

ST. LAWRENCE HIGH SCHOOL A JESUIT CHRISTIAN MINORITY INSTITUTION



STUDY MATERIAL - 03 TOPIC – EVOLUTION OF COMPUTERS & COMPUTER ORGANIZATION

SUBJECT: COMPUTER APPLICATION

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* Processing Unit

- □ The processor is the brain of the computer and is involved in doing all the calculations that takes place whenever any data is processed.
- □ For personal computers, the main processor is known as the microprocessor, which is a single chip mounted on the motherboard.
- □ For larger computers, a single microprocessor may be replaced by several parallel processors, which work together increasing the total processing power of the computer.
- **D** These are collectively known as Central Processing Unit or CPU.

Central Processing Unit(CPU) :

CPU is made up of two basic components:

- ✓ Control Unit (CU)
- ✓ Arithmetic and Logic Unit(ALU)

The CPU also contains a set of memory registers to temporarily store Instructions and data during processing.

Each processor has its own instruction set, built into its hardware.



• Control Unit(CU):

During data processing, the control unit carries out the following functions:

- <u>Control supervision</u>: The control unit acts like a supervisory unit in the CPU and is responsible for issuing control instructions.
- <u>Activate memory locations</u>: To read the data and instruction from the main memory, the CU issues control signals to activate windows memory locations.
- **Decode instructions**: The decoder present inside the CU is used to decode an instruction.
- <u>Control coordination</u>: The CU is responsible for coordination between the memory and different input output devices.
- Arithmetic and Logic Unit(ALU) :
 - □ The ALU is the place where the actual execution of the instructions takes place during data processing.
 - □ It is responsible for carrying out different arithmetic and logical operations with the help of some special purpose registers, an adder and a comparator circuit.
 - During calculation, data is first moved from the main memory to temporary storage registers in the ALU.
 - **□** The data are then transferred to the adder or the comparator circuit.
 - □ After the operation, the result is stored back in the accumulator.
 - □ Finally the result is moved from the accumulator to the main memory through the storage registers.

The ALU carries out the following functions:

- > Fetch data
- Carry out calculations
- > Compare data
- Logical operation

Store processed data

Microprocessor:

- ✓ When the functions of a CPU are integrated on a single integrated circuit (IC), using ULSI technology, then it is called a microprocessor.
- ✓ After many stages of development nowadays, multicore processors are in use.
- ✓ For example, a dual core processor is basically two microprocessors built into one IC package.

* <u>Storage Devices</u>

- □ All computer data and instructions are stored in special locations of the computer called the computer memory.
- **Depending upon the type of storage, there are two basic types of memories:**
 - > Primary memory
 - Secondary memory

• <u>Primary Memory</u> :

This is the main memory of the computer and computer cannot run without it.

The types of primary memory are:

- Random Access Memory (RAM)
- Read Only Memory (ROM)

Random Access Memory (RAM) :

RAM is a volatile memory that is used to store instructions and data temporarily, needed during the program execution.

Depending on its retentive power, a RAM can be broadly classified into:

- ✓ Dynamic RAM: It is a volatile memory that usually consists of a transistor and a capacitor. As the memory cell needs to be recharged at regular intervals of time to retain its data, this type of RAM is called dynamic. DRAM has high packing density and lower cost. DRAM is used to make working memory of computer.
- ✓ Static RAM: Static RAM is also volatile memory which is made using special memory elements called memory latch. These RAM do not require periodic refreshing of the existing data, so are called static RAM. They are much faster than DRAM. They have lower packing densities and are costly. SRAMs are used to make cache memory of a computer.

* Read Only Memory (ROM) :

ROM is a non volatile memory that stores instructions that are required by the computer during start-up.

There are various types of ROMs available based on methods used to write new data to them and the number of times they can be rewritten:

- ✓ ROM: These are the first semiconductor ROMs that contained a pre-programmed set of data or instructions.
- PROM(programmable ROM): It is purchased in unprogrammed state. A device programmer is used to write data into PROM. Once a PROM has been programmed, its contents are permanent.

