



COMPUTER HARDWARE

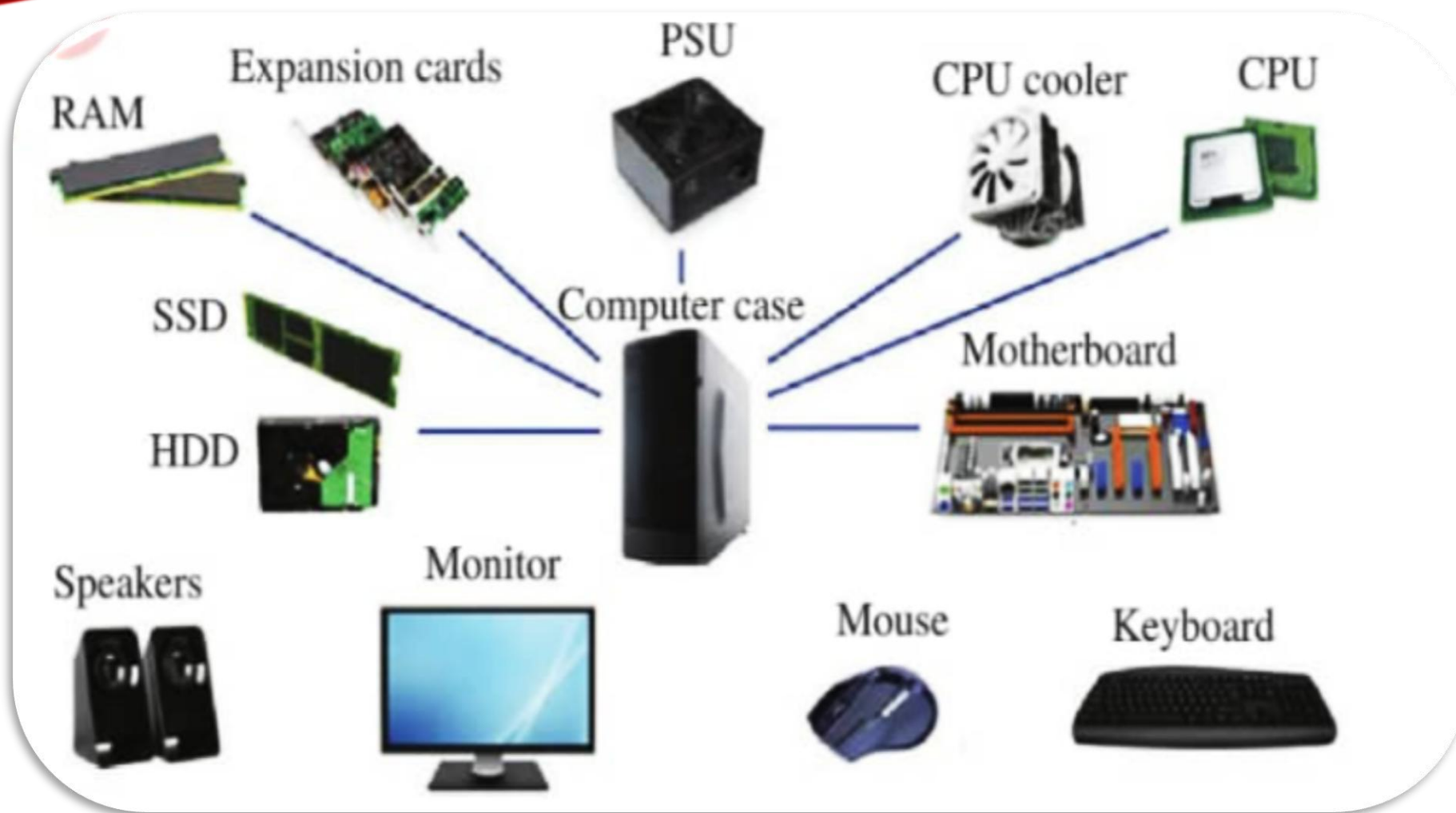
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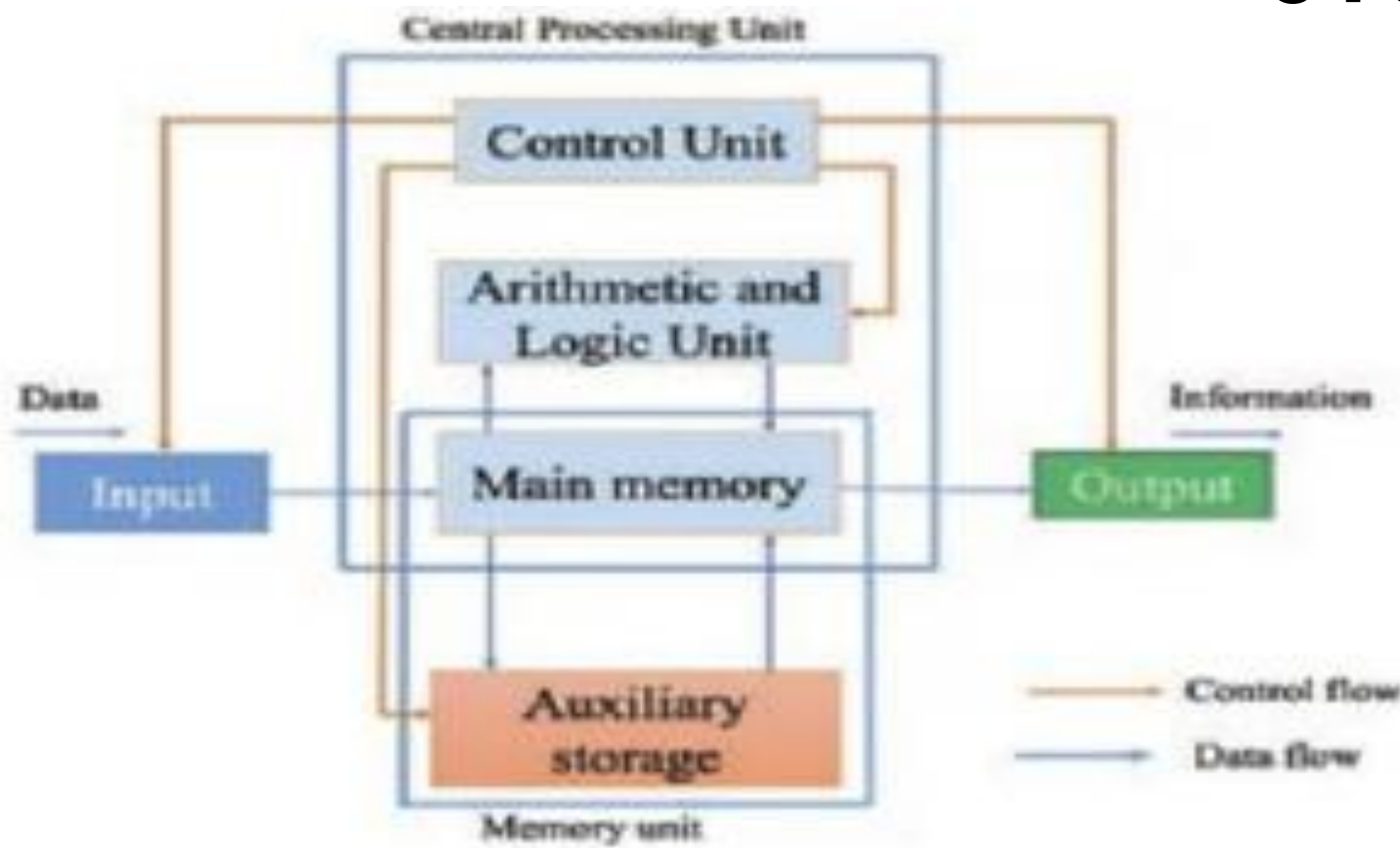
COMPUTER HARDWARE

