DEFINITION OF A COMPUTER

A computer is a programmable electronic device that accepts raw data as input and processes it with a set of instructions (a program) to produce the information as output.

COMPUTER SYSTEM

A computer system is a basic, complete and functional hardware and software setup to make it functional to the user.

CHARACTERISTICS OF A COMPUTER

Speed; Computers can process millions of instructions per second compared to human beings. Be it logical decisions or arithmetic computations, the time taken by computers for their operations is microseconds and nanoseconds. A powerful computer can handle trillions of instructions per second. With this speed, computers can reduce the amount of time needed to perform any digital task.

Accuracy; Computers have a very high degree of accuracy. They can perform calculations with 100% accuracy. Exceptions for errors may occur due to data inconsistency or inaccuracy/wrong human input as the term goes Garbage in Garbage out (GIGO)

Diligence; Computers can perform millions and millions of instructions with the same consistency and accuracy, repeatedly without getting tired or loosing concentration. They can carry out instructions day and night yet the human brain and body is programmed to work for just 8 hours before a human being starts to wear out.

Versatility; Computers can perform different tasks with the same accuracy and efficiency at the same time. For example, one can use a computer to create invoices/bills and at the same time carry out inventory management or any other multimedia tasks.

Reliability; A computer is capable of giving consistent results for similar sets of data i.e; if we gave the same set of input any number of times, we will get the same result.

Automation; Computers can be used to automate routine tasks with the help of a task scheduler such as launching a specific application or software, sending an email, scanning for viruses, software updates, system diagnosis and many other maintenance tasks. Computers can also be programmed to perform many complex tasks without any supervision or manual intervention.

Storage Capacity (Primary Memory, Secondary); A computer has built-in memory called primary memory where it stores data. Secondary storage are removable devices such as cds, pen drives, etc., Which are also used to store data.

Memory is a very important characteristic of Computers. A computer has much more storage capacity than human beings. It can store large amount of data. It can store any type of data such as images, videos, text, audio and many others.

BASIC APPLICATIONS OF COMPUTER SYSTEMS

Computers play a role in every field of life. Some of the fields and how they are used include;

Education; Computers are used in education sector through, online learning, online examination, research, e-books etc.

Entertainment; Online movies, online games, e-music, e-radio etc.

Government; In government sectors, computers are used in data processing, maintaining a database of citizens and supporting a paperless environment, military uses computers for missile development, satellites, rocket launches etc.

Banking; In banking sector, computers are used to store customer details and conduct transactions, such as withdrawal and deposit of money through ATMs. Banks have reduced manual errors and expenses to a great extent through extensive use of computers.

Science and engineering; Computers with high performance are used to stimulate dynamic processes in science and engineering. Supercomputers have numerous applications in area of research and development. Topographic images can be created through computers. Scientists use computers to plot and analyze data to have better understanding of earthquakes.

Arts; Extensively used in dance, photography, arts and culture. The fluid movement of dance can be shown live via animation. Photos can be digitized using computers.

Medical field; Computers are used in hospitals to maintain a database of patients' history, diagnosis, x-rays, live monitoring of patients, etc. Surgeons nowadays use robotic surgical devices to perform delicate operations, and conduct surgeries remotely. Virtual reality technologies are also used for training purposes. It also helps to monitor the fetus inside the mother's womb.

Home; Computers are used at homes for several purposes like online bill payment, watching movies or shows at home, home tutoring, social media access, playing games, internet access, etc. They provide communication through electronic mail. They help to avail work from home facility for corporate employees. Computers help the student community to avail online educational support.

Industry; Computers are used to perform several tasks in industries like managing inventory, designing purpose, creating virtual sample products, interior designing etc.

Business; These days' computers are totally integrated into business. They are used for transaction processing which involves transactions with suppliers, employees or customers. Computers can make these transactions easy and accurate. Businesses can analyze investments, sales, expenses, markets, video conferencing, etc.

Online marketing has seen a great revolution in its ability to sell various products to inaccessible corners like interior or rural areas. Stock markets have seen phenomenal participation from different levels of people through the use of computers.

COMPUTER HARDWARE

Computer hardware describes any of the physical parts of a computer system and other peripheral devices. A peripheral refers to all hardware components that are attached to a computer and are controlled by the computer system, but they are not the core components of the computer. For example a scanner, printer.

Computer hardware describes the physical parts of a computer, such as the case, central processing unit, random access memory, monitor, mouse, keyboard, computer data storage, graphics card, sound card, speakers and motherboard

TYPES OF COMPUTER HARDWARE

Computer hardware can be classified as internal or external, which relates to the placement of the physical parts in or around the device. Generally, internal hardware is required for the computer to run, while external hardware enhances the use or functionality.

INTERNAL COMPUTER HARDWARE

The internal components of a computer system consist of the hardware installed inside the computer that's required to process data and to allow the processor to communicate with other devices such as secondary storage, display screens and printers. Examples of internal computer hardware include;

Motherboard: A motherboard is the main circuit board inside a computer that connects the different parts of a computer together. It has sockets for the CPU, RAM and expansion cards and it also hooks up to hard drives, disc drives and front panel ports with cables and wires. Motherboard is also known as a mainboard, planar board or logic board, system board, mobo or MB. It links all the individual parts of a computer together and also, allows the CPU to access and control these separate parts. The Motherboard is the backbone that ties the computer's components together at one spot and allows them to talk to each other. Without it, none of the computer pieces, such as the CPU, hard drive, could interact. Total motherboard functionality is necessary for a computer to work well

Other than bridging internal components, the motherboard ports also allows you to connect external devices to the computer. Such external devices would include the monitor, speakers, headphones, microphone, keyboard, mouse, modem and other USB devices.

