

Types of RAM.

There are two fundamental types of RAM.

a) Dynamic RAM (DRAM)

b) static RAM (SRAM)

a) Dynamic RAM :-

Dynamic random access memory which stores each bit of a data in a separate capacitor and a transistor. DRAM needs to have its storage cells refreshed. DRAM is a volatile memory.

b) static RAM

static random access memory holds its data without external refresh. It is faster and more reliable than DRAM. Static RAM is a volatile memory.

Read only Memory :-

ROM is a type of Memory only be read, There are two main reasons

that read-only memory.

Permpance:-

The values stored in ROM are always there whether the power is on or not. It is called non-valatile Storage.

security:-

The fact that ROM cannot easily be modified.

Types of ROM:-

There are five basic ROM types:-

i) Masked ROM

ii) programmable read only memory (PROM)

iii) Erasable programmable ROM (EPROM)

iv) Electrically Erasable programmable ROM (EEPROM)

v) Flash memory.

i) Masked ROM

The first ROMs were made using a procedure that directly writes the binary data in a silicon plate using a mask. It is designed to perform a specific function and cannot be changed.

ii) programmable read-only memory

This is a type of ROM that can be programmed using special equipment which can be written to but only once. When they change their code they can create new PROMS without requiring expensive equipment.

iii) Erasable programmable ROM (EPROM)

An EPROM is a ROM that can be erased and reprogrammed. A little glass window is installed in the top of the ROM package, Ultraviolet light of a specific frequency can be shined through this window for a specified period of time, which will erase the EPROM and allow it to be reprogrammed again.

iv) Electrically Erasable programmable ROM:

An electrical charge is used to erase one byte at a time. This is the most flexible type of ROM, and is now commonly used for holding BIOS programs.

v) Flash memory:-

It is a modern type of EEPROM invented in 1984. Flash memory can be erased and rewritten faster than ordinary EEPROM. Flash memory is sometimes called flash ROM or flash EEPROM when used as a replacement for older ROM types but not in applications that take advantage of its ability to be modified quickly and frequently.

RAM, ROM, AND CPU INTERACTION.

The CPU accesses memory according to a distinct hierarchy.

All of the components in the computer, such as the CPU, the hard drive and the

operating system, work together as a single unit and memory is one of the most essential parts of this unit. The working of a memory is as follows:

i) The computer is turned on.

ii) 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.

iii) The computer loads the basic input/output system (BIOS) from ROM.

iv) The computer loads the operating system (OS) from the hard drive into the system's RAM.

v) When an application is opened, it is loaded into RAM.

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

vii) When a file is saved and the application is closed, the file is written to the specified storage device, and then it and the application are deleted from RAM.

The CPU requests the data it needs from RAM, processes it and writes new data back to RAM in a continuous cycle. When an application is closed, it and any accompanying files are usually deleted

from RAM to make room for new data.

TYPES OF SECONDARY STORAGE DEVICES.

Secondary storage is also called auxiliary storage and is used to store data and programs when they are not being processed. secondary storage is more permanent than main memory, as data and programs are retained when the power is turned off. The two most common types of secondary storage are magnetic tapes and magnetic disks.

Magnetic Tape Storage

Magnatic tape is a one-half inch or one-quarter inch ribbon of plastic material on which data is recorded. The tape drive is an input/output device that reads, writes and erases data on tapes. Magnetic tapes are erasable, reusable and durable. Magnetic tape is not suitable for data files that are revised or updated often because it stores data sequentially.

Magnetic Disk Storage:

Magnetic disks are the most widely used storage medium for computers. A magnetic disk offers high storage capacity, reliability and the capacity to directly access stored data. Magnetic disks hold more data in a small place and attain faster

data access speeds. Types of magnetic disks include diskettes, hard disks, and removable disk cartridges.

Magnetic Tape:

Magnetic tape is a medium for Magnetic recording generally consisting of a thin magnetically coating on a long and narrow strip of plastic. A device that stores computer data on magnetic tape can be called a tape drive, a tape unit or a streamer.

