

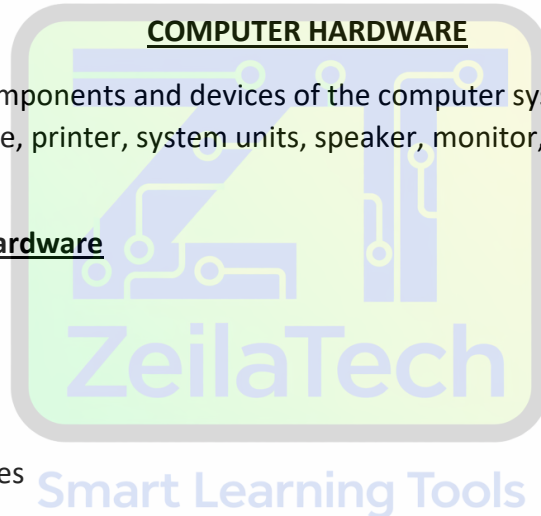
CHAPTER THREE (3)

INTRODUCTION TO COMPUTER HARDWARE

LESSON OBJECTIVES

The student will be able to:

- Describe functions of hardware components of a computer system.
- Identify the types of Input and Output devices
- Identify the main parts of the CPU.
- Describe the processes involved in the machine cycle
- Define the terms associated with the workings of the CPU.
- Identify the main and backup storage media and their devices.
- Discuss the functions of the primary and secondary storage media and their devices
- Distinguish between the primary and secondary storage media.
- Describe the disk filing system and hierarchical directory structure.



It is the physical, electrical components and devices of the computer system that you can see and touch. For example, keyboard, mouse, printer, system units, speaker, monitor, cables that connect the devices etc.

Classification of Computer Hardware

1. Input Devices
2. Processing Devices
3. Output Devices
4. Storage Devices
5. Communication Devices
6. System Unit

INPUT DEVICES

Input Devices are any hardware components that allow users to enter data and instructions into a computer system for processing. Input devices convert data e.g., text, image, drawings into a form that a computer can understand and use. Keyboard and Mouse are the most popular input unit devices.

EXAMPLES OF INPUT DEVICES

Keyboard

A device that converts letters, numbers, and other characters into electronic signals that are machine-readable by the computer's processor. The keyboard has a direct link with the central processing unit (CPU). The most common English-language key pattern for typewriters and keyboards is called QWERTY. Computer keyboards comes in either **QWERTY** or **DVORAK** keyboard layout.



Mouse

A **mouse** is a handheld pointing device for computers, involving a small object fitted with one or more buttons and shaped to sit naturally under the hand. It is used to open and close files, navigate web sites, and click on commands (to tell the computer what to do) when using different applications.

The types of mouse are Wireless, Trackball, Optical, G-stick and Mechanical.

Digital Camera

It can be used to take pictures. It can be hooked up to a computer to transfer the pictures from the camera to the computer. Some digital cameras hold a memory card that can be taken out of the camera and put directly into the computer's memory card reader.



Scanners

It uses laser beams and reflected light to translate images of text, drawings, photo and like into digital form. The types of Scanners are

- **Image Scanner:** A scanner is used to copy pictures or other documents and save them as files on the computer.
- **Bar Code (reader) Scanner:** Barcode scanner is an electronic device that can read and output barcodes to a computer.
- **Faxing Machines:** It is an electronic device that scans a document and transmit it through a telephone line system to a receiving fax machine which then print out the document as an image.



In addition, others like Mark/Character Recognition devices, and Imaging Systems.

Joystick

It used to move the cursor from place to place, and to click on various items in programs. A joystick is used mostly for computer games.



Microphone (mic)

Is a transducer that converts sound into electrical signals. Microphones are used in many applications such as telephones, hearing aids, public address systems, etc.



PROCESSING DEVICES

When a computer receives data from an input device (e.g., keyboard or mouse), the data must go through an **intermediate stage** before it can be sent to an output device (e.g., monitor or printer). A processing device is any device in a computer that handles this **intermediate stage**. For example, the Central Processing Unit.

CENTRAL PROCESSING UNIT (CPU)



CPU is the electronic circuitry within a computer that carries out the instructions of a computer program by performing the basic arithmetic, logical, control and input/output (I/O) operations specified by the instructions.

CPU is the brain of the computer also called processor/ Microprocessor, which is responsible for data processing. The CPU sits in the motherboard as the processor. Some computers

employ a multi-core processor, which is a single chip containing two or more CPUs called cores

COMPONENTS OF A CPU

1. **Arithmetic Logic Unit (ALU):** ALU performs arithmetic and logic operations. ALUs are capable of calculating the results of a wide variety of basic arithmetical computations. The ALU can perform 4- kinds of arithmetic operations (mathematical operations) that is **addition, subtraction, multiplication and division**. The ALU also performs logical operations such as Equal-to (=)

conditions, Less-than (<) conditions, Greater-than (>) conditions, which is usually a comparison of letters, numbers or special characters.

2. **Control Unit (CU):** CU extracts instructions from memory, decodes, and executes them, calling on the ALU when necessary. Control Unit controls the fetching (from memory) and execution of instructions by directing the coordinated operations of the ALU, registers and other components.
3. **Register:** Registers are temporary storage areas for instructions or data. They are not a part of memory; rather they are special additional storage locations that offer the advantage of speed. Registers work under the direction of the CU to accept, hold, and transfer instructions or data.