Functions of the motherboard include;

- The motherboard acts as the central backbone of a computer on which other modular parts are installed such as the CPU, RAM and hard disks.
- The Motherboard is the backbone that ties the computer's components together at one spot and allows them to talk to each other
- The motherboard also acts as the platform on which various expansion slots are available to install other devices / interfaces.
- The motherboard is also responsible to distribute power to the various components of the computer.
- They are also used in the coordination of the various devices in the computer and maintain an interface among them.
- Some of the Sizes in which the motherboards are available are: BTX, ATX, mini- ATX, micro-ATX, LPX, NLX etc.

The motherboard holds all the major components of the computer. These motherboard components include:

1. The processor (CPU)
2. CPU socket
3. Main Memory (RAM)
4. Memory slot
5. BIOS
6. CMOS Battery
7. Expansion slots
8. Cache memory
9. CPU Clock
10. I/O ports

Central Processing Unit or the CPU or Processor

Also known as the microprocessor, the CPU is the brain of the computer. It fetches, decodes and executes program instructions as well as performs mathematical and logical calculations. The processor is one of the most crucial computer motherboard components.

The CPU chip is identified by the processor type and the manufacturer. This information is usually inscribed on the processor chip, for instance, Intel 386, Advanced Micro Devices (AMD) 386, Cyrix 486, Pentium MMX, Intel Core 2Duo, and Intel Core i7, among others. The processor fits into the processor socket.

Processor Socket

A CPU or processor socket is a connection that allows a computer microprocessor to be inserted into the motherboard. There are various types of processor sockets depending on the CPU being inserted. You can identify the processor socket as socket 1 to Socket 8

Main Memory (RAM)

The Main Memory, Primary Memory, System Memory or Random Access Memory (RAM), refers to the physical memory of the computer. The word main is used to distinguish it from external mass storage devices such as disk drives.

Memory is the working place of a computer. It is a hardware device that stores data for easy retrieval. It is volatile meaning it holds data as long as there is power. Once the power goes off or the computer is turned off, all the contents in RAM are lost.

The computer can manipulate only data that is in the main memory. Therefore, every program you execute and every file you access must be copied from a storage device into the main memory. The amount of main memory on a computer is crucial. This is because it determines how many programs can be executed at once and how much data can be readily available to a program.

Types of RAM; There are two broad categories of RAM. These are SRAM and DRAM.

Basic Input Output System – BIOS

BIOS is a term that stands for basic input/output system. It consists of low-level software that controls the system hardware and acts as an interface between the operating system and the hardware. The microprocessor uses BIOS to get the computer started after it is turned on. BIOS is Stored in a **ROM Chip**

The BIOS is stored on a ROM chip because ROM retains information even when no power is being supplied to the computer. The downside of storing data in an older computer's ROM is that the chip has to be removed to update information. Many modern PCs have flash BIOS, which means that the BIOS has been recorded on a flash memory chip, which can be updated if necessary.

Complementary Metal Oxide Semiconductor – CMOS

Motherboards also include a small separate block of memory made from CMOS RAM chips. Other names of the CMOS are RTC (real-time clock), NVRAM (non-volatile RAM) or CMOS RAM.

It stores information about the PC's settings. The CMOS RAM is kept alive by the CMOS battery even when the PC's power is off. This prevents reconfiguration when the PC is powered on. CMOS devices require very little power to operate.

Information about the PC's configuration; Date and time, RAM size, CPU, Power Saving settings, hard disk drive types

Cache Memory
It is a small block of high-speed memory (RAM) that enhances PC performance by pre-loading information from the main memory (relatively slow) and passing it to the processor on demand.

Most CPUs have an internal cache (in-built into the processor) which is referred to as Level-I cache memory or primary cache memory. This can be supplemented by external cache memory fitted on the motherboard. This is the Level-2 Cache memory or secondary cache. Even though Level-2 cache is optional, it results in a major improvement in system performance.

Expansion Buses
Expansion buses enhance the PC's capabilities by allowing users to add missing features to their computers in the form of adapter cards that are slotted in expansion slots. The different types of buses include PCI, ISA, EISA, and Input/Output (I/O) buses among others. It is where an expansion card is inserted.

The **NorthBridge** (also called the memory controller) is in charge of controlling transfers between the processor and the RAM. That is why it is located physically near the processor.

The **SouthBridge** (also called the input/output controller or expansion controller) handles communications between peripheral devices.

CPU Clock

The CPU clock is an internal timing device that breathes life into the microprocessor by feeding it a constant flow of pulses. For example, a 400 MHz CPU receives 400 million pulses per second from the clock. A 2 GHz CPU gets two billion pulses per second. The clock synchronizes the operation of all parts of the computer and provides the basic timing signal for the CPU.

Heat Sink

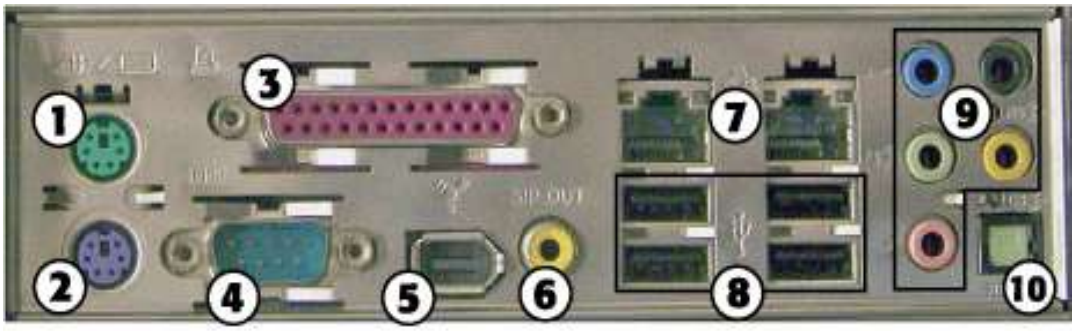
A heat sink is a device made of an aluminium finned radiator used to absorb excessive or unwanted heat from some computer motherboard components. There are two types of heat sinks, active and passive heat sinks.