✓

- ✓ EPROM(erasable and programmable ROM): It is programmed in exactly the same manner as a PROM. However EPROM can be erased and reprogrammed repeatedly. The process of erasing is done by exposing EPROM to a strong source of ultraviolet light. By doing this, the entire chip is reset to its initial unprogrammed state.
- ✓ EEPROM(electrically erasable and programmable ROM) : Internally it is similar to EPROM, but instead of using UV light, the erase operation is done electrically. Any byte within an EEPROM can be erased and rewritten without reprogramming the whole chip.

<u>Secondary Memory</u>

- Secondary memory is computer memory that is non-volatile and persistent in nature and is not directly accessed by a computer/processor.
- It allows a user to store data that may be instantly and easily retrieved, transported and used by applications and services.
- > Secondary memory is also known as secondary storage.

Magnetic Disk:

A magnetic disk is a storage device that uses a magnetization process to write, rewrite and access data. It is covered with a magnetic coating and stores data in the form of tracks, spots and sectors. Hard disks, zip disks and floppy disks are common examples of magnetic disks.

Hard Disk Drive(HDD):

Hard disk drive is a Direct Access Storage Device(DASD), made up of a series of circular disks called platters arranged one over the other almost ½ inches apart around a spindle. Disks are made of non-magnetic material like aluminium alloy and coated with 10-20 nm of magnetic material.

Standard diameter of these disks is 14 inches and they rotate with speeds varying from 4200 rpm (rotations per minute) for personal computers to 15000 rpm for servers. Data is stored by magnetizing or demagnetizing the magnetic coating. A magnetic reader arm is used to read data from and write data to the disks. A typical modern HDD has capacity in terabytes (TB).

Hard disks can be used in a computer system only after they are prepared by a process called disk formatting. During formatting, a pattern divides the disk surface into a number of invisible concentric logical circles called *Tracks*. Each track is again subdivided into smaller sections called *Sectors*. Disk drives, read/write the whole sectors at a time. Some OS like Windows combine several sectors to form *Clusters*.

Several factors determine the time required to access the data during a read/write operation. The disk access time is the interval between the time a computer makes a request for data transfer from disk to primary memory, and the time this operation is completed. The disk access time depends on:

Seek Time: When anything is read or written to a disc drive, the read/write head of the disc needs to move to the right position(track). The actual physical positioning of the read/write

head of the disc is called seeking. The amount of time that it takes the read/write head of the disc to move from one part of the disk to another is called the seek time.

Latency: Once the track is selected and the read/write head is activated, the time required to position the desired sector under the read/write head is called Latency or Rotational Delay.

Data Transfer Rate: Once read/write head is positioned, the rate at which the data is read or written onto the disk is called Data Transfer Rate or Block Transfer Rate.

Access time = Seek Time + Latency + Data Transfer Rate



- Floppy Disk :
- This is another type of Direct Access Storage Device(DASD), which is a removable plastic diskette coated with a magnetic material and has a much lower storage capacity.
- > Three different standards of Floppy disks were available.
- ✓ The first one was an 8-inch variety with a storage capacity of 80KB.
- ✓ Later 5 1/4-inch with 1.2MB storage and
- ✓ 3 1/2 inch with 1.44MB storage.
- > Nowadays, floppy disks have become obsolete, being replaced by high capacity flash drives



Optical Media

Optical media refers to discs that are read by a laser. This includes CD-ROMs, DVD-ROMs, and all the variations of the two formats -- CD-R, CD-RW, DVD-R, DVD+R, Blu-ray, and many others.

CD Drive

CD stands for Compact Disk. CDs are circular disks that use optical rays, usually lasers, to read and write data. They are very cheap. CDs are inserted in CD drives built into CPU cabinet. They are portable as you can eject the drive, remove the CD and carry it with you. There are three types of CDs –

- □ CD-ROM (Compact Disk Read Only Memory) The data on these CDs are recorded by the manufacturer. Proprietary Software, audio or video are released on CD-ROMs.
- □ CD-R (Compact Disk Recordable) Data can be written by the user once on the CD-R. It cannot be deleted or modified later.
- □ CD-RW (Compact Disk Rewritable) Data can be written and deleted on these optical disks again and again.