The are many registers including;

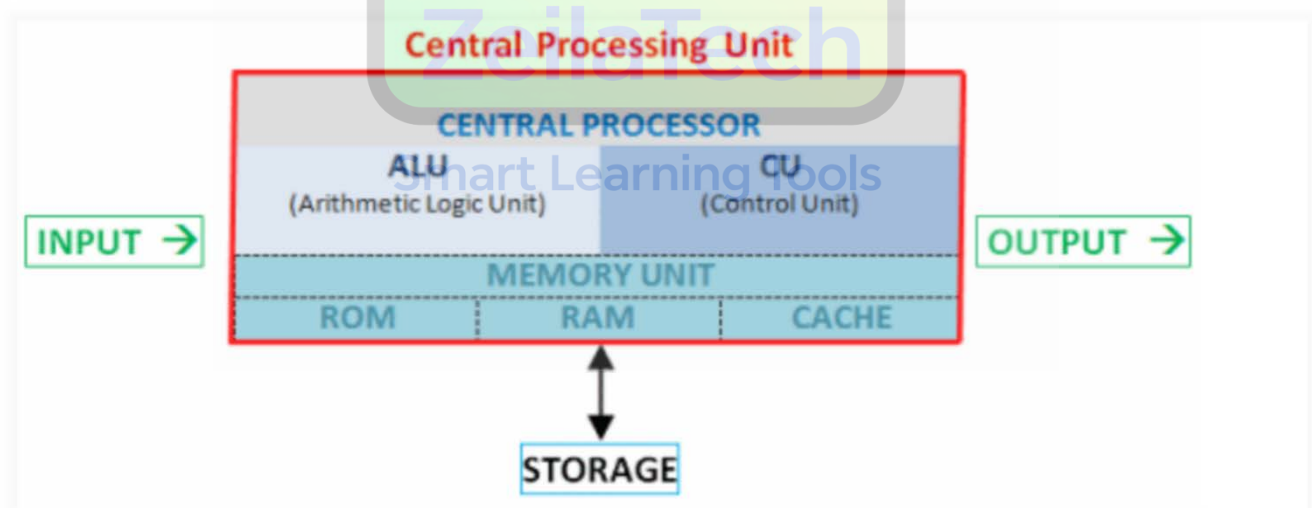
- **Memory Address Register (MAR):** Holds the address of a location in memory.
- **Memory Data Register (MDR):** Holds data just read or written to memory.
- **Program Counter (PC):** Holds the address of the next instructions to be fetched.
- **Instruction Register (IR):** Holds the current instruction being executed.
- **General Purpose Registers:** Can be used by programmers.

NB: The more registers a CPU has available, the faster it works.

4. **Memory Unit:** the area of storage in a computer that maintains information for instant retrieval and processing, as distinct from disk storage. The Memory buffer that temporarily stores data the processor needs, allowing the processor to retrieve the data faster than if it came from main memory.

It holds random data, usually on first in first out, or first in last out basis.

RELATIONSHIP BETWEEN THE ELEMENTS OF CPU, INPUT, OUTPUT, AND MEMORY



MACHINE CYCLE

Machine Cycle is a series of steps CPU takes to execute an instruction. The machine cycle is a 4-process cycle that includes reading and interpreting the machine language, executing the code and then storing that code.

Four steps of Machine cycle:

1. **Fetch**: Retrieve an instruction from the memory. Before the CPU can execute an instruction, the control unit must retrieve or fetch a command or data from the computer's memory.
2. **Decode**: Translate the retrieved instruction into a series of computer commands. Before a command can be executed, the control unit must decode the command into instruction set into form the ALU can understand.
3. **Execute**: Execute the computer commands. When the command is executed, the CPU carried out the instructions in order by converting them into macrocode.
4. **Store**: Send and write the results back in memory. The CPU may be required to store the result of an instruction in memory.

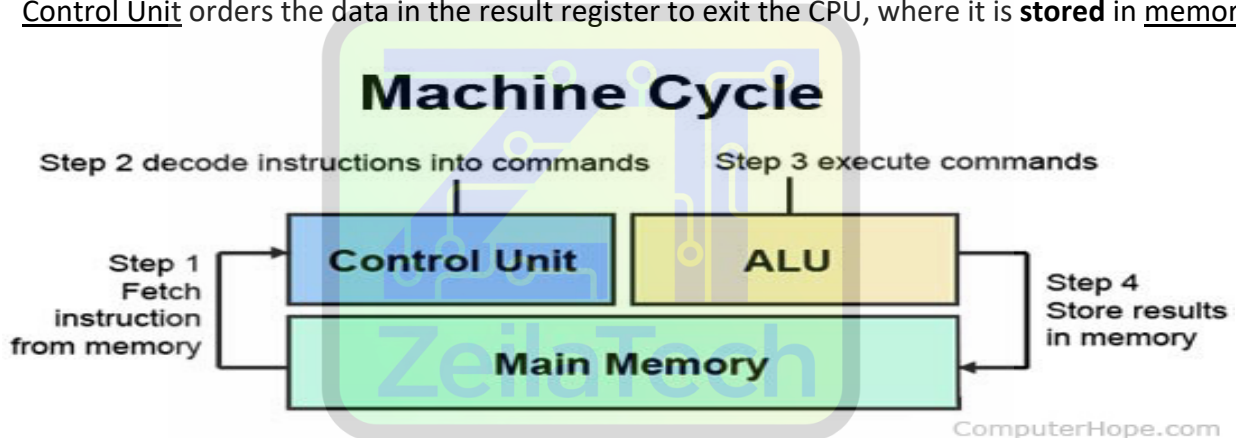
Simplified

Control Unit **fetches** the data from the RAM and places it in the data registers, and **fetches** the instruction and places it in an instruction register.

Control Unit **decodes** the instruction to determine what needs to happen and tells the ALU.

ALU **executes** the instruction and places the result in a result register (accumulator).

Control Unit orders the data in the result register to exit the CPU, where it is **stored** in memory.



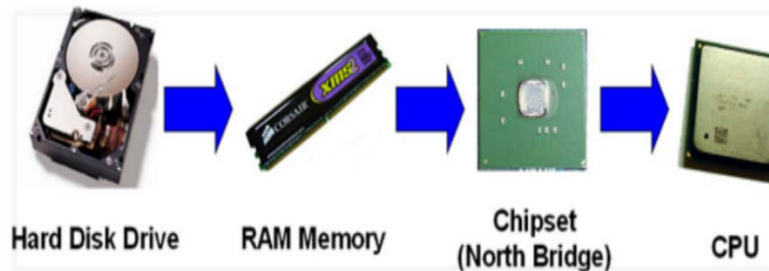
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WHEN YOU DOUBLE CLICK ON AN ICON TO RUN A PROGRAM, HERE IS WHAT HAPPENS:

1. The program, which is stored inside the hard disk drive, is transferred to the RAM memory.
2. The CPU, using a circuit called memory controller, loads the program data from the RAM memory.
3. The data, now inside the CPU, decoded and given to the ALU to work on (processing).
4. The CPU could continue to load and executing the program, depending on the program (instructions).
5. It is then sent back to the main memory for temporal storage before giving it out as information (displaying something on the screen).