20-Pin ATX Power Supply Connector

This is where you connect the ATX power supply to the motherboard. The corresponding connector has a small clip on the top that snaps to hold the connector in place. The connector is keyed to ensure it connects in one direction.

Input/Output Ports

The input/output units, that is the devices that allow the introduction of data and the display of the results (keyboard, mouse, monitor, printers, etc.), are external to the Matherboard, and are connected through appropriate connectors, called ports of connection or input/output (I/O).



1. PS/2 mouse port
2. PS/2 keyboard port
3. Parallel port
4. Serial port
5. IEEE 1394a port
6. SPDIF coaxial digital audio port
7. Ethernet ports
8. USB ports
9. 1/8-inch mini-jack audio ports
10. SPDIF optical digital audio port

IEEE 1394 is an interface standard for a serial bus for high-speed communications and isochronous real-time data transfer

Central Processing Unit (CPU)/Processor: The Central Processing Unit is the main processing device in any computer system. It performs basic arithmetic, logic, controlling, and input/output (I/O) operations specified by the instructions in the program. To be specific; The CPU is made up of the Arithmetic and Logical Unit (ALU) and the Control Unit (CU). The Arithmetic Unit performs mathematical computations such as addition, subtraction, multiplication and division while the Logical Unit performs logical operations such as comparing of data and the selection of the desired problem-solving procedure or a viable alternative based on predetermined decision criteria. The Control Unit regulates and integrates the operations of the computer. It selects and retrieves instructions from the main memory in proper sequence and interprets them so as to activate the other functional elements of the system at the appropriate moment to perform their respective operations. The speed of a processor is based on its clock speed which is measured in Gigahertz (GH) or Megahertz (MHz).

Random Access Memory (RAM) : This is the hardware in a computing device where the operating system (OS), application programs and data in current use are kept so they can be quickly reached by the device's processor. RAM is part of primary memory/main memory in a computer and is embedded on the motherboard. When the computer system is turned on, RAM fetches all necessary data and instructions from the hard disk and stores them. The CPU uses the fetched data by RAM to perform the specific tasks. It is much faster to read from and write to than other kinds of storage, such as a hard disk drive (HDD), solid-state drive (SSD) or optical drive because it is closest to the CPU. RAM is volatile memory i.e; contents are lost when power is switched off. It is the fastest memory which means that the computer is not kept waiting for data to process. It is used to store temporary data/information that's in active use. It is more expensive than secondary memory.

Read Only Memory (ROM): The memory from which we can only read but cannot write on it. It is part of primary memory/main memory and holds 30% of it. This type of memory is non-volatile. The data is stored permanently in such memories during manufacture. This makes it a more reliable form of storage. You cannot change the data on it or rewrite on it, you can only read it. ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.

Cache Memory: Cache, which is pronounced "cash" (not "catch" or "cashay"). Stores recently used information so that it can be quickly accessed at a later time. Supplementary memory system that temporarily stores frequently used instructions and data for quicker processing by the CPU of a computer. Cache holds a copy of only the most frequently used information or program codes stored in the main memory. Computers incorporate several different types of caching in order to run more efficiently, thereby improving performance. Common types of caches include browser cache, disk cache, memory cache, and processor cache. Most caching is done in the background, so you won't even notice it is happening. In fact, the only cache you can control is the browser cache, because for it you can open your browser preferences to view the cache settings and alter the size of your browser cache or empty the cache if needed.

Hard drive: Sometimes known as the hard disk drive (HDD) or hard disk is the secondary storage that reads, writes and stores data on hard disks. HDDs are often inside a computer attached to the motherboard, or in an external case connected by a USB cable. The hard drive contains a spinning disk with a thin magnetic coating. A spinning disk is the mechanism within a hard disk drive to which memory is written. With rotating plates attached to an arm that writes the data, the spinning disk mechanism physically resembles a record player (although it is sealed within an enclosure). The plates are magnetized (similarly to cassette tapes) in order to store data that is written using copper heads. The hard drive's performance is measured in the speed that the data can transfer from the platters storing the bits to the computer (known as data throughput). Usually, the higher the density of the platters and revolutions per minute translates in higher performance. Although nowadays, you can find hard drives spinning up to 15000 RPM, the most popular ones for desktops and laptops are between 5400 and 7200 RPM.

Parts of Hard Disk

Platter: It is a metallic disk that can be magnetized or demagnetized to read or write data on it.

Tracks: These are concentric circles that run around the surface of the platter

Sector: it is the specific location where data is stored. It is identified by indicating the platter and the track number.

Read/Write head: This is the electronic head that is used to read or write data to the specific sector of the disk.

Spindle: It is the central point where the platter rotates from. It holds platters together to enable them to rotate.

Actuator (Read/write arm): this is the mechanism that holds the head in position.

Magnetic: disks use magnetic technology to store data. They have magnetic properties that can be magnetized or demagnetized to represent 0 or 1.