Computer Hardware is the collection of all the tangible parts of a computer that can be seen and touched.





BLOCK DIAGRAM OF A COMPUTER SYSTEM





TYPES OF COMPUTER HARDWARE



1. Input Devices
2. Processing Devices
3. Storage Devices
4. Output Devices



1.INPUT DEVICES

1. KEYBOARDS

A computer keyboard is an input device used to enter data into the computer system by pressing buttons or keys.

It contains keys for individual letters, numbers and special characters as well as keys for specific functions and punctuation marks.



The keyboard is connected to the computer system using either a cable or a wireless connection.

Laptops have in built keyboards while other mobile devices like tablets and smartphones use virtual keyboards



DIAGRAM OF KEYBOARDS





1. Alphanumeric Keys

This part of the keyboard is for typing letters on the computer

The letters are arranged in three rows but not in the ascending order of the English letters

The first row consists of the letters Q,W,E,R,T and Y such a keyboard is known as a **QWERTY**
PROUNOUNCED AS KWER TREE



2. MODIFIERS KEYS

These are keys that modify the input of other keys

Modifiers Keys include

- a) Shift key
- b) Control key(Ctrl)
- c) Alternate key (alt)

3. FUNCTION KEYS

The keys, **F1** through **F12** are called Function keys.

They may have various uses, depending on the installed operating system

Example **Alt+F4** in Microsoft windows, the active window closes



4. THE CURSOR MOVEMENT KEYS

A cursor is a movable indicator that displays the location on a computer screen where text will be entered when a user types on the keyboard.

Example Home, End, Enter, Page up, Page down, the arrow keys



The Home key: this key when pressed it returns the cursor at the beginning of a line.