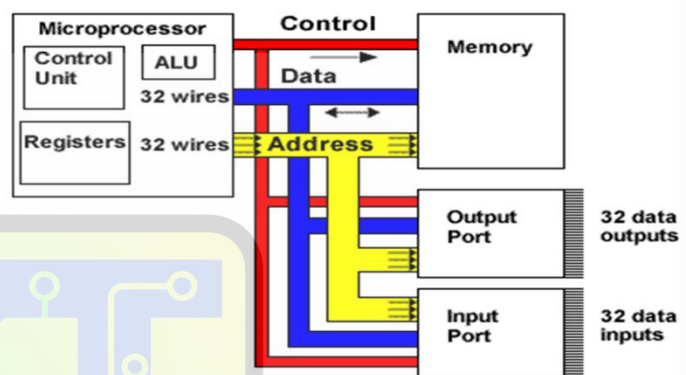
NB: A program is a series of instructions to the CPU.

HOW STORED DATA IS TRANSFERRED TO THE CPU



Terms associated with the workings of CPU

- Main memory and addresses:
- Address bus and address space
- Data bus and word length
- The instruction set
- Processor speed



Memory: Memory is the physical storage space in computer where data is processed and instructions required for processing are stored. Memory is a collection of cells, each with a unique physical/memory address. Each cell can hold one byte or 8 bits

Memory Address: A memory address is a unique identifier used by a device or CPU for data tracking. A memory address is a reference to a specific memory location used at various levels by software and hardware. This binary address is defined by an ordered and finite sequence allowing the CPU to track the location of each memory byte.

Computer Bus: A computer bus is a pathway through which the processor communicates with the internal and external devices attached to the computer. Bus transfers the data between the computer subsystems and between the computers and sends the instructions to and from the processor and the different devices. It connects all internal computer components to the main memory and the central processing unit.

Address Bus: It is the set of wires that carry the addressing information used to describe the memory location to which the data is being sent or from which data is being retrieved. Address bus is a part of the computer system bus that is dedicated for specifying a physical address. When the computer processor needs to read or write from or to the memory, it uses the address bus to specify the physical address of the individual memory block it needs to access (the actual data is sent along the data bus).

Address Space: It is the range of discrete addresses, each of which may correspond to a network host, peripheral device, disk sector, a memory cell or other logical or physical entity. Address spaces are created by combining enough uniquely identified qualifiers to make an address plain within the address space. For

a person's physical address, the address space would be a combination of locations, such as a neighbourhood, town, city, or country.

Data Bus: A data bus simply carries data. The same data bus is used for both read/write operations. The data bus consists of 8, 16, or 32 parallel lines. The data bus is bidirectional bus, means the data can be transferred from CPU to main memory and vice versa.

NB: A **data bus** carries data while an **address bus** carries instructions.

Word length: Refers to the maximum number of bits it can take as input. Word length is also the number of bits a computer can process in a single operation. The computer further takes this input for process and gives the output.

Instruction Set: is a group of commands for a CPU in machine language. The instruction set provides commands to the processor, to tell it what it needs to do. The instruction set, also called instruction set architecture (ISA).

Examples of instruction set

- ADD - Add two numbers together.
- COMPARE - Compare numbers.
- IN - Input information from a device, e.g., keyboard.
- JUMP - Jump to designated RAM address, etc.

Processor Speed: This refers to the speed at which a microprocessor executes instructions. This is usually measured in megahertz (MHz) or gigahertz (GHz). Processor speed is more important because the CPU is the driving force and brain of your computer. A Processor works by performing instructions from its instruction set. A GHz means one billion hertz or cycles per speed.

The rate at which the CPU executes instructions is dependent on the **system clock (clock rate)**.

System Clock/Clock Rate: Is an internal clock that regulates the rate which the instructions are executed and synchronises all the various computer components. The system clock is measured in Hertz, Megahertz, Gigahertz, etc.

NB: Processor speed is the same as clock speed of a CPU. **The clock speed of a CPU** is the frequency at which the processor executes instructions or data are processed.

Simple analysis:

- Machine A: 1.3 GHz Pentium 4 with 4gigs of ram
- Machine B: 2.2 GHz Core 2 duo with 2gigs of ram
- Machine B will run faster as it's a dual core CPU with higher clock speed and it will better utilize the 2gigs of ram. Even if both machines had 2gigs of ram, machine B would still run faster and more efficient.

32-BIT vs. 64-BIT PROCESSORS

In computing, there exist **two type processor i.e., 32-bit and 64-bit**. This processor tells us how much memory a processor can have access from a CPU register. For instance,

- A 32-bit system can access 2^{32} memory addresses, i.e., 4 GB of RAM or physical memory.
- A 64-bit system can access 2^{64} memory addresses, i.e., actually 18-Quintillion GB of RAM. In short, any amount of memory greater than 4 GB can be easily handled by it.

Advantages of 64-bit over 32-bit

- Using 64-bit one can do a lot in multi-tasking, user can easily switch between various applications without any windows hanging problems.
- Gamers can easily play High graphical games like Modern Warfare, GTA V, or use high-end software like Photoshop or CAD, which takes a lot of memory, since it makes multi-tasking with big software easy and efficient for users. However, upgrading the video card instead of getting a 64-bit processor would be more beneficial.
- A computer with a 64-bit processor can have a 64-bit or 32-bit version of an operating system installed. However, with a 32-bit operating system, the 64-bit processor would not run at its full capability.
- On a computer with a 64-bit processor, we can't run a 16-bit legacy program. Many 32-bit programs will work with a 64-bit processor and operating system, but some older 32-bit programs may not function properly, or at all, due to limited or no compatibility.

OUTPUT DEVICE

Output Device is any hardware component that sends information out of the computer or provides the result of processing from the computer to the user. This device receives information from CPU and converts into suitable human readable form. Example of output devices are Monitor, Printer, Plotter, Projector, Speaker, etc.

EXAMPLES OF OUTPUT DEVICES

Monitor

A monitor displays information that is user readable (user-language) such as words, numbers, graphics, etc.