A solid-state drive (SSD) is a solid-state storage device that uses integrated circuit assemblies to store data persistently
Disadvantages of a Magnetic Disk

- Slow to access data from
- Suffers from tear and wears since it has moving parts
- Makes noise as it operates
- Can have bad sectors that cannot store data

Power supply unit (PSU): This is an internal hardware component that converts direct current (DC) voltage to internal computer components. It changes the incoming electricity to a format that the computer can use.

Video card: A video card, also known as a graphics card, is an internal hardware output device which is responsible for handling the processing of the visual data you see on your display. This device can either be a separate component which plugs into a slot on the computer's motherboard, or what is referred to as "onboard", which is actually integrated into the motherboard itself.

Network Interface card (NIC): This is an internal hardware communication device that connects a computer to a computer network, usually a LAN. Without this card, a computer cannot be connected over a network. It is a circuit board installed in a computer that provides a dedicated network connection to the computer. It is also known as a Network Interface Controller, Network adapter or LAN adapter.

Bluetooth card (or adapter): This is an internal hardware communication device that allows computers to connect to peripheral devices like mice, keyboards and headsets as well as communicate and share files with other Bluetooth-equipped devices such as smartphones.

A **modem (modulator-demodulator):** This is a hardware networking device that converts data to a signal so it can be easily sent and received over a phone line, cable or satellite connection.

EXTERNAL COMPUTER HARDWARE

External hardware components (including peripheral components), are those hardware components that are often externally connected to the computer to control either input or output or storage or communication functions. External describes a hardware device that's installed outside of the computer. Examples include;

Computer case/System Unit: This is a metal enclosure that holds the internal hardware components used to make desktop computers operate. On laptop computers, the device itself may be considered a computer case, but traditionally this term is used to refer to a desktop computer. Computer cases come in many shapes and sizes, but most are built in tower-form, ranging between 15 and 25 inches tall. They are used to mount items such as the motherboard, the hard drive, and the optical drive. Most computer cases come bundled with a power supply to allow them to operate. The largest benefits that computer cases offer are to protect internal hardware from dust, hair, and other hazards; and to keep the surrounding area cooler, as heat is contained within. Computer cases for desktop computers also contain external ports to connect external hardware to the internal components. Output devices such as printers, speakers, and monitors; and input devices such as keyboards, microphones, cameras, image scanners, or a mouse can be attached to the computer case via a USB cord or cable in order to increase the usability of the computer. Ethernet cables may also be connected via a special Ethernet port to establish a more stable and wired internet connection.

Mouse: A computer mouse is a handheld hardware input device that controls a cursor in a GUI (graphical user interface) for pointing, moving and selecting text, icons, files, and folders on your computer. In addition to these functions, a mouse can also be used to drag-and-drop objects and give you access to the right-click menu.

Keyboard: A computer keyboard is an input device used to enter characters and functions into the computer system by pressing buttons, or keys.

Microphone: A microphone is a hardware peripheral and input device that allows computer users to input audio into their computers.

Camera: A camera is a hardware peripheral and input device that captures either still images or motion video.

Speakers: Speakers are output devices that are used to connect to a computer to generate sound.

Monitor: A monitor is an output device that is also known as a **video display terminal** (VDT) or a **video display unit** (VDU). It is used to display images, text, video, and graphics information generated by a connected computer via a computer's video card.

Printer: A printer is basically an output device which prints a hard copy of the electronic data that is stored in the computer or any other devices. The electronic data may include documents, text, images or even the combination of all three.

Projector: A projector is an output device that takes images generated by a computer or Blu-ray player and reproduce them by projection onto a screen, wall, or another surface. In most cases, the surface projected onto is large, flat, and lightly colored.

Scanner: A scanner is a hardware input device that reads an image and converts it to a digital signal. For example, a scanner may be used to convert a printed picture, drawing, or document (hard copy) to a digital file that can be edited on a computer.

Memory card: A memory card is a type of secondary storage hardware device that is sued to store videos, photos or other media files in digital form.

USB flash drive: A USB flash drive is a type of secondary storage hardware device that is designed to store files which can be anything from text documents to multimedia files as well as software.

Touchpad: A touch pad is an input device for pointing (controlling input positioning) on a computer display screen. It is an alternative to the mouse.

Router: A router is a hardware networking device that forwards data packets between computer networks.

Modem: Short for modulator/demodulator is a hardware communication device that allows a computer to send and receive information over telephone lines.

Network Interface card: A Network Interface card is a hardware component that enables a computer to connect to a computer network.

COMPUTER HARDWARE ACQUISITION

Computer hardware acquisition is the act of buying or obtaining hardware equipment at a cost pursuant to the acquisition agreement by and between an organization/business and computer hardware vendor. Computer hardware can be purchased, rented or leased from the manufacturer (vendor) or from a leasing company.

Under these arrangements, hardware is acquired, installed in the organization's facilities, and operated by the organization's personnel. It should be noted that an organization preferring not to own or manage its own computer facilities can use any of the outsourcing options such as service bureau or an ASP, to fulfill its hardware needs.

COMPUTER HARDWARE ACQUISITION METHODS

Buying/Outright Purchase is the method of paying for computer hardware in full with one payment in order to own the equipment.

ADVANTAGES

- Having full ownership of the equipment gives you full control as it means that the machine is always available to you and you are able to do with it as you please which gives great flexibility.
- In terms of overall cost, purchasing for cash will be the lowest cost of acquisition.
- Ability to customize the equipment to your own unique needs since you're not tied into a contract or a leasing agreement.
- In some cases, the equipment provides tax advantages of accelerated depreciation because you can deduct or write off the value of the assets for tax purposes.

DISADVANTAGES

- Requires a large capital investment which will reduce the organization's available cash flow.