The end key This is key takes the cursor to the end of the line

The enter key moves the cursor to anew line

Page Up move the cursor to the previous page in a document

Page down: Move the cursor to the next page in a document

Arrow key : Move the cursor to the left,up,right and down



5. Special keys

These keys perform special functions

Example Tab, Caps Lock, Numlock, Num
Keys, Home, end, Enter



MICE



2. MICE

A computer mouse is a handheld hardware input device that controls a cursor in Graphical User Interface (GUI), and can move and select text, icons, files and folders on the computer.



What are the uses of a mouse?

1. Move the mouse cursor.

This the primary function is to move the mouse pointer on the screen.

2. Open or execute a program.

Once you have moved the pointer to an icon, folder or other object clicking or double clicking that object opens the document or executes the program.



3. Select.

A mouse also allows you to select text or a file or highlight and select multiple file at once.

4. Drag and drop.

Once something is selected, it can also be moved using a drag and drop method.



5. Scroll.

When working with a long document or viewing a long webpage you may need to scroll up or down, to scroll use the mouse wheel.



TYPES OF MICE



1. Mechanical mouse
2. Optical mouse
3. Infrared, R or Radio frequency cordless mouse.



1. Mechanical Mouse

Is a computer mouse that contains a metal or rubber ball on its underside.

When the rubber ball rolled in any direction, sensors inside the mouse detect mouse this motion and move the on screen mouse pointer in the same direction.





2. Optical Mouse.

An optical mouse is an advanced computer pointing device that uses a Light Emitting Diode (LED) an optical sensor.

Optical Mouse is a computer mouse which uses a light source, typically a light emitting diode(LED) and light detector to detect movement relative to a surface.





3. Cordless mouse also called Wireless mouse.

Is a mouse that connects to a computer without the use of wires, instead the mouse uses some manner of wireless technology like Bluetooth RF or Infrared radio waves.

Usually a USB receiver is plugged into the computer and receives signals from the cordless mouse.



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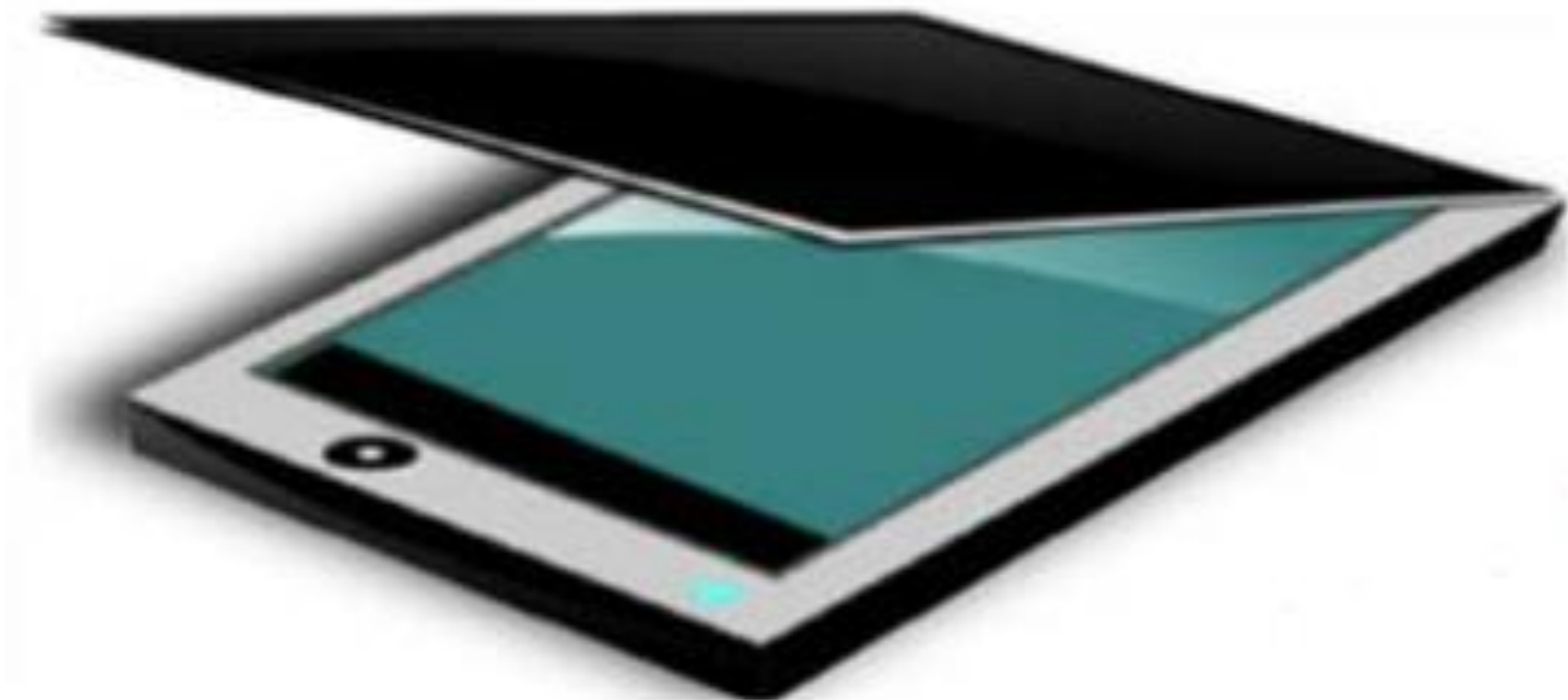
3. SCANNERS