Magnetic tape allowed massive amounts of data to be stored in computers for long periods of time and rapidly accessed when needed. The data is stored in the form of tiny segments of magnetised and de-magnetised portion on the surface of the material. Magnetised portion of the surface refers to the bit value '1' where as demagnetised portion refers to the bit value '0'.

Magnetic disk:

Magnetic disks are generally termed as secondary storage for computer systems. Before data can be stored on a magnetic disk, the disk must first be divided into numbered areas so the data can be easily retrieved. is known as formating the disk.

The format program divides each data surface into tracks and sectors.

Tracks.

Concentric rings, called tracks are written on the disk during the formatting process. Each track is assigned a number The outermost track on a disk is assigned number 00. The innermost track is assigned the highest consecutive number.

Sectors :

Each track is divided into sectors. Sectors are numbered divisions of the tracks designed to make data storage more manageable.

TYPES OF MAGNETIC DISK :

Broadly, magnetic disks can be classified into three types : Floppy disk, hard disk, and zip disk.

Floppy Disk

A floppy disk is a data storage medium that is composed of a disk of thin, flexible magnetic storage medium encased in a square or rectangular plastic shell. Invented by IBM, floppy disks in 8 inch, 5¼-inch and 3½-inch formats.

Structure

The 5¼-inch disk had a large circular hole in the center for spindle of the drive and a small oval aperture in both

sides of the plastic to allow the heads of the drive to read and write the data. The magnetic medium could be spun by rotating it from the middle hole. A small notch on the right hand side of the disk would identify whether the disk was read-only or writable.

Another LED/phototransistor pair located near the center of the disk could detect a small hole once per rotation, called the index hole. It was used to detect the start of each track and whether or not the disk rotated at the correct speed.

Inside the disk where two layers of fabric designed to reduce friction between the medium and the outer casing. A catch was lowered into position in front of the drive to prevent the disk from emerging.

The 3½-inch disk is made of two pieces of rigid plastic with the fabric-medium-fabric sandwich in the middle to remove dust and dirt. The front has only a label and a small aperture for reading and writing data, protected by a spring-loaded metal or plastic cover, which is pushed back on entry into the drive.

The reverse has a similar covered aperture, as well as a hole to allow the spindle to connect into a metal plate glued to the medium. Two holes bottom left and right, indicate the write-protect status

and high density disk correspondingly.
A notch top right ensures that the disk is inserted correctly.

Parts of a Floppy Disk Drive

The Disk :

A floppy disk use a thin plastic base material coated with iron oxide on both sides. This oxide is a ferromagnetic material which when exposed to a magnetic field gets permanently magnetized. It can record information instantly can be erased and reused many times very inexpensive and easy to use.

The Drive

The major parts of a FDD include

* Read/write Heads :

The same head is used for reading and writing, while a second, wider head is used for erasing a track just prior to it being written.

* Drive Motor :

A very small spindle motor engages the metal hub at the center of the diskette, spinning it at either 300 or 360 rotations per minute (RPM).

* Stepper Motor :

This motor makes a precise number of stepped revolutions to move the read/write head assembly to the proper track position.

*Mechanical Frame:

A system of levers that opens the little protective window. An external button allows the diskette to be ejected, at which point the spring-loaded protective window on the diskette closes.

*Circuit Board:

contains all of the electronics to handle the data read from or written to the diskette. It also controls the stepper-motor control circuits used to move the read/write heads to each track as well as the movement of the read/write heads toward the diskette surface.

3.5-inch diskette to see of the user wants to present data from being written on it.

Hard Disk :-

The hard drive, also called the hard disk or fixed disk, is the primary storage unit of the computer. It is always labeled the C drive. Additional drives are labeled after it as the D, E, F etc. They hold more data and are faster than floppy disks.

A single hard disk usually consists of several platters. Each platter requires two read/write heads, one for each side. All the read/write heads are attached to a single access arm so that they cannot independently, on each of

the platters there is a thin layer of magnetic film. Each platter has the same number of tracks, and a track location that cuts across all platters is called a cylinder.