- Risk of obsolescence; losing value over time - hardware depreciates quickly and may become obsolete after a few years, requiring a further investment. The needs of a business may also change as well and it's difficult to change equipment when you have a lot invested into it.
- Full responsibility for the equipment including any maintenance, repairs, liabilities and management which can be costly.

Leasing is a contractual agreement between a lessor and a lessee for the hire of computer hardware for a specific period at a fee. You enter a contract with a leasing provider and, at the end of the agreed term, you typically either; give the equipment back or extend the lease if you wish to keep using it. Depending on the leasing company, you may also agree to buy the computer hardware equipment at the end of the lease.

ADVANTAGES

- No capital/tied up
- No financing is required because it minimizes maintenance costs as the lender is typically responsible for any upkeep
- Gives you a chance to use a computerized asset without actually owning it
- It is more flexible for example in case you are looking for a short-term commitment and makes it easier to upgrade your equipment
- It is considered an operating cost, so you can write it off against profits
- The leasing company carries the risks if the equipment breaks down

DISADVANTAGES

- Company doesn't own the system when lease expires
- Usually a heavy penalty for terminating the lease; your business can be locked into inflexible medium or long-term agreements, which may be difficult to terminate
- Leasing over long term may not be cost-effective, as you may end up paying more than the equipment is worth that's why they say it's more expensive in the long run than buying
- When you lease an asset, you don't own it, although you may be allowed to buy it at the end of the agreement

Renting involves hiring computer hardware equipment for a temporary and short period of time at a fee. This can range from a few days to a few months. The main difference between a lease and rent agreement is the period of time they cover. A rental agreement tends to cover a short term—usually 30 days—while a lease contract is applied to long periods—usually 12 months, although 6 and 18-month contracts are also common.

ADVANTAGES

- No capital is tied up
- No financing is required
- Easy to change systems
- Maintenance and insurance are usually included

DISADVANTAGES

- Company doesn't own the computer hardware equipment
- Cost is very high because the vendor assumes the risk (most expensive option)

CLASSIFICATION OF COMPUTERS

Computers are classified according to; *Purpose, Process* and *Size.*

CLASSIFICATION BY PURPOSE

Computers can be classified according to the tasks executed. These include;

General purpose computers: These computers can do various everyday tasks such as writing a word processing letter, document preparation, recording, financial analysis, printing documents, creating databases, and calculations with accuracy and consistency.

The size, storage capacity, and cost of such computers are mainly less. The ability of these computers is limited in performing specialized tasks. Still, it has versatility and useful for serving people's basic needs at home or in the workplace in the environment. Examples include; Desktops, laptops, smartphones, and tablets used on a daily basis for general purposes.

Special purpose computers: These computers are designed to perform a particular or specialized task. The size, storage capacity, and cost of such computers mainly depend on the nature and size of the work. The function of these computers is consistent with any particular task. A special computer needs specific input and output devices as well as a compatible motherboard with the processor to conduct work efficiently. These computers are used for special purposes in weather forecasting, space research,

agriculture, engineering, meteorology, satellite operation, traffic control, and research in chemical sciences. Examples: Automatic teller machines (ATM), Surveillance equipment, Weather-forecasting simulators, Traffic-control computers, Defense-oriented applications, Oil-exploration systems, Military planes controlling computers.

CLASSIFICATION BY PROCESS

Computers can be classified based on how data is processed/handled in a computer system. These include; Analog computers, digital computers and hybrid computers.

Digital Computers; These solve problems by processing data in discrete form. In form of 0s and 1s. examples include; desktops, laptops, smartphones, tablets, Chromebook, digital watch, accounting machines, digital clock, etc. these computers can perform arithmetic operations such as addition, occurrence, subtraction, multiplication, or division and all types of logical(mathematical) operations at a very high speed**.** Most computers available on the market today are digital computers.

Analog computers; These are used to process data in a continuous form. They are used primarily to measure physical units like the voltage, pressure, electric current, temperature, and convert them into digits. They obtain all their data from some measurement way. Analog computers are mainly used in the fields of science and engineering. They are slow and equipped to measure things rather than count or check. They are used in the fields of technology, science, research, engineering, etc. This is because quantities like voltage, pressure, electric current, temperature are used more in these areas. These types of computers give only approximate estimates. Examples; An analog computer installed on a petrol pump measures the amount of petrol coming out of the pump and it appears in liters then calculates its value.

Hybrid computers; These computers exhibit features of both analog and digital computers. The purpose of designing hybrid computers is to provide functions and features that can be found on both analog and digital devices in order to maximize the benefits of both computers in one combination. Incorporating the properties of both (analog and digital) computers into hybrid computers makes it possible to resolve more difficult equations immediately. Hybrid computers are most commonly used in vast industries, research centers, organizations, and manufacturing firms (where many equations need to be solved). Also, the solutions and uses of hybrid computers have proved to be much more detailed, accurate, and useful. Hybrid computers are used in scientific calculations, for nations' defense and radar systems as well. Examples may include an Auto gasoline pump**,** a device installed on a petrol pump not only to measure

the amount of petrol but also to calculate its value, in this way it is capable of both functions i.e. hybrid function.

CLASSIFICATION BY SIZE

Computers can be classified based by size. These include; supercomputers, mainframes, mini-computers, personal computers/microcomputers. The size of the computer determines the processing abilities. Larger computers have higher processing speeds while smaller ones offer a better experience for personal computing keeping in mind that each category excels at a specific function.

Super Computers; These computers are the largest in terms of size. They can occupy anything from a few feet to hundreds of feet. They are expensive to acquire but worth the cost especially for big organizations. These are the most powerful in terms of speed and accuracy. They are used in solving complex mathematical computations. They are capable of executing trillions of instructions per second yet the typical personal computer used at home and the office is only capable of calculating millions of instructions per second.