A scanner is device that is used to convert a hardcopy document to digital form (softcopy).

The process of converting a printed format into a digital format is called **scanning**



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TYPES OF SCANNERS

a) Optical scanners

Optical scanner capture data using optical or light technology



1. Optical Marks Recognition Scanner (OMR).

Optical Marks Recognition Scanner (OMR) are used to mark multiple choice questions, analyzing, responses to structured questionnaires and selecting correct number





2. Optical Barcode Recognition (OBR)

Used to capture data corded as lines of varying thickness known as **barcodes** or **Universal Product Code (UPC)**





3) Optical Character Recognition (OCR).

Is used to read typewritten, computer printed a hand written characters and transforms the images into a softcopy that can be manipulated using a word processor.





b) Magnetic Scanners.

Magnetic Scanners are used to capture data written using magnetic Ink or coded onto a magnetic strip.

Magnetic Ink Character Recognition (MICR)

Magnetic Ink Character Recognition (MICR) scanners are used to read characters written using magnetic Ink. An example of an MICR is the cheque reader used in banks.





ADVANTAGES OF SCANNERS

1. They produce accurate and high resolution images
2. Scanned images can easily be shared, added to electronic document or edited



DISADVANTAGES OF SCANNER

1. Most of scanners can only scan flat objects
2. The quality of scanned items may differ from that of the original one
3. Some scanners are slow

DIGITAL CAMERA

4. DIGITAL CAMERA

The input device which take photograph and convert into digital image.

The light from the object pass through the lens to the light, Sensor and convert it into digital image then image is taken to the memory chips from the memory chips image.





5. MAGNETIC STRIPE READER

Magnetic stripe: These are thin strips of magnetic tape which are usually found on the back of credit and debit cards.





TOUCH SCREEN



6. TOUCH SCREEN

A touch screen is a special computer screen that you can control by touching it with your finger or special tool called stylus





MICROPHONE



7. MICROPHONE

Sound is recorded using microphones.

After recording, the sound is transferred to computer storage.

Sometimes the word microphone is informally referred to as a mic

The computer or other devices using a cable or wirelessly through a sound card.

Some computers such as laptops have built in microphones



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JOYSTICKS

8. JOYSTICKS

Joystick is an input device consisting of a stick that pivots on a base and reports its angle or directions to the device.

Joysticks are commonly used to control video games, cranes, trucks





REMOTE CONTROL

9. REMOTE CONTROL

It is a device which emits a beam of infra- red light carrying digital data to a TV.



TRACKBALL

10. TRACKBALL

A trackball is a pointing device consisting of a ball held by a socket containing sensors to detect a rotation of the ball about two axes—like an upside-down mouse with an exposed protruding ball.

The user rolls the ball with the thumb, fingers, or the palm of the hand to move a pointer





11.MIDI INSTRUMENT

These are devices used to produce music. They have Midi- port with specialized software digitized music into digital data so as a file.



12. VIDEO DIGITIZER

This device is used to convert analogue signals from a video camera or video cassette recorder into a digital format. The digitized video data can be saved as a file or played on the screen interface used:





Mouse



Keyboard



Microphone



Scanner



Trackball



Joystick



Graphics Tablet



Digital Camera



2.PROCESSING



CENTRAL PROCESSING UNIT

The CPU is the central hardware component that acts as the brain of a computer.

It does all processing activities that occur inside the computer.



In processing this data, the CPU performs four basic steps:

(i) Fetch

Each instruction is stored in memory and has its own address.

The processor takes this address number from the program counter, which is responsible for tracking which instructions the CPU should execute next.



(ii) Decode

All programs to be executed are translated to into Assembly instructions. Assembly code must be decoded into binary instructions, which are understandable to your CPU. This step is called decoding.



(iii) Execute

While executing instructions the CPU can do one of three things: Do calculations with its ALU, move data from one memory location to another, or jump to a different address.



(iv) Store

The CPU must give feedback after executing an instruction and the output data is written to the memory.





The CPU takes data and instructions from the main memory and processes them based on the instructions given by a program.