The average drives had 9 to 14 ms access time. the lower access time the faster the hard drive.

File systems:

File system is the way in which your computer stores data on the hard disk. The most common file systems are FAT16 for older computers, FAT32, and NTFS. FAT stands for File Allocation Table. NTFS stands for NT File system.

Every file would take up a minimum of 32kb in space. FAT32 allowed disk sizes up to 2 Terra bytes. NTFS is believed to be far greater file systems than any of the FAT's.

Measuring the speed of Hard Disk

There are various ways ~~of~~ measuring the speed of the hard disk. The main ones are the maximum data transfer rate, the spindle rotation speed and the seek time.

Maximum Transfer Rate::

This is the highest amount of data that can be transferred per second.

Spindle Rotation speed.

The faster the rotation speed, the more data can be written per second and the

quicker it is to find the correct data on the platter.

Seek Time:

The seek time of a hard disk is the average time it takes for the disk to find the data you need on the platters.

Disk Fragmentation:

This process leaves the disk in no sort of order and when new file are written to the disk they start to get written in the gaps on the disk. The fact that single files are written in different parts of the disks means that the disk has to go round the disk reading different parts of insted of just streaming the data straight off the disk. This is called Fragmentation.

Connection Types

There are currently 3 connections for a hard disk IDE (or ATA) SCSI and serial ATA. The most common is the IDE interface. SCSI connections often require extra hardware unless it is built into the motherboard. The serial ATA standard is more reliable and uses smaller un-obtrusive wires Smaller wires also means better airflow for the system. case.

Types of Hard Drive Connections

Integrated Drive Electronics (IDE)

It is a connector that can connect

up to the two hard drives at one time to a computer. The drives have the capacity of storing only 528 MB of data each.

Small computer Interface (SCSI)

It is a connector that is a fast and easy way to connect a hard drive. It is expensive, but can also be used to connect other devices such as scanners, printers, CD-ROM drives that can all be "chained together". Three types of SCSIs include:

SCSI-1

It connects up to 7 devices to a computer.

SCSI-2

This is the current industry standard. It is faster but is also more compatible with more devices.

SCSI-3

It can connect more than 8 devices together. It is the most expensive and has the fastest data transfer rate.

Enhanced Integrated Drive Electronics (EIDE)

This is the drive that most computers come with. It can connect up to 4 devices to a computer such as hard drive, CD-ROM and tape drives. Each hard drive capacity is at 528 MB of Data.

Zip Disk :-

The zip drive is a medium-capacity removable disk storage system, introduced by Iomega in late 1994. originally, zip disks had a capacity of 100 MB, but later versions increased this to first 250MB and then 750MB.

Optical Disk :

Optical disk is an electronic data storage medium from which data is read and written to by using a low-powered laser beam. The formatting of the optical disk will dictate whether it is a DVD, CD, read only or rewritable. optical disks have replaced vinyl records, cassette tapes, videotapes and floppy disks. The optical disk became preferred medium for music, movies and software programs because of its many advantages. Compact, lightweight, durable and digital optical disk also provides a minimum of 650 of megabytes (MB) storage. A double layered and double sided DVD optical disk holds up to 15.9 gigabytes (GB) of data.

The optical disk is so named because its technology is based on light. As the disk spins, a laser beam follows a spiraling trail of pits and lands in the plastic meterial of the disk. The pits reflect light different than the lands, while a device translates the reflective difference to bits of on/off or 1 and 0. The bits from bytes that carry the digital code of the data stored

on the optical disk.

A standard optical disk measures 4.724 inches (120 mm) in diameter and 0.478 inches (1.2mm) in thickness. It is made from polycarbonate with a reflective layer of aluminum, coated in lacquer. The master optical disk is made from glass.

An optical disk offers many advantages over magnetic storage media.

* Highest storage capacity.
* Low cost per Megabyte of storage
* Environmental condition tolerance
* High data stability
* Long media life.