Three (3) main qualities that affect the screen clarity of the monitor:

1. Resolution,
2. Dot pitch
3. Refresh Rate.

There are basically two (2) types of computer monitor

1. **Cathode Ray Tube (CRT):** Cathode ray tubes are glass tubes that are narrow at one end, and open up to a wide screen at another.
2. **Flat Panel:** Flat panel displays are made up of two plates of glass with a substance in between them, which is activate in different way. The substance between the plates is either
 - **LCD (Liquid crystal display):** It consist of liquid crystal display the molecules which line up in a way that alters their optional properties and as a result backlighting behind the screen is blocked to create an image
 - **ELs (Electroluminescent display):** It consist of a substance that grows when it is charged by an electric current
 - **Gas plasma:** It's displays uses a gas that emits light in the presence of an electric current
 - **Light-emitting diodes (LED).** Is a semiconductor light source that emits light when current flows through it.

Printer

A printer is an external output device that takes data from a computer or other device and generates output in the form of graphics / text on a paper (hardcopy).



There are two (2) types of Printers:

1. **Impact Printers:** refers to a class of printers that work by banging a head or needle against an ink ribbon to make a mark on the paper. This printer uses striking mechanism such as a print hammer. Examples of impact printer: Dot matrix, Daisy wheel, Line, Drum, chain and Band printers.
2. **Non-impact printer:** Form characters and images by fusing toner to the page electronically or spraying droplets of ink. Examples of Non-impact printer: Ink-jet printers, Laser Printer, thermal printer.

Speaker

A speaker gives you sound output from your computer. Some speakers are built into the computer and some are separate. Headphones give sound output from the computer. They are similar to speakers; except they are worn on the ears so only one person can hear the output at a time.



Projector

A Projector is an output device that can take images generated by a computer and reproduce them onto a screen, wall or other surface. The surface projected onto is large, flat and lightly coloured. Projector can produce either still (slides) or moving picture (videos).



Plotter

A plotter is a computer hardware device that is used for printing vector graphics on a large format while maintaining high resolution. Plotter prints on wide variety of flat materials such as plywood, aluminium, sheet steel, cardboard and plastic. It is quite large as compared to the traditional printer.



STORAGE DEVICES

Storage devices are any hardware components that enables a user to store data, information or an instruction. Examples CD ROM Drive, Floppy Disk Drive, Flash Drive, Hard Disk, RAM, etc.

- **Writing** is the process of transferring data, information, and instructions from a computer's memory to a storage medium.
- **Reading** is the process of transferring data, information, and instructions from a storage medium into a computer's memory.

TYPES OF STORAGE MEDIA

Storage Media are the hardware component on which data or information is stored.

There are two types of storage media, which are

1. **Primary (main) Storage Media** and
2. **Secondary (backup) Storage Media.**

Data is stored either on a primary or secondary storage.

PRIMARY STORAGE MEDIA

Primary storage media are the only memory that is directly accessible to CPU and have fastest data access speed. Primary storages are set of chips plugged in the motherboard and hardware capable of holding information temporarily.

Types of Primary storage

1. Random Access Memory (RAM)
2. Read Only Memory (ROM)
3. Cache memory

Random Access Memory (RAM)

A computer writes and reads (i.e., storing and retrieving) information to and from the RAM, for processing by the CPU and the results are returned to RAM. RAM derives its name for the fact that any of its memory cells can be accessed directly. It is a **volatile** memory that is the data vanishes when the power supply is cut off. The amount of RAM determines how many programs can be executed at one time and how much data can be readily available to a program.

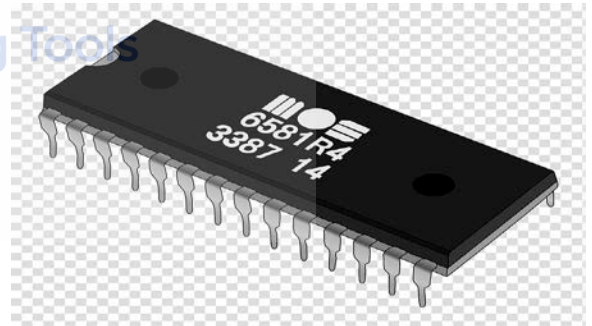


There are two (2) types of RAM

1. **SRAM (Static Random Access Memory)**: It is faster than the DRAM as it uses a six-transistor configuration. In this, the direction of current depicts the value 0 or 1. SRAM holds data in a static form, as long as the memory has power. It is expensive than DRAM. This memory need not to be refreshed frequently.
2. **DRAM (Dynamic Random Access Memory)**: This is Dynamic Random Access Memory that stores each bit of data in separate capacitor. The capacitor can be either charged or discharged; these two states are taken to represent the two values of bit that are 0 and 1. This memory needs to be refreshed periodically.

Read Only Memory (ROM)

ROM is “built-in” computer memory containing data that normally can only be read, not written to. ROM is one in which information are stored permanently. It is **non-volatile** memory that is it does not loss data when the power is cut off.



There are four (4) types of ROM

1. **PROM (Programmable Read Only Memory)**: It is manufactured as a blank memory and then the data is written on it also called burning the program. The recorded information cannot be changed and the data can be written only once. It is also non-volatile storage. E.g., video games, mobile phones etc.
2. **EPROM (Erasable Programmable Read Only Memory)**: It is a special type of ROM that retains its contents until it is exposed to ultraviolet light. The ultraviolet light clears its contents, makes it

possible to reprogram the memory. It was used in the old IBM PCs and XTs for storing the BIOS information.

3. **EEPROM (Electrically Erasable Programmable Read Only Memory):** It is a special type of PROM that can be erased by exposing it to an electric charge. Like other RAM, it retains its memory even if the power is switched off. Data is written or erased one byte at a time. EEPROM chip is often referred to as the CMOS BIOS chip in computer.
4. **EAROM (Electrically Alterable Read Only Memory):** Memory can be programmed and erased by electrical signals. It does not require exposure to ultraviolet light to erase its contents. It provides easy means to load and store temporary or permanent information in a form of ROM memory. This memory can be retained for many years without any power supplied. It is a backup to RAM memory.