The CPU performs four basic tasks, Fetching, Decoding, manipulating(excute) and outputing*(store)



The CPU consists of two major parts:

- a. The Arithmetic Logical Unit (ALU)
- b. The Central Unit (CU)



ARITHMETIC AND LOGICAL UNIT (ALU)



The arithmetic Logic Unit performs arithmetic operations on the data.

Common arithmetic operations performed by the ALU are addition, multiplication, subtraction and division.

It also performs logical operations like AND, NOT, OR



FUNCTIONS OF ALU

1. It helps ensure that information goes in and out of a computer's parts
2. It interprets instructions
3. It controls data flow inside the processor
4. It get messages from the outside and turn them into signals that tell the computer what to do
5. It control other execution units like data, buffers and registers contained in CPU



CU



A control unit (CU) handles all processor control signals.

It directs all input and output flow, fetches code for instructions from micro programs and directs other units and models by providing control and timing signals.

A CU component is considered the processor brain because it issues orders to just about everything and ensures correct instruction execution.



3. STORAGE DEVICES

Storage

Storage refers to the process of recording, retaining and organizing data or information for future use..

It enables us to preserve and access vast amounts of data efficiently and securely



Storage technologies continue to change with advancements in capacity, speed, reliability and energy efficiency.

Computer storage is primarily used to store data and instructions that are being processed.

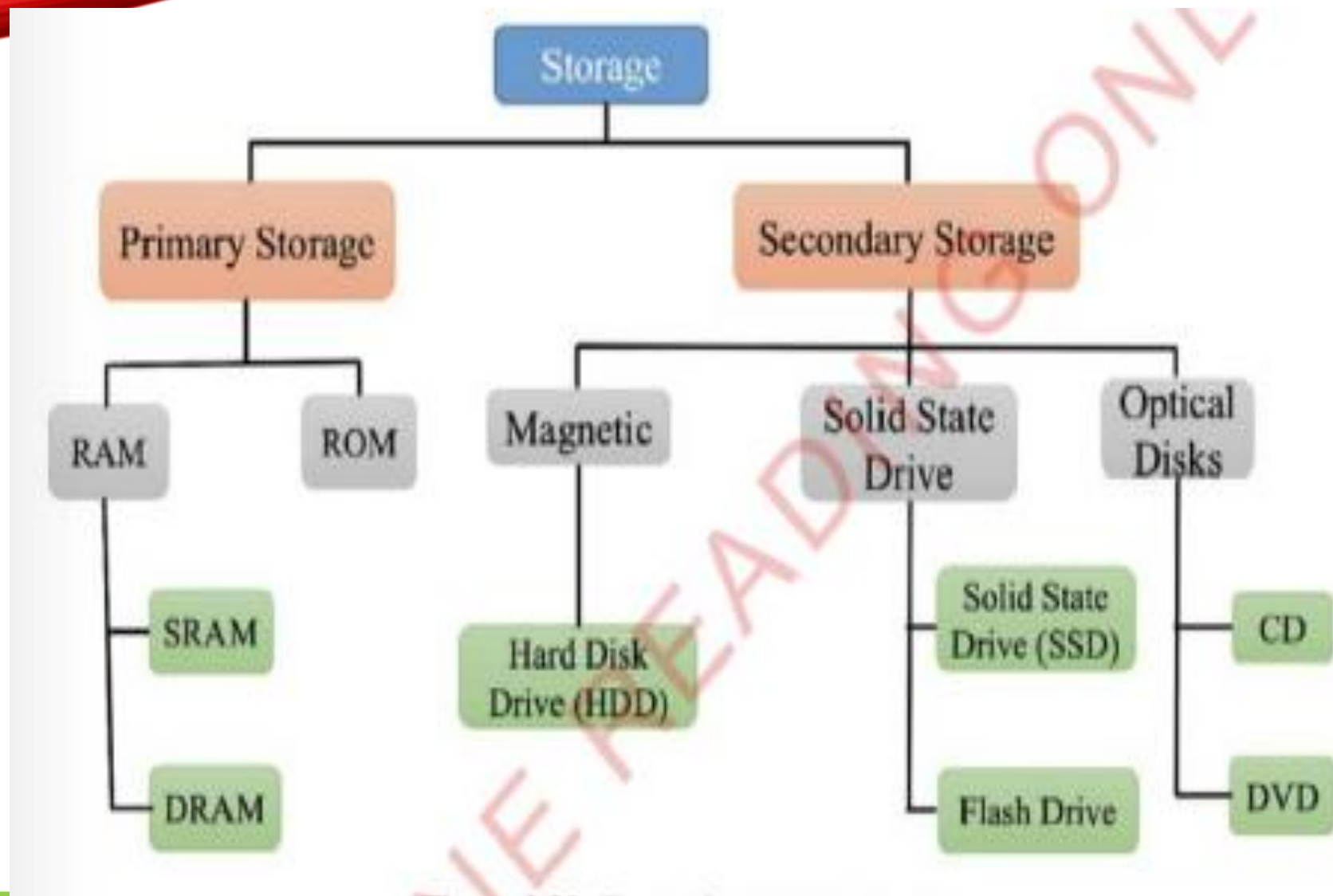
It is also used to permanently store data and information that can be retrieved in the future.



