Group RED (Niman, Jaideep and Ronit)

COMPUTER SYSTEM WORKSHOP TECHNOLOGY

PROJECT

Summary on various types of Computer Hardware

Computer hardware is a collective term used to describe any of the physical components of an analog or digital computer. Generally, internal hardware components are those necessary for the proper functioning of the computer, while external hardware components are attached to the computer to add or enhance functionality.These basically includes the following components :-

- Pointing Devices
- Audio Input/Output Devices
- Visual and imaging devices
- Network Devices
- Processing Devices
- Input/Output Devices
- Memory/Storage Devices

Pointing device

A pointing device, or sometimes called a pointing tool, is a hardware input device that allows the user to move the mouse cursor in a computer program or GUI operating system. Using a pointing device, you can point at or manipulate any object or text on the screen. For example, using a pointing device you could point at and select an icon from a list of icons.

Below are examples of pointing devices that can be used on a computer.

- Computer 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.

- Joystick
  - A joystick is an input device that can be used for controlling the movement of the cursor or a pointer in a computer device. The pointer/cursor movement is controlled by maneuvering a lever on the joystick. The input device is mostly used for gaming applications and,

sometimes, in graphics applications. A joystick also can be helpful as an input device for people with movement disabilities

- Light pen (pen)
  - A light pen is a light-sensitive computer input device, basically a stylus, that is used to select text, draw pictures and interact with user interface elements on a computer screen or monitor. The light pen works well with CRT monitors because of the way such monitors scan the screen, which is one pixel at a time, giving the computer a way to keep track of the expected scanning time by the electron beam and infer the pen's position based on the latest timestamp of the scanning

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

computers, touch pads are also being made for use with desktop computers. A touch pad works by sensing the user's finger movement and downward pressure.

- Keyboard (Can be used to move the mouse pointer.)

A keyboard is a peripheral device that enables a user to input text into a computer or any other electronic machinery. A keyboard is an input device and is the most basic way for the user to communicate with a computer. This device is patterned after its predecessor, the typewriter, from which the keyboard inherited its layout, although the keys or letters are arranged to function as electronic switches. The keys include punctuation, alphanumeric and special keys like the Windows key and various multimedia keys, which have specific functions assigned to them

1. What is the most common pointing device?

- For desktop computers, the most common pointing device is the computer mouse. For laptop computers, the most common pointing device is the touchpad. Finally, for smartphones and tablets, the most common pointing devices is your finger on a touch screen.

2. Why is a mouse called a pointing device?

- A mouse is called a pointing device because using it allows you to move the mouse cursor and point to anything on the screen.

3. Why are pointing devices input devices?

- Pointing devices send information (axis pointer information) to the computer and do not receive any information from the computer which makes them input devices.

• Memory/Storage Device

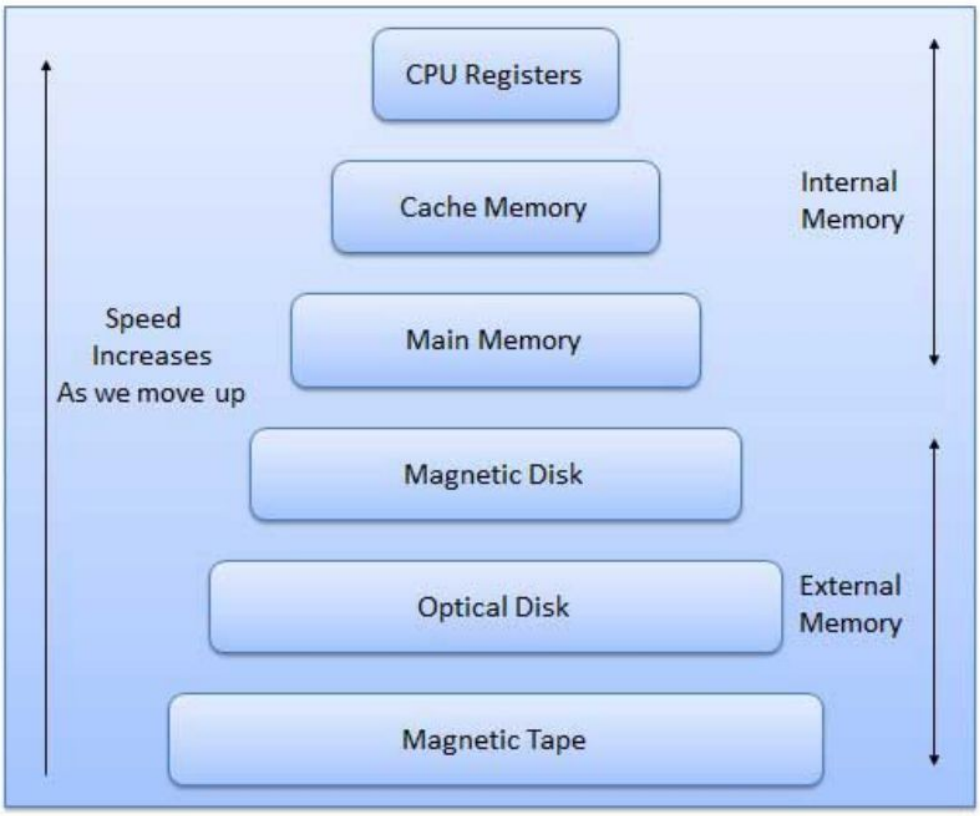
A memory is just like a human brain. It is used to store data and instruction. Computer memory is the storage space in computer where data is to be processed and instructions required for processing are stored.