DIFFERENCES BETWEEN ROM AND RAM

ROM	RAM
Used primarily in the start-up process of a computer	Used in the normal processing in a computer
Permanent storage memory	Temporary storage
Is non-volatile	Is volatile
Can hold data even without electricity	Needs electricity to hold data
ROM chip can only store several megabytes of data	RAM chip can store multiple Gigabytes of data

Cache Memory

The cache is a smaller, faster memory, which stores copies of the data from the most frequently, used main memory locations (RAM). ***It acts as buffer between the CPU and main memory.***

Computer microprocessor can access cache memory more quickly than it can access regular RAM. The CPU uses cache memory to store instructions that are repeatedly required to run programs, improving overall system speed.

The advantage of cache memory is that the CPU does not have to use the motherboard's system bus for data transfer. Whenever data must be passed through the system bus, the data transfer speed slows to the motherboard's capability. The CPU can process data much faster by avoiding the bottleneck created by the system bus.



NOTE: A computer cannot run without a RAM Chip. Memory chip is an integrated circuit (IC) made up of millions of transistors and capacitors.

SECONDARY STORAGE MEDIA

Secondary storage media does not lose data when the device is powered down, means it is **non-volatile**. Secondary storage also known as **external memory or auxiliary storage** not directly accessible by the CPU.

Three types of Secondary storage media:

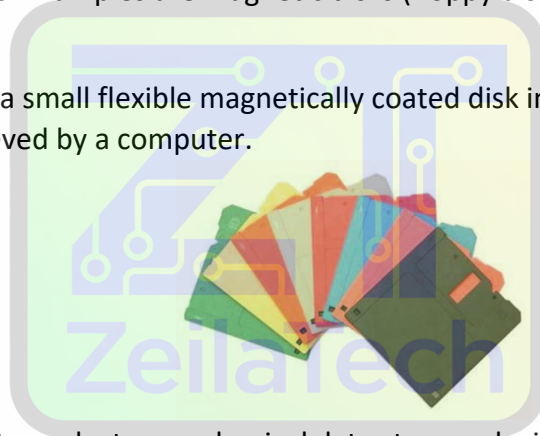
There are three (3) types of secondary storage media. These types are based on the technology they used to store data;

1. Magnetic Storage Media: e.g., floppy disk (diskette), HDD, Zip disc, Magnetic Tape, Flash drive.
2. Optical Storage Media: e.g., DVD-ROM, CD-ROM, CD-R, CD-RW, Blu-ray disk, HD DVDs.
3. Solid-State Storage: e.g., SSC, SSD, SSM.

MAGNETIC STORAGE MEDIA

A magnetic disk is a storage device that uses a **magnetization** process to write, rewrite and access data. They are type of backup storage that store data, instructions and in formation in a form of magnetic particles on their disk surfaces. Examples are magnetic disks (floppy disk/diskette, hard disk, zip disk) and magnetic tape.

- **Diskette/Floppy disk:** a small flexible magnetically coated disk in a rigid plastic case on which data can be stored or retrieved by a computer.



- **Hard Disk Drive (HDD):** an electro-mechanical data storage device that uses magnetic storage to store and retrieve digital information using one or more rigid rapidly rotating disks (platters) coated with magnetic material.



- **Magnetic Tape:** a thin ribbon of material, usually plastic, coated with iron oxide and used to record sounds, images, or data. It is the tape used in audio and video cassettes, and on computers with tape drives. The main advantage of using magnetic tape as backing storage is that it is relatively cheap and can store large amounts of data.



- **Flash memory cards (storage card):** is a small storage device that uses non-volatile semiconductor memory to store data on portable or remote computing. Capacity of flash memory card varies from Megabytes to Gigabytes.



- **USB flash drive (Pen drive/USB stick):** consists of a flash memory data storage device integrated with a USB (Universal Serial Bus) interface. **USB flash drives** are typically removable and rewritable, and physically much smaller than a floppy disk. Most weigh less than 30 gram. Storage capacities in 2010 can be as large as 256 GB with steady improvements in size and price per capacity expected.



OPTICAL STORAGE MEDIA

They are type of backup storage that store data, instruction and information on a rigid computer storage disk with data stored as tiny pits in the plastic coating, readable by **laser beam**. Data is recorded by making marks in a pattern that can read back with the aid of light, usually a beam of laser light focused on a spinning optical disc. Examples are DVD Disc, CD, CD-ROM, CD-R, CD-RW, Blu-ray Disc, etc.

- **Digital Video Disc or Digital Versatile Disc:** DVD is a 5-inch optically readable digital disk that looks like an audio compact disk but can store about 4.7 gigabytes of data on a side. Single layer DVDs can hold 4.7 GB, and double sided is 9.4GB. Dual layered DVDs can hold 8.5GB and double sided is 17GB
- **Compact Disc:** CD is an audio disk that uses digital code and that looks like a miniature phonograph record. A CD holds up to 80 minutes of high-fidelity stereo sound. Although some discs are used strictly for digital data storage, many others combine text, visuals and sound. The CD can store 700 MB of data.



- **Compact Disc-Read Only Memory:** CD-ROM is an optical-disk format that is used to hold rerecorded data such as graphics, sound, etc.
- **Compact Disc-Recordable:** CD-R is a CD format that allows you to write data onto a specially manufactured disk that can be read by a standard CD-ROM drive. CD-R cannot be erased.
- **Compact Disc-Rewritable:** CD-RW is a compact disc that can be written, read arbitrary many times, erased and written again. CD-RW is a form of CD with the same capacity.
- **Blu-ray Disc:** BD is an optical disc storage medium designed to replace the DVD format. The standard physical medium is a 12 cm plastic optical disc, the same size as DVDs and CDs. Blu-Ray Discs contain 25 GB per layer, with dual layer discs (50 GB) the norm for feature-length video discs and additional layers possible later.
- **HD DVD-ROM, HD DVD-R and HD DVD-RW:** have a single-layer capacity of 15 GB, and a dual-layer capacity of 30 GB. HD DVD-RAM has a single-layer capacity of 20 GB. All HD DVD players are backward compatible with DVD and CD.