Uses of Super Computers

Due to their superiority, supercomputers are not intended for your everyday tasks. They handle exhaustive scientific applications that require complex and real time processing.

- In the field of science, researchers use these machines to compute and model properties of biological compounds like protein and human blood. They are also used to interpret new diseases and strains and predict illness behavior and treatment.
- The military uses supercomputers to test new aircraft, tanks, and a host of weaponry and camouflage. They also use them to understand the effects they will have on soldiers and wars. These machines are also used to help encrypt and decrypt sensitive data.
- In entertainment, supercomputers are used to help make a flawless online gaming experience. Games like world of Warcraft demand intense processing. When thousands of gamers around the world are playing, supercomputers help stabilize the game performance.
- Meteorologists use them to simulate weather behavior. They can also be used to predict earthquakes.
- Scientists use them to simulate and test the effects of nuclear weapon detonation.

- Scientists also use them to simulate the events of the big bang and other space-related projects.
- Hollywood uses supercomputers to create realistic animations.

Main frames; They are large sized computer types. Equally powerful but fall short in terms of the computation ability in supercomputers. They are like big file servers, enabling multiple users from nearby and remote locations to access resources at the same time. They can handle massive amounts of data going in and out simultaneously. This makes them popular with businesses. They are also resilient as they are capable of operating for over 10 years without failing. Users access the mainframe using terminals or personal computers. This can happen within the same building or via a Wide Area Network (WAN).

Uses of Mainframes

They are used in large organizations where thousands of clients have to access data simultaneously. For example;

- Performing ATM cash withdrawals and deposits. During the process, communication between the mainframe and remote computer will help accomplish the financial transactions at hand.
- Business transactions that use credit cards or pre-paid cards.
- Online electronic transactions.
- Cloud storage.
- Handling of patient records in major hospitals.
- Making reservations and travel schedules for airline companies.
- Manipulation and tallying of data for census and electoral purposes.

Mini computers; These are smaller than mainframe computers. Their processor power is below that of mainframe systems but above the capabilities of personal computers. They have become almost extinct because of the popularity of personal computers. The latter can now perform most of the tasks reserved for mini computers.

Uses of Mini computers

They became popular for control related functions as opposed to computing prowess. Over the years, their usage was limited to dedicated control assignments in mid-range organizations. Minicomputers were intended for a number of activities listed below:

- Switchboard control.
- Dedicated applications for graphics and computer design.
- Time-sharing, to allow multiple users to interact concurrently on a single system.
- Control and monitoring of manufacturing activities.
- Monitoring and control of laboratory equipment.

Micro computers/Personal computers; Microcomputers are the smallest, least expensive and the most used types of computers. They have a small memory, less processing power, are physically smaller, and permit fewer peripherals compared to super and mainframe computers. They are more commonly known as personal computers or simply pcs. They are more affordable for office use and create cheaper networking environments.

Uses of Microcomputers/Personal computers

- Personal microcomputers are often used for education and entertainment. Beyond laptops and desktops, microcomputers can include video game consoles, computerized electronics and smartphones.
- In the workplace, microcomputers have been used for applications including data and word processing, electronic spreadsheets, professional presentation and graphics programs, communications and database management systems. They have been used in business for tasks such as bookkeeping, inventory and communication; in medical settings to record and recall patient data, manage healthcare plans, complete schedule and for data processing; in financial institutions to record transactions, track billing, prepare financial statements and payrolls, and auditing; and in military applications for training devices, among other uses.

COMPUTER HARDWARE SPECIFICATIONS

Computer hardware specifications are technical descriptions of the computer's components and capabilities. Such specifications include;

- Random Access Memory (RAM), this is typically indicated in gigabytes (gb) and the more RAM in a computer the more it can do simultaneously.
- Hard disk space. This is typically indicated in gigabytes (GB) and refers generally to the amount of information (like documents, music and other data) your computer can hold.

- Other specifications might include network (Ethernet or Wi-Fi) adapters or audio and video capabilities.
- Battery life span. A brand new machine the battery should last between 5hrs to 6hrs while off power

Businesses mostly purchase PC hardware such as desktop computers. Hardware specifications are key in determining the cost of hardware. These specifications are determined by some key components such as;

- Central Processing Unit
- Random Access Memory
- Hard Disk

Central Processing Unit; The CPU is the brain of your PC. Hence, if you want to ensure great performance, you'll need to pick the right one. The most important specifications to look at in regards to CPU include;
*Processor Manufacturers: AMD and Intel***:-**There are only two choices to choose from that is; AMD and Intel. The brand you may end up choosing depends on your specific needs and what you'd personally prefer. AMD had had a reputation for being the low-cost option for years, but not until four years ago when their critically-acclaimed Ryzen processor series came out. As of late, AMD Ryzen is the preeminent choice if you want to build a high-spec rig, whether for gaming or productivity. On the other hand, Intel has a reputation for offering premium products that are lauded for their track record and overall reliability. They still lord it over AMD in processor market share but haven't been performing well against Ryzen for the past four years--until their 12th generation Alder Lake chips. *Cores/Core Count:* - This is one of the most (if not the) most important processor specs to look at. Cores refer to the microprocessors inside an Intel or AMD CPU, which allow the chip to work on multiple tasks at the same time. Most of the time, the more cores, the better and faster your PC will perform. But it all depends on what you intend to use your computer on. If you plan to use it on gaming, for instance, you will do well with a bare minimum of four cores, with the recommended core count at six or more. For productivity workloads such as video editing (which are known for using a lot of processor power), you'd do well with eight cores or more. The lineup of Core processors includes the Intel Core i3 with 2 cores, Intel Core i5 with 4 cores, Intel Core i7 with 4 cores, and Intel Core i9 with 8 cores, along with the X-series of Intel Core CPUs. *SMT/Hyperthreading***: -** Modern CPUs can at times not only come with multiple cores, but also multiple threads. AMD has SMT (simultaneous multithreading, specifically on their newer Ryzen processor series), and Intel has hyperthreading. SMT and hyperthreading mean that a single CPU core could do the job of two cores by giving it two individual processing threads. A single core would be recognized by the OS as two CPU cores with