Types of optical disks

There are three basic types of optical disks:

*Read-only optical disks:

The optical disks, which are recorded at the time of manufacture and cannot be erased. CD, CD-ROM, DVD-ROM, and DVD-Video are the read only disks.

* WORM:

WORM stands for write-once, read many. The optical disks that can be recorded by the user only once but cannot be erased. After they have been recorded once, they behave like a read-only optical disk CD-R, DVD-R and WORM disks are write-once.

*Rewritable/Magneto-optic disks:

The optical disks that can be erased and written to with the new information. CR-RW, DVD-RAM, DVD-RW, and magneto-optic disks and Data Play are rewritable. Rewritable disks use magneto-optic or phase change technology.

Compact Disc-Read only Memory

CD-ROM is an adaptation of the CD that is designed to store computer data in the form of text and graphics, as well as hi-fi stereo sound. A standard CD is 120 mm (4.75 inches) in diameter and 1.2mm (0.05 inches) thick and is composed of a polycarbonate plastic substrate (under layer- this is the main body of the disc) one or more thin reflective metal (usually aluminum) layers, and a lacquer coating. The advantages of using CD-ROM include:

* Capacity to store large amounts of information.
* Ability to store data, graphics, audio, and video on the same disc.
* Durability

Digital versatile/Video Disk-Read only Memory (DVD-ROM)

The major difference is that the DVD-ROM is formatted to hold far more data. A CD commonly has a capacity of 650 megabytes, while the smallest capacity DVD can store about seven times more data or 4.38 gigabytes (GB)

A DVD-ROM encodes data in the form

of a spiraling trail of pits and lands separated by mere nanometers. The trail starts at the center of the DVD-ROM and winds around countless. times untill it reaches the outer edge. In the case of a double layer disk, the trail continues on a second layer of material.

A laser beam in the DVD player tracks the beam. The reflective variance gets translated to bits of data which from bytes. The DVD-ROM can also hold more information in a higher format, and one can skip to specific scenes without the need for fast-forwarding or rewinding.

Write-Once-Read-Many (WORM)

WORM stands for write-once, read many. These optical disks can be recorded by the user only once but cannot be erased.

Compact Disc-Recordable

CD-R (for compact disc, recordable) is a type of write once, read many (WORM) compact disc (CD) formats that allows one-time recording on a disc. CD-Rs are composed of a polycarbonate plastic substrate, a thin reflective metal coating, and a protective outer coating. However in a CD-R a layer of organic polymer dye between the polycarbonate and metal layers serves as the recording medium. The composition of the dye is permanently transformed by exposure to a specific frequency of light. CD-R discs usually hold 74 minutes (650 MB) of Data. The

rewritable CDs, CD-RWs use an alloy layer (instead of the dye layer) which can be transformed to and from a crystalline state repeatedly.

DVD-R.

DVD-Recordable, shortly called as DVD-R. A DVD-R can only record data once. A DVD-R typically has a storage capacity of 4.71 GB.

CD-RW

CD-RW is an abbreviation of compact disc-rewritable. It is a recordable CD format that can be erased and rerecorded multiple times. CD-RW disc is round plastic, about 5 inches in diameter. CD-RW disks can be played or recorded in the CD-RW drive only. A CD-RW disc can be read optically by laser light.

DVD-RW

DVD-RW stands for Digital versatile Disk-Rewritable. It is a rerecordable optical DISC, which can record up to 4.7GB per side in a similar fashion to a CD-RW. DVD-RW supports sequential read/write access. The information stored on DVD-RW can be erased and rerecorded over multiple times. DVD-RW is also called DVD Dash RW.

DVD-RAM

DVD-RAM is a DVD (optical disc) technology for high-capacity data storage. DVD-RAM provides the capabilities of Rewritable CD (CD-RW)- users can run programs from the discs, copy files

to them and rewrite or delete them. DVD-RAM discs can be rewritten 100,000 times. DVD-RAM uses phase change recording, in which varying laser intensities cause targeted areas in the phase change recording layer to alternate between an amorphous and a crystalline state.