DIFFERENCES BETWEEN SECONDARY AND PRIMARY STORAGE MEDIA

PRIMARY STORAGE MEDIA	SECONDARY STORAGE MEDIA
They are temporary storage media	They are permanent storage media
They are the main storage media	They are backup storage media
They are semiconductors	They are magnetic, optical or silicon microchip
They are volatile	They are non-volatile
Faster than secondary storage	Slower than primary storage

STORAGE IN THE CLOUD

Popular alternative to secondary storage devices is to store and manage data on a remote server. Cloud Storage is a service provided through a network (usually the internet), either free or fee based, to backup, maintain, and manage data remotely. Examples are Google Drive, SkyDrive, iCloud, Dropbox, etc.

DISK FILING SYSTEM AND HIERARCHICAL DIRECTORY STRUCTURE

FILE

File is a specific piece of data held in the computer system. Files are used for storing the information of the users. Generally, for arranging all the Files, directories or Folders are used. A folder is also called as the container of the files in which sub directors and Files are stored. Locating information of the file will be accessible from this means (Storage Architecture)

File System

The structure and logic rules used to manage the groups of information and their names is called a "file system".

Disk File System

Are file systems, which manage data on permanent storage devices.

Hierarchical File System

Is how drives, folders, and files are displayed on an operating system. In a hierarchical file system, the drives, folders and files are displayed in groups, which allow the user to see only the files they are interested in seeing (In terms of the Operating System's GUI).

Types of File Systems

- a. FAT
- b. FAT32
- c. NTFS

a. THE FAT FILE SYSTEM

File Allocation Table (**FAT**) is an old general-purpose file system that is compatible with all major operating systems (Windows, Mac OS X, and Linux/Unix). It has relatively simple technical underpinnings, and was the default for all Windows Operating Systems prior to Windows 2000. Because of its overly simplistic structure FAT suffers from issues such as over-fragmentation, file corruption, and limits to file names and sizes.

b. THE FAT32 FILE SYSTEM

FAT32 is an advanced version of FAT file system. It can be used on drives from 512 MB to 2TB in size. One of the most important features of FAT and **FAT32** is that they offer compatibility with operating systems other than Windows 2000 and above.

c. THE NTFS FILE SYSTEM

New Technology File System (**NTFS**) is a modern, well-formed file system that is most commonly used by Windows Vista, 7, 8, and 10. It has a rich feature, yet simple organization that allows to be used on very large volumes. It is recommended that NTFS be used on all media whose primarily with modern Windows Systems.

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STORAGE BLOCK

A **storage block** is a physical sector on the surface of a disk or diskette. It is the smallest unit of transference between the main memory and a given disk drive.

A **block** is a sequence of bytes or bits, having a fixed length (a block size). Data thus structured are said to be **blocked**. The process of putting data into blocks is called **blocking** while **deblocking** is the process of extracting data from blocks.

Blocking is used to facilitate the handling of the data-stream by the computer program receiving the data. Blocked data is normally read a whole block at a time.

ACCESS TIME (Latency)

The total time it takes the computer to read from a storage device such as computer memory, hard drive CD-ROM or other mechanism. Computer access time is measured in nanoseconds or milliseconds and the

lower the access time the better. For example, when a computer reading a 100MB of data an access time of 10ns is a lot faster than 50ns.

COMMUNICATION DEVICES

Is a hardware component that enables a computer to send (transmit) and receive data, instructions and information to and from one or more computers. A widely used communication device is the modem. Communications occur over cables, telephone lines, cellular radio networks, satellites, modem and other transmission media. Other Communication devices include a network interface card (NIC), Wi-Fi devices, External Storage devices, and an access point.

SYSTEM UNIT

SYSTEM UNIT

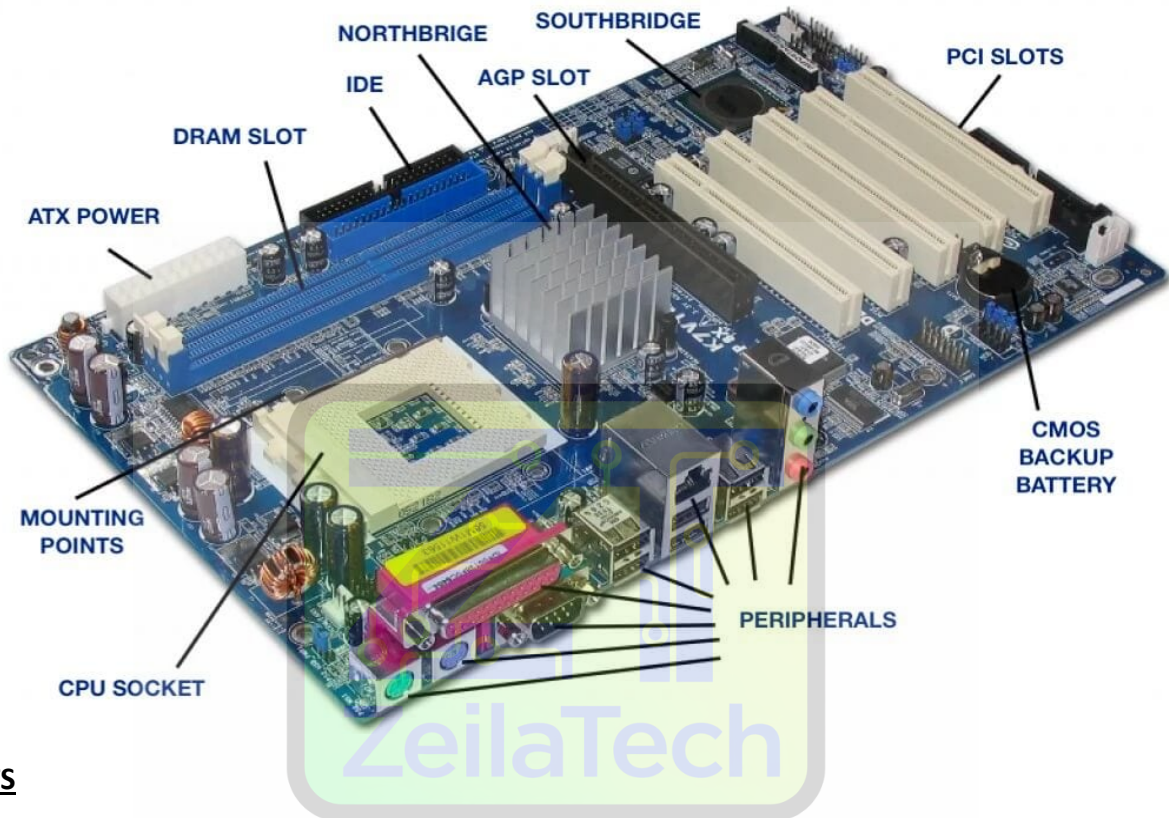
The computer System Unit is the enclosure for all the other main interior components of a computer. It is also called the case, or computer tower. System Units are available in a variety of shapes and sizes. Almost every other part of your computer connects to the system unit using cables. The cables plug into specific ports (openings), typically on the back of the system unit.