SMT or hyperthreading enabled. This is why you might see a processor like AMD's Ryzen 7 3700X, which possesses 8 cores and 16 threads. This means that for each core, there are two processing threads. The more threads, the better the CPU is at multitasking. *Clock Speed***: -** The clock speed measures the number of cycles your CPU executes per second, measured in GHz (gigahertz). For example, if you see a processor that has a rating of 3.1 GHz, it means that it operates at 3.1 billion cycles per second. Generally, a higher clock speed refers to a faster processor. A lot of modern chips from Intel and AMD are programmed to dynamically adjust their clock speeds based on what task they're doing and their operating temperatures. As such, you'll often see two different clock speeds on the box: a base clock and a boost/turbo or max clock. *TDP (Thermal Design Power)*: - TDP refers to the total heat output of the CPU, which is measured in watts. Most of the time, a high TDP is an indicator of great performance, but at the cost of having to buy an expensive CPU cooler. *Cache*: - This spec refers to the CPU's "short term memory," if you will. Its main purpose is to offer extremely fast data access, which speeds up the performance of the chip overall. Cache comes in three main types: L1, which is the fastest but offers the smallest capacity; L2 has more capacity but is a little slower--and L3 is the most spacious and the slowest. A big L1 cache often coincides with faster performance. *CPU Socket*: - A CPU socket designates which type of motherboard it will be compatible with. In layman's terms, you'll never be able to make an AMD CPU work with an Intel socket, and vice versa. And there are also so many kinds of sockets under these two brands. The socket is clearly indicated in the product box when you buy a new chip. It depends on which generation products are out, but modern AMD Ryzen CPUs use the AM4 socket, while the newest 12th gen Intel Alder Lake chips use the LGA 1200 socket. *Memory Support:* -Just like the socket, you can't use memory that the processor doesn't support in the first place. This spec will also be indicated firsthand in the box and main product pages as either DDR, DDR2, DDR3, DDR4, or even the newest DDR5. Modern AMD Ryzen and Intel chips support DDR4, with the newest Alder Lake CPUs supporting DDR5. Make sure to pick compatible memory when you buy a new CPU.

Random Access Memory (RAM); Computer memory is a crucial component within computers, largely responsible for the computer's speed and performance. Random Access Memory (RAM) allows you to open and use the programs on your computer, including your operating system. There are many types and sizes available and different systems require different types. RAM comes shaped in physical strips. Each strip has a set amount of memory storage space ranging from 2GB to 32GB. Most laptop's motherboards come with 2 to 3 slots for RAM. If your laptop has 8GB of RAM, it probably uses two 4GB strips of RAM in separate slots. Understanding the technical specifications

associated with RAM helps you determine what type and amount your computer can use and these include;

Physical size-RAM modules vary in physical size based on the type of computer they're used for and the number of pins on the module. Dual Inline Memory Modules (DIMMs) with 168 pins are 5.25 inches long. DIMMs with less pins are typically smaller, with more pins meaning a physically larger module. DIMMs are commonly used in desktop computers, whereas laptops typically use Small Outline Dual Inline Memory Modules (SODIMMs). SODIMMs use the same technology but they're physically smaller, allowing them to fit in laptops. *Amount*- The amount is another important specification to remember. Your computer can only hold so much RAM and while going over the specified limit won't harm your computer; your PC will only use as much of it as it was designed to use. Amount is commonly measured in gigabytes (GB); though older or low-end computers may measure maximum RAM in megabytes (MB). A gigabyte contains roughly 1,000 megabytes, meaning the RAM is much faster. Be sure to consider how many memory slots your computer has, as well. Some computers have two slots to install memory, others have four and some have even more. *Type*- The memory type is important because this is where the majority of RAM's compatibility issues lie. Multiple variations of Double Data Rate (DDR) memory technology are used in various computers. DDR2 is faster than DDR memory, while DDR3 memory is faster than both. If your computer requires DDR3 memory, DDR2 memory won't work. *Speed*- The speed and performance of your system directly correlate to the amount of RAM you have installed. If your system has too little RAM, it can make your computer system to be slow and sluggish. Your computer must have enough memory to make the most of the processor speed. You should have at least 4 gigabytes (GB) of RAM in order to use multiple modern software applications effectively and preferably 8 GB or above for more memory intense software applications such as video editing, photography or design. When selecting RAM, be sure that it's compatible with your motherboard. Memory speed is frequently denoted by "PC-" followed by a number that denotes the peak transfer rate and bandwidth of that type of memory. For example, PC-2400's peak transfer rate is around 2,400 megabytes per second (MB/s). The peak transfer rate basically denotes the best performance possible for that memory. "PC2" and "PC3" simply refer to DDR2 and DDR3 memory, respectively. The specifications may list the memory under a name known as the "friendly name," which looks something like "DDR3-1066." In this case, 1066 represents the data transfer rate in millions per second. All together, the memory specification may read something like "2 GB PC3-6400 DDR3 SODIMM."