The memory is divided into large number of small parts. Each part is called a cell. Each location or cell has a unique address which varies from zero to memory size minus one.

For example, if computer has 64k words, then this memory unit has 64 * 1024 = 65536 memory location. The address of these locations varies from 0 to 65535.

Memory is primarily of two types

- **Internal Memory** – cache memory and primary/main memory
- **External Memory** – magnetic disk / optical disk etc



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❖ Characteristics of Memory Hierarchy are following when we go from top to bottom.

- Capacity in terms of storage increases.
- Cost per bit of storage decreases.
- Frequency of access of the memory by the CPU decreases.
- Access time by the CPU increases.

RAM:

A RAM constitutes the internal memory of the CPU for storing data, program, and program result. It is read/write memory. It is called random access memory (RAM).

Since access time in RAM is independent of the address to the word that is, each storage location inside the memory is as easy to reach as other location & takes the same amount of time. We can reach into the memory at random & extremely fast but can also be quite expensive.

RAM is volatile, i.e., data stored in it is lost when we switch off the computer or if there is a power failure. Hence, a backup uninterrupted

tible power system (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types

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

Static RAM (SRAM)

The word **static** indicates that the memory retains its contents as long as power remains applied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Transistors do not require power to prevent leakage, so SRAM need not have to be refreshed on a regular basis.

Because of the extra space in the matrix, SRAM uses more chips than DRAM for the same amount of storage space, thus making the manufacturing costs higher.

Static RAM is used as cache memory needs to be very fast and small.

Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually **refreshed** for it to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory because it is cheap and small. All DRAMs are made up of memory cells. These cells are composed of one capacitor and one transistor.

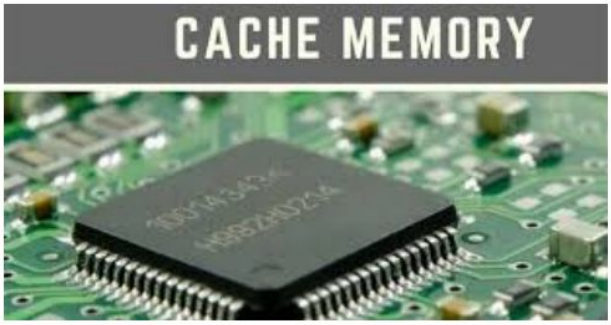
ROM:

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture.

A ROM stores such instruction as are required to start computer when electricity is first turned on, 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 memory is a very high-speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.

Advantages

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

- Cache memory has limited capacity.
- It is very expensive.

Virtual Memory:

Virtual memory is a technique that allows the execution of processes which are not completely available in memory. The main visible advantage of this scheme is that programs can be larger than physical memory. Virtual memory is the separation of user logical memory from physical memory.

This separation allows an extremely large virtual memory to be provided for programmers when only a smaller physical memory is available. Following are the situations, when entire program is not required to be loaded fully in main memory.

- User written error handling routines are used only when an error occurred in the data or computation.
- Certain options and features of a program may be used rarely.

- Many tables are assigned a fixed amount of address space even though only a small amount of the table is actually used.
- The ability to execute a program that is only partially in memory would counter many benefits.
- Less number of I/O would be needed to load or swap each user program into memory.
- A program would no longer be constrained by the amount of physical memory that is available.
- Each user program could take less physical memory, more programs could be run the same time, with a corresponding increase in CPU utilization and throughput.

Audio Devices

Audio Input DeviceAudio input can be provided to the computer using human voice or speech. Audio input to the computer can be used for different purposes. It can be used for making telephone calls, for audio and video conferencing over Internet, to record voice, to create audio files. Audio input devices like a microphone is used to input a person's voice into the computer. A sound card translates analog audio signals from microphone into digital codes that the computer can store and process. Sound card also translates back the digital sound into analog signals that can be sent to the speakers.

Audio input devices

(Microphone)

Audio output devices

The term "audio output device" refers to any device that attaches to a computer for the purpose of playing sound, such as music or speech.

1. Speakers

Speakers are the most common type of audio output device.On laptops and other mobile computing devices, speakers are usually built in. External speakers can attach to a computer using a variety of audio plugs, or they can attach using a USB connection.