TYPES OF STORAGE

Storage is classified into two types:-

- a) Primary memory
- b) Secondary memory





MEASURING MEMORY CAPACITY

The smallest unit of memory a computer can handle is the bit (binary digit 0 and 1).

1 bytes = 8bit

The capacity of computer memory is determined by amount of data it can hold



DATA MEASUREMENT	SIZE
Bit	Single binary digit (1 or 0)
1 Kilobyte(KB)	1024 bytes
1 Megabyte (MB)	1024 Kilobytes
1 Gigabyte (GB)	1024 megabytes
1 Terabyte (TB)	1024 Gigabytes
1 Petabyte (PT)	1024 trabytes



a) Primary Storage

Primary storage is computer memory that the processor accesses first or directly.

It stores running applications and data that are temporarily or permanently stored in a specific memory location.

The CPU interacts directly with this memory to perform read and write operations.



Characteristics of primary storage

1. It is the working memory of the computer
2. It is faster than secondary memory

TYPES OF PRIMARY STORAGE

- i. Random Access Memory (RAM)
- ii. Read only Memory (ROM)

The flag of Tanzania is shown in the top left corner, featuring green, black, and blue diagonal stripes with yellow borders.

RANDOM ACCESS MEMORY (RAM)

RAM is the temporary storage of running programs, input data and intermediate results.

The input data enters the computer using the input devices and stored in RAM before processing, results are stored in RAM before being send to the output devices



RAM is volatile memory it loses information when the computer is **switched off**.

Any information that needs to be kept for a longer time must be saved in secondary storage before the computer is turned off.





CHARACTERISTICS OF MAIN MEMORY

1. These are semiconductor memories
2. It is known as main memory.
3. Usually volatile memory.
4. Data is lost in case power is switched off.
5. It is working memory of the computer.
6. Faster than secondary memories.
7. A computer cannot run without primary memory.



TYPES OF RAM

RAM is of two types

- a) Static RAM (SRAM)
- b) Dynamic RAM (DRAM)



a. Static RAM (SRAM)

The word static indicates that the memory retains its contents as long as power is being supplied.

Data is lost when the power gets down due to volatile nature.

SRAM chips use a matrix of 6- transistors and no capacitors.



b. Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually refreshed in order to maintain the data.

DRAM is used for most system memory because it is cheap and small.

All DRAMs are made up of memory cells which are composed of one capacitor and one transistor.



READ ONLY MEMORY(ROM)

Read Only Memory

The read only memory (ROM) is a permanent storage memory that stores data that can be read only but not to be rewritten.



Figure 3.25: ROM chip on a motherboard



TYPES OF ROM

1) MROM (Masked ROM)

The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kind of ROMs are known as masked ROMs which are inexpensive.



2) PROM (Programmable Read only Memory)

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program.

Inside the PROM chip there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.



3) EPROM (Erasable and Programmable Read Only Memory)

The EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes.

For erasing this charge, ultra-violet light is passed through a quartz crystal window (lid).

This exposure to ultra-violet light dissipates the charge. During normal use the quartz lid is sealed with a sticker.

4) EEPROM (Electrically Erasable and Programmable Read Only Memory)

The EEPROM is programmed and erased electrically.

It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (milli second).



ADVANTAGES OF ROM



- (i) Non-volatile in nature
- (ii) These cannot be accidentally changed
- (iii) Cheaper than RAMs
- (iv) Easy to test
- (v) More reliable than RAMs
- (vi) These are static and do not require refreshing



DIFFERENCE BETWEEN RAM AND ROM



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RAM	ROM
Stands for Random-Access Memory	Stands for Read-Only Memory
RAM is a read and write memory	Normally ROM is read only memory and it cannot be overwritten. However, EPROMs can be reprogrammed
RAM is faster	ROM is relatively slower than RAM
RAM is a volatile memory. It means that the data in RAM will be lost if power supply is cut-off	ROM is permanent memory. Data in ROM will stay as it is even if we remove the power-supply
There are mainly two types of RAM; static RAM and Dynamic RAM	There are several types of ROM; Erasable ROM, Programmable ROM, EPROM etc.
RAM stores all the applications and data when the computer is up and running	ROM usually stores instructions that are required For starting (booting) the computer
Price of RAM is comparatively high	ROM chips are comparatively cheaper
RAM chips are bigger in size	ROM chips are smaller in size
Processor can directly access the content of RAM	Content of ROM are usually first transferred to RAM and then accessed by processor. This is done in order to be able to access ROM content at a faster speed.
RAM is often installed with large storage.	Storage capacity of ROM installed in a computer is much lesser than RAM



OTHER TYPES OF MEMORY

1. Cache memory

Cache memory is very special type of high speed memory that users cannot access.