Hard Drives; A computer hard drive (or a hard disk or HDD) is one kind of technology that stores the operating system, applications, and data files such a documents, pictures and music that your computer uses. It is a non-volatile storage device. Every computer has an internal hard drive, but you can also get external hard drives that can be used to expand the storage of a computer. All computers require drives to store data on a long-term basis. Hard drives are considered to be secondary storage and these come in two forms, i.e; the hard disk drive (HDD) and the solid state drive (SSD).

The *Hard disk drive* is a more traditional type of hard drive. Hard disk drives are made up of magnetized disks—known as platters—that spin rapidly, typically somewhere between 5,400 and 15,000 RPM (Revolutions per minute). The higher the RPM means faster transfer of data to and from the drive. The faster the magnetic disk rotates, the quicker your computer is able to access information from it. All digital data comes in the form of binary code—a series of ones and zeros that can represent any piece of information. The read/write heads of a hard disk drive are used to input these ones and zeros by magnetizing portions of the platter. Each tiny portion of the platter houses a bit, which will be equal to either 1 or 0. The head can detect the magnetism of each portion, thus "reading" information from it. The same head that can "read" data can also "write" it, by changing the magnetization of bits on a platter. Any time a change is made—such as a new file being saved or a file being deleted—the head of the hard drive will adjust the magnetism of the platter accordingly. Because data is stored magnetically, HDDs are non-volatile devices, meaning that they retain data even when the computer is turned off. These days, internal HDDs can reach a maximum capacity of 20 TB. The most common form factors for HDDs in enterprise systems are 2.5-inch, also known as small form factor (SFF), and 3.5-inch, also known as large form factor (LFF)

Since the emergence of *Solid State Drive*, hard disk drives are rarely used as a computer's secondary storage, but are still reliable as an external storage option. SSDs (solid state drives) are the newer of the type of hard drive. They have become the preferred format for high-end laptops' internal hard drives, and all smartphones and tablets also use a form of SSD. Solid-state drives use flash memory, which is also what's used in USB flash drives and memory cards for digital cameras. There are no magnets involved here, SSDs use semiconductors that store data by altering the electrical state of the trillions of circuits contained within the SSD. Because they have no moving parts, not only do they work faster (as you don't need to wait for disks to spin and heads to gather information), they also tend to last longer than HDDs. SDDs are a lot more expensive to manufacture, so while they're increasingly prevalent as the primary disk drive for high-end laptops and PCs, hard disk drives are still preferred by many as a cheaper external option. SSDs for computers are available between 120GB to 30.72TB. The standard form factor for an SSD is 2.5-inch, which fits inside the drive bay of most laptop or desktop computers.

Other specifications might include network (Ethernet or Wi-Fi) adapters or audio and video capabilities.

FACTORS TO CONSIDER WHEN PURCHASING COMPUTER HARDWARE

Cost/Price Vs Budget: Costs have to be weighed against the benefits that the hardware will yield. This may be about reducing costs by automating routine tasks or improving customer service. Of course, price does matter. Even though you have listed your priorities and precisely know what you require, a lower and/or more reasonably priced option is what users settle for, especially if you are sticking to a budget. Many users favor performance over appearance.

Scalability: Does the hardware have the ability to increase or decrease in performance and cost in response to changes in application and system processing demands? For example, how well can the hardware system perform when the number of users is increased or how well can an operating system perform on different classes of hardware. So enterprises that are growing rapidly should pay special attention to scalability when evaluating hardware.

Hardware specifications: Look at the components and capabilities of the hardware. Consider the processor speed, how many gigahertz, because the higher the number the faster the computer. How much memory of RAM because the more RAM in a computer, the more it can do simultaneously. Hard disk space, how much information like documents, music and other data can be stored on it? Because these specifications largely affect the utility of the computer. It is these specifications that will ensure the correct operation of the software.

Compatibility with software: Hardware requires software to run correctly. Without the correct hardware, your software may not run efficiently or at all. So it is important to choose hardware that is effectively compatible with the software in question as it can affect the way you work and your productivity.

Warranty: Hardware warranty covers the repair and if repair is not possible, replacement of any PC, laptop, tablet, monitor, printer/scanner purchased from an IT house. So before you buy hardware, ask yourself, what is the warranty, is it limited to just specific parts, certain types of defects or other conditions. Warranty may be 90 days, I,2,3,4 or 5 years and above. So when purchasing hardware, its recommended that you add a more comprehensive warranty which can save your business from high costs related to hardware break down.

Peripherals: If you're looking forward to connecting to watching dvds in your laptop, for example, make sure that you consider your machine has a built-in DVD reader or optical drive in it. Keep in mind that the more peripherals a machine can handle, the bulkier and more expensive it may get. If you can live without installing something on your laptop via an optical drive, it may be a great option for you to simply skip it to avail of a thinner and cheaper model.

The monitor is the computer's display screen. Most modern monitors use some form of liquid crystal display (LCD) technology. Monitors are normally measured diagonally in inches - typically 22, 24 or 27 inches. Larger or ultra wide-screen monitors allow you to compare two documents on-screen. Which LCD technology you should use will depend on the cost of it, and whether you require true color reproduction or high screen refresh rates. The aspect ratio of a monitor is the proportion of image width to height. A common aspect ratio for monitors is 16:9 but other aspect ratios may be required for specialist purposes such as CCTV monitoring or movie editing.

The keyboard and mouse usually come as part of a bundle, but you may be able to select wireless devices that make desktops neater. There are alternative computers to conventional desktop pcs available, such as apple, macs. These have historically been used to support desktop publishing software but now also offer a comparable system for general office use.