Speakers

2. Headphones

Headphone

Headphones are another type of audio output device. Variations on the headphone concept include ear buds, which fit inside the ear, and headsets, which include both headphones and a microphone.

3. Sound card

Sound card

A sound card is a computer component that converts information from digital audio files into electronic sound signals. These signals are then passed on to an audio output device, such as speakers or headphones. Although sound cards do not themselves play sound, they do output audio signals. For this reason, they can be considered audio output devices.

Imaging Devices

Imaing devices means any mechanical, digi- tal or electronic viewing device, camera or any other instrument capable of recording, storing or transmitting visual images that can be utilized to observe a person.

1. Webcam

It is a imaging device which is actually a camera but in a very small size. It is attatched or fixed on the laptop or computer through which we can attend any kind of video conferences and take pictures. These are usually took pictures of low quality.

2. Digital Camera

A digital camera is a hardware device that takes photographs and stores the image as data on a memory card. Unlike an analog camera, which exposes

film chemicals to light, a digital camera uses digital optical components to register the intensity and color of light, and converts it into pixel data. Many digital cameras are capable of recording video in addition to taking photos.

Networking Devices

Computer network components are the major parts which are needed toinstall thesoftware important network components are **NIC, SWITCH, HUB, ROUTER, MODEM.** Depending on the type of network that we need to install, some network components can also be removed. For example, the wireless network does not require a cable.

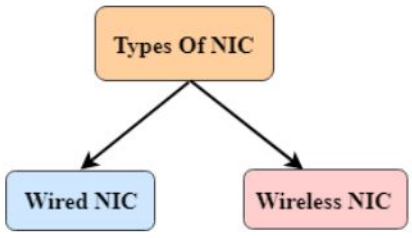
Following are the major components required to install a network:

1. NIC

- ❍NIC stands for network interface card.
- ❍NIC is a hardware component used to connect a computer with another computer onto a network
- ❍It can support a transfer rate of 10,100 to 1000 Mb/s.
- ❍The MAC address or physical address is encoded on the network card chip which is assigned by the IEEE to identify a network card uniquely.

1.There are two types of NIC:Wireless NIC

2.Wired NIC



Wired NIC: The Wired NIC is present inside the motherboard. Cables and connectors are used with wired NIC to transfer data.

Wireless NIC: The wireless NIC contains the antenna to obtain the connection over the wireless network. For example, laptop computer contains the wireless NIC.

2. Hub

A Hub is a hardware device that divides the network connection among multiple devices. When computer requests for some information from a network, it first sends the request to the Hub through cable. Hub will broadcast this request to the entire network. All the devices will check whether the request belongs to them or not. If not, the request will be dropped.

The process used by the Hub consumes more bandwidth and limits the amount of communication. Nowadays, the use of hub is obsolete, and it is replaced by more advanced computer network components such as Switches, Routers.

3. Switch

A switch is a hardware device that connects multiple devices on a computer network. A Switch contains more advanced features than Hub. The Switch contains the updated table that decides where the data is transmitted or not. Switch delivers the message to the correct destination based on the physical address present in the incoming message. A Switch does not broadcast the message to the entire network like the Hub. It determines the device to whom the message is to be transmitted. Therefore, we can say that switch provides a direct connection between the source and destination. It increases the speed of the network.

4. Router

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- A router is a hardware device which is used to connect a LAN with an internet connection. It is used to receive, analyze and forward the incoming packets to another network.A router works in a **Layer 3 (Network layer)** of the OSI Reference model.

❍A router forwards the packet based on the information available in the routing table.

❍It determines the best path from the available paths for the transmission of the packet.

Advantages Of Router:

❍**Security:** The information which is transmitted to the network will traverse the entire cable, but the only specified device which has been addressed can read the data.

❍**Reliability:** If the server has stopped functioning, the network goes down, but no other networks are affected that are served by the router.

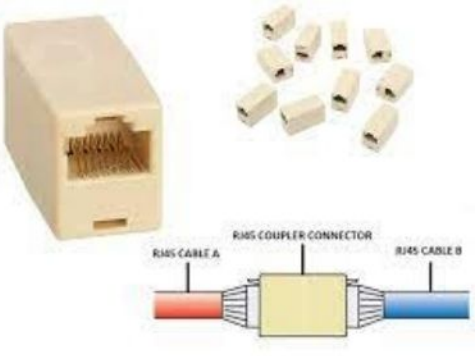
❍**Performance:** Router enhances the overall performance of the network. Suppose there are 24 workstations in a network generates a same amount of traffic. This increases the traffic load on the network. Router splits the single network into two networks of 12 workstations each, reduces the traffic load by half.

❍**Network range**

5. Modem

❍A modem is a hardware device that allows the computer to connect to the internet over the existing telephone line.A modem is not integrated with the motherboard rather than it is installed on the PCI slot found on the motherboard.

❍It stands for Modulator/Demodulator. It converts the digital data into an analog signal over