It is very small.

It is located in between the CPU and main memory.

The main function is to increase the availability of instructions and data that are frequently used by the CPU.



2. Register memory

Register memory are small and high speed memory locations found in the CPU that are used to retain information temporarily



SECONDARY MEMORY

Secondary memory is the computer memory used to store data permanently.

Secondary memory is known as storage or auxiliary memory.

It holds all the data and programs on a computer including the operating system.

Secondary storage is particularly useful for storing large amounts of data that can't fit in the main memory.



Characteristics of secondary memory

1. Has a larger capacity compared to primary memory(main memory)
2. It is non volatile
3. It is slower in term of reading and writing data than primary memory



TYPES OF SECONDARY STORAGE



1. Magnetic disk
2. Flash Memory
3. Online storage
4. Optical Disk



1. Magnetic disk

magnetic storage is one of the most common types of storage used with computers and is the technology that many computer hard drives use.



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i. Floppy diskette

An external form of storage used for back up. Information can be deleted and rewritten and re-saved.

The storage device is common for microcomputers



ii. Hard disk drive(HDD)

Fixed device for storing information within the computer system unit.

The disk is not movable and is also referred to as the C:\ drive.

The amount of disk space a computer has determines the power of a computer.

It provides fast access known as Random access and has high-speed storage.



b) Optical Storage devices

Another common storage is optical storage, which uses lasers and lights as its method of reading and writing data.

i. Blue-Ray Disks are used to store more than 25 GB of data with a very high speed in less amount of time. A single layer of BD can store 13 hours of video where as double layer BD can store more than 20 hours of video.



ii. CD-ROM (Compact Disk Read Only Memory)

Beams of laser light are used to write on optical disks by magnetic means.

After writing, the disk can only be read from and not written to. Access to information is direct and very fast.



iii. CD-R

Disks allow microcomputers with the proper drive known as a **CD Rewriters** (or a burner) to record own data on a blank CD. Once the recording is done, the disk can only be read from and cannot be rewritten.



iv. CR-RW

CD-RW (Compact Disk-Rewritable) also called as Erasable Optical Disk allow users to record and erase data so that the disk can be used over and over again.

Special CD-RW drives and software is required.



v. DVD-R

DVD (Digital Versatile Disks)

A form of optical disks similar to CD ROMS but has much more storage capacities of up to 3.9GB.

They support audio and video as well as data on the same disk.

But it used to read only data user can not erase data



vi. DVD-RW and DVD-RAM

DVD disks that allow one time recording by the consumer.

Two types of reusable disks are DVD-RW (DVD Rewritable) and DVD-RAM (DVD Random Access Memory), both of which can be recorded on and erased more than once.



c) FLASH MEMORY DEVICES

Flash memory has started to replace magnetic media as it becomes cheaper as it is the more efficient and reliable solution.

- i. Jump drive or flash drive
- ii. Memory card (Memory stick)
- iii. SSD (SOLID STATE DISK)



d) ONLINE AND CLOUD

Storing data online and in cloud storage is becoming popular as people need to access their data from more than one device.

- i. Google drive
- iii. SkyDrive now OneDrive
- iv. iCloud
- v. email storage
- vi. mediafire.com



DIFFERENCE BETWEEN PRIMARY STORAGE AND SECONDARY STORAGE



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PRIMARY STORAGE	SECONDARY STORAGE
Primary memory storage is temporary	Secondary storage is permanent
Nature of parts of primary storage varies. RAM is volatile in nature and ROM is Non-volatile.	It is always Non-volatile in nature
Example RAM, ROM, Cache Memory and PROM	Example Magnetic tapes, Floppy disk, USB drivers and Optical disk
Primary memory is expensive and smaller	Secondary memory is cheaper and Larger
Primary memory storage is faster	Secondary storage are slower.
Primary memory storage is connected through data buses to CPU	Secondary storage is connected through data cables to CPU



4. OUTPUT DEVICES

Computer output devices are used to provide information for a user in different forms.

The formats include visual, audio and digital.



Monitor or VDU



Printers



Plotters



Speaker

4. OUTPUT DEVICE

1. Monitors

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer.

It forms images from tiny dots, called pixels that are arranged in a rectangular form.

The sharpness of the image depends upon the number of pixels.



TYPES OF MONITORS

1. Cathode-Ray Tube (CRT)
2. Liquid Crystal Display(LCD)



1. Cathode-Ray Tube (CRT)

Crt monitors produce an image using an electron beam produced by the cathode ray tube.