DVD Drive

DVD stands for Digital Video Display. DVD are optical devices that can store 15 times the data held by CDs. They are usually used to store rich multimedia files that need high storage capacity. DVDs also come in three varieties – read only, recordable and rewritable.

Blu Ray Disk

Blu Ray Disk (BD) is an optical storage media used to store high definition (HD) video and other multimedia files. BD uses shorter wavelength laser as compared to CD/DVD. This enables writing arm to focus more tightly on the disk and hence pack in more data. BDs can store up to 128 GB data.



Flash Memory:

Flash memory is a non-volatile solid state storage device, which means that there are no mechanical moving parts.. It has the ability to be electronically reprogrammed and erased like EEPROM and uses a Floating-gate transistor for storing data. It is often found in USB flash drives, MP3 players, digital cameras and solid-state drives.

Pen drive:

These are USB flash drive consisting of USB flash memory integrated with a USB interface. They are now used as a replacement to the floppy disks and are available in various high capacity sizes. Some drives allow 1 million write or erase cycles and have 10-year data retention. Flash drives are not prone to dust and are mechanically very sturdy, hence, suitable for transporting data from place to place.



Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and the main memory. It is used to hold those parts of data and program which are most frequently used by the CPU. The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.

- > Advantages:
- **Cache memory is faster than main memory.**
- □ It consumes less access time as compared to main memory.
- □ It stores the program that can be executed within a short period of time.
- □ It stores data for temporary use.
- > Disadvantages:
- **Cache memory has limited capacity.**
- □ It is very expensive.

Communication Bus

- □ In computer architecture, a bus (historically also called data highway) is a communication system that transfers data between components inside a computer, or between computers.
- These are a set of parallel wires through which data, address and control information flows from one part of the computer to another. Bus can be broadly classified into the internal bus and the external bus.
- **□** The internal bus is used to connect the internal components of the CPU.

- **D** The external bus connects the CPU with the external memory and the input output systems.
- Bus consists of three main components:
- Address bus carries memory addresses from the processor to other components such as primary storage and input/output devices. The address bus is unidirectional.
- Data bus carries the data between the processor and other components. The data bus is bidirectional.
- Control bus carries control signals from the processor to other components. The control bus also carries the clock's pulses. The control bus is unidirectional.



Universal Serial Bus(USB)

A Universal Serial Bus (USB) is a common interface that enables communication between devices and a host controller such as a personal computer (PC). It connects peripheral devices such as digital cameras, mice, keyboards, printers, scanners, media devices, external hard drives and flash drives.

□ Although there are several types of USB connectors, the majority of USB cables are one of two types, type A and type B.

- □ The USB 2.0 standard is type A; it has a flat rectangle interface that inserts into a hub or USB host which transmits data and supplies power.
- □ A keyboard or mouse are common examples of a type A USB connector.
- □ A type B USB connector is square with slanted exterior corners. It is connected to an upstream port that uses a removable cable such as a printer.



- **The type B connector also transmits data and supplies power.**
- □ USB Version 1 allowed for two speeds: 1.5 Mb/s (megabits per second) and 12 Mb/s, which work well for slow I/O devices.
- **USB** Version 2 allows up to 480 Mb/s and is backward compatible with slower USB devices.
- □ USB 3.0 is the third major version of the Universal Serial Bus standard for interfacing computers and electronic devices.
- Among other improvements, USB 3.0 adds the new transfer rate referred to as SuperSpeed USB that can transfer data at up to 5 Gbit/s, which is about 10 times faster than the USB 2.0 standard



USB-C is the emerging standard for charging and transferring data.

- **USB-C** features a new, smaller connector shape that's reversible so it's easier to plug in.
- □ USB-C cables can carry significantly more power, so they can be used to charge larger devices like laptops.
- □ They also offer up to speed of 10 Gbps.

Presently, USB is the most popular communication bus used to attach peripheral devices to a computer.



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