FUNCTIONS OF THE SYSTEM UNIT COMPONENTS

MOTHERBOARD

Motherboard is the main component of a computer with integrated circuitry that connects the other parts of the computer including the CPU, the RAM, disk drive (CD, DVD, Hard disk) as well as any peripherals connected via the ports.



CHIPSETS

Integrated Circuits are set of microchips that allow PC components to communicate with each other.

COMPUTER PORT

A **computer port** is a socket on the outside of the system unit that is connected to the motherboard on the inside of the system unit. It allows users to connect devices such as a monitor, printer, modem, etc. so that it can communicate with the computer.

Computer ports include:

1. PS/2 port,
2. HDMI port,
3. Parallel port,
4. Serial port,
5. Game port,
6. Video adapter port,
7. SCSI port,
8. Infrared port,
9. USB port,

10. Ethernet/Network port,
11. Power connector port,

COMPLEMENTARY METAL OXIDE SEMI-CONDUCTOR (CMOS) BATTERY

The **CMOS battery** powers the memory for date and time in the BIOS chip. This battery is generally a watch battery.

MEMORY

Memory is the physical storage space in computer where data is processed and instructions required for processing are stored. The three main types of internal memory in a computer system are RAM, ROM and cache.

CENTRAL PROCESSING UNIT

CPU is a piece of hardware that carries out the instructions of a computer program. It performs basic arithmetical, logical, and input/output operations of a computer system. The basic function of CPU is to fetch, decode and execute instructions held in RAM or ROM.

SYSTEM FAN

The **fan** is used in a computer system to suck hot air out of the system to make sure that it does not overheat. Most processors also have a fan connected to them to draw the heat away from them and ensure that it operates at the best speed possible.

HEAT SINK

The **heat sink** is used to keep systems cool by drawing the heat away from it. Heat sink is made from materials that draw heat away such as aluminium and copper and is placed on top of a processor.

INTEGRATED DRIVE ELECTRONICS

IDE is an electronic interface used between computers motherboard's data path or bus and storage devices.

ADVANCE TECHNOLOGY ATTACHMENT

ATA interface is used to connect hard drives and optical drives. Two drives can be attached on the same ribbon, one master and the other slave, and it supports almost all modern hard drives storage capacities.

SERIAL ADVANCE TECHNOLOGY ATTACHMENT

S-ATA is a computer bus interface that connect host bus to mass storage devices such as hard disk drives, optical drives and solid-state drives.

SERIAL CONNECTOR

It is used to connect peripherals in a serial communication interface through which information transfers in or out one bit at a time.

PARALLEL CONNECTORS

It is a type of interface found on computers connecting peripherals, which send multiple bits of data at once, in parallel communication.

POWER SUPPLY UNITS

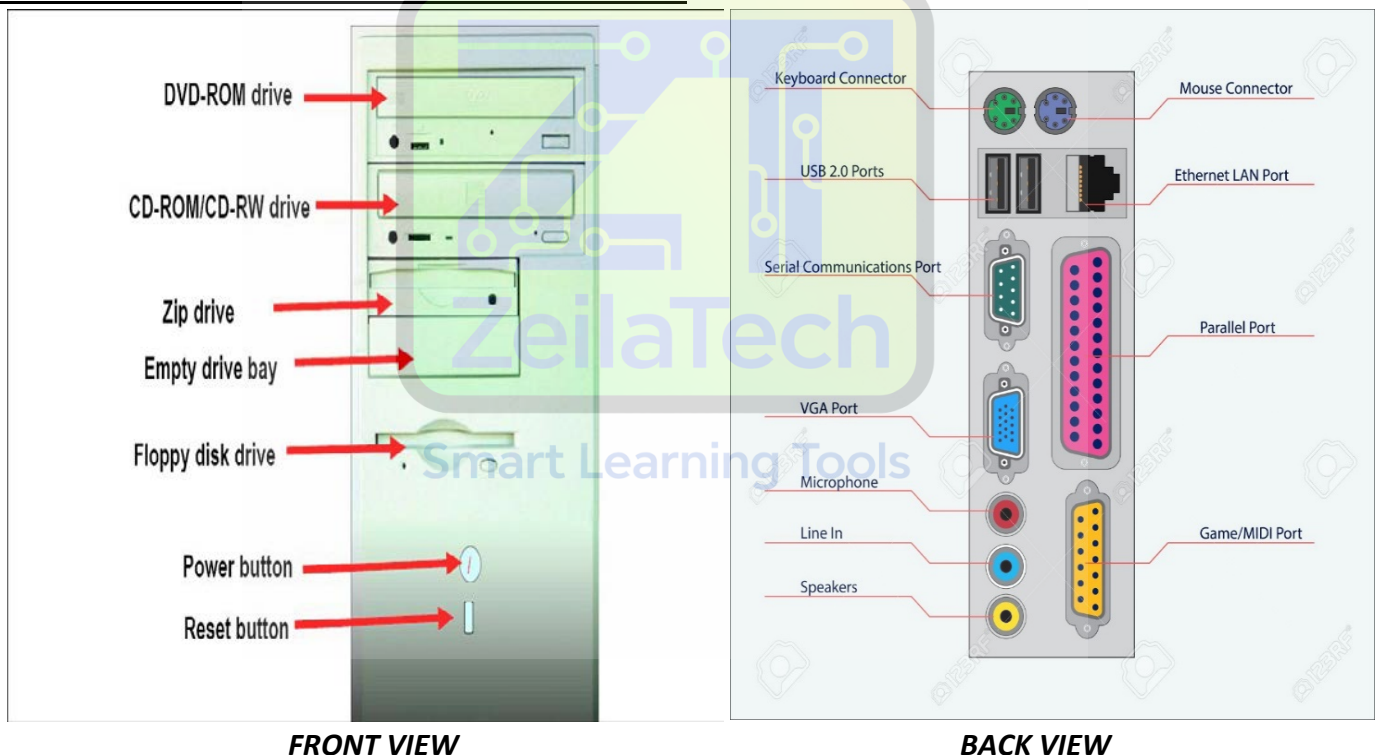
PSU converts alternating current (AC) electric power to low-voltage DC power for the internal components of the computer. Laptops are capable of running from a built-in battery, normally for a period of hours.