These monitors use the same technology as old TVs and have become rare these days





2. Liquid Crystal Display(LCD)

LCD is widely used electronic display device that operates by applying a varying electronic voltage to a layer uof liquid crystal, thereby including changes in its optical properties.





ADVANTAGES OF LCD

1. LCDs are lighter and more compact, making them suitable for portable devices like smartphones, digital cameras and laptops
2. LCDs consume less power
3. LCDs do not suffer from image burn in



2. Projector

Image projectors are used to display output from computer onto a plain white screen such as wall or a whiteboard.





3. Printer

A printer is an output device that produces text and graphics on a physical medium as paper.

Printed information often called a **hardcopy** because the information exists physically.



TYPES OF PRINTER

1. Impact printer
2. Non impact printer



1. IMPACT PRINTERS

An impact printer creates letters and images on a piece of paper using a striking device that hits an ink ribbon.

Then, the ink ribbon makes direct contact with the printing surface.



CHARACTERISTICS OF IMPACT PRINTER



1. Very low consumable costs
2. Very noisy
3. Useful for bulk printing due to low cost
4. There are physical contact with the paper to produce an image



1. These printers are of two types

- a. Character printer
- b. Line printer



A. CHARACTER PRINTERS

Character printers are the printers which print one character at a time. These are further divided into two types:

- i. Dot matrix printer(DMP)
- ii. Daisy wheel



i. Dot Matrix Printer

These printers are popular because of their ease of printing and economical price.

Each character printed is in form of pattern of dots and head consists of a Matrix of Pins of size $(5 \times 7, 7 \times 9, 9 \times 7$ or $9 \times 9)$ which come out to form a character that is why it is called Dot Matrix Printer.



ii. Daisy Wheel

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower name) that is why it is called Daisy Wheel Printer.

These printers are generally used for word-processing in offices which require a few letters to be sent here and there with very nice quality.



B. LINE PRINTERS

Line printers are the printers which print one line at a time.

These are of further two types

- i. Drum Printer
- ii. Chain Printer



i. Drum Printer

This printer is like a drum in shape so it is called drum printer.

The surf number of tracks. Total tracks are equal to size of paper i.e. for a paper width of 132 characters, drum will have 132 tracks.



ii. Chain Printer

In this printer, chain of character sets are used so it is called Chain Printer. A standard character set may have 48, 64, or 96 characters.



ADVANTAGES OF IMPACT PRINTERS



1. Printer can manage printing work in tough conditions. Like industrial workspaces and point of Sale(POS)
2. It is useful for businesses that need extra copies
3. Ribbons and paper are cheaper
4. It easily to identify problem



DISADVANTAGES OF IMPACT PRINTERS



1. It require regular maintenance
2. They can only print in black or one additional colour
3. They produce lower print quality
4. Very noisy when they operate
5. Slow speed



2. NON IMPACT PRINTERS

Non-impact printers print the characters without using ribbon. These printers print a complete page at a time so they are also called as Page Printers.

These printers are of three types

- a. Laser Printers
- b. Inkjet Printers
- c. Thermal Printers



CHARACTERISTICS OF NON IMPACT PRINTERS



1. Faster than impact printer
2. They are not noisy
3. High quality
4. Support many fonts and different character size.



a. Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.



b. Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper.

Inkjet printers produce high quality output with presentable features



ADVANTAGES OF NON IMPACT PRINTERS



1. They produce high quality text and graphics
2. They are much faster than impact printers
3. They are easy to use
4. It require less maintenance compared to impact printers.
5. They can handle a variety of media types including paper, envelopes, labels, glossy photo paper.
6. They can produce full colour prints.



DISADVANTAGES OF NON IMPACT PRINTERS



1. It is more expensive than impact
2. They print colourful pictures but sometimes the colours may not be perfect.
3. It is cost (maintenance and repairs)



DIFFERENCE BETWEEN IMPACT PRINTERS AND NON IMPACT PRINTER



Impact printer	Non-impact printer
Makes noise when printing	Quiet printers
Print head makes contact with the paper	No contact creates an image without striking a ribbon against the paper. Creates images on a surface without contacting it.
Strike ribbon against the paper	Use a laser beam which form an image onto paper using toner
Slow printer	Fast printers
Has too many moving parts hence unreliable	Has fewer moving parts hence they are reliable.
Impact printers are relatively inexpensive, and the cost of printing is also low because ink ribbons are inexpensive.	Very expensive computers



4. Plotters

A plotter is a large type of hard copy output device.

It is most used for printing geographical, architectural and engineering drawings.

It can be used to print maps, advertisement posters to be placed on billboards





5. Speakers

Speakers are devices attached to a computer to give out sound.

Most of laptop computers and some desktop computer monitors have built in speakers.

Some computers come with separate wired or wireless speakers.