UNIVERSAL SERIAL BUS (USB)

Computer interface for peripherals: an external interface standard designed for communication between a computer and attached low- to mid-speed peripheral devices such as printers, scanners, and keyboards.

NOTE: A **Universal Serial BUS (USB)** can connect up to 127 different peripheral devices with a single connector type. **Peripheral Device** is a piece of computer hardware such as a printer or a disk drive that is external to but controlled by a computer's central processing unit/system unit.

FRONT VIEW AND BACK VIEW OF THE SYSTEM UNIT



BOTH INPUT AND OUTPUT DEVICES (DUAL DEVICES)

The devices that can be used to perform both functions: input and output are called **Dual Purpose Devices**. With the help of a dual-purpose device, we can enter data into computer as well as we can output data from the computer to outside world.

EXAMPLES OF DUAL-PURPOSE DEVICES

MODEM

A **modem** is considered an input/output device because a **modem** sends and receives data at the same time. For example, whenever you are surfing, you send a webpage request that its info out, or output. When you receive or access webpages, which would entail input device.

TOUCH SCREEN

One is **touch** and the other is **screen** which displays the content in the computer. Therefore, touch is basically embedded with the sensors and the screen of the device. So, in this manner **touchscreen** combined is an input and output device both.

It a computer display screen that allows user to interact with the computer by touching pictures, icons or words etc. on the screen. Examples of touch screens include smart board, ATM, microwave, dishwasher.



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HEADSET

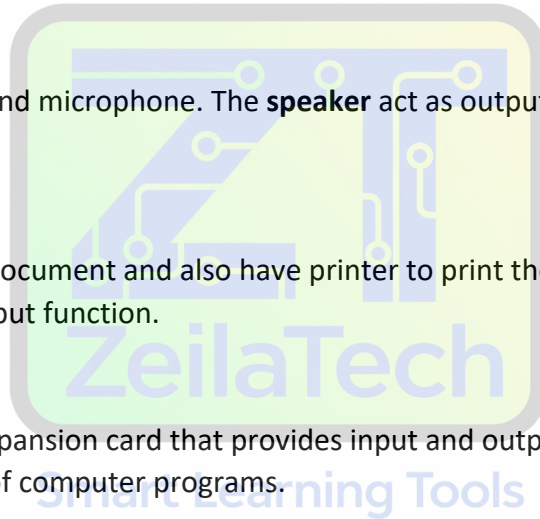
Headset consists of speaker and microphone. The **speaker** act as output device and **microphone** act as input device.

FACSIMILE (FAX)

FAX has scanner to scan the document and also have printer to print the document. Therefore, it combines both input and output function.

AUDIO/SOUND CARD

A sound card is an internal expansion card that provides input and output of audio signals to and from a computer under the control of computer programs.



LESSON ASSESSMENT

OBJECTIVES

1. A device used within the computer that conducts and draws heat away from the processor is called
 - A. Radiator
 - B. Thermostat
 - C. Heatsink
 - D. Air conditioner
2. Which of the following can be found on the motherboard?
 - A. USB Drive
 - B. CMOS battery

- C. Hard disk drive
- D. Underlying circuitry
- 3. Which of the following printers uses the striking mechanism in printing?
 - A. Dot matrix
 - B. Laser
 - C. Inkjet
 - D. Thermal
- 4. Which of the following parts of a computer performs calculations?
 - A. Cache
 - B. Hard disk
 - C. Random Access Memory
 - D. Central Processing Unit
- 5. The following are types of file management system **except**
 - A. NTFS
 - B. FAT
 - C. NTFS32
 - D. FAT32
- 6. The device that converts AC to DC to run the computer is called
 - A. Motherboard
 - B. Power converter
 - C. Power supply unit
 - D. Uninterruptible power supply
- 7. Which of the following depicts that a CMOS battery is going down? The computer
 - A. Fails to boot properly
 - B. Gives a long beep sound
 - C. Starts losing information in memory
 - D. Starts showing incorrect date and times
- 8. The part of the computer that temporarily stores data and programs for immediate processing is the
 - A. Hard disk
 - B. System unit
 - C. Read only memory
 - D. Random access memory
- 9. The central processing unit consists of control unit,
 - A. Arithmetic unit and logic unit
 - B. Arithmetic unit and processing unit
 - C. Primary storage and secondary storage
 - D. Arithmetic logic unit and basic memory
- 10. The hard disk space that the CPU uses as RAM when there is not enough RAM is called
 - A. Cache memory
 - B. Flash memory
 - C. Main memory
 - D. Virtual memory

SUBJECTIVES

1. A) What is;

- i. Computer port
- ii. Computer bus
- iii. Clock speed of a CPU

B) State one difference between;

- i. Data bus and Address bus
- ii. Magnetic disk and Optical disk

2. A) What is a computer monitor?

B) List;

- i. **three** types of computer monitors
- ii. **three** ports on the system unit that the computer monitor can be connected to
- iii. **two** colours of light generated by a computer monitor

3. A) What is a machine cycle?

B) With the help of a diagram describe the machine cycle.

C) Machine A: 1.3 GHz Pentium 4 with 4gigs of ram | Machine B: 2.2 GHz Core 2 duo with 2gigs of ram.

Which of the machine will run faster?

4. A) What is Storage System?

B) State the types of File Systems.

C) In terms of Storage Media, differentiate between Writing and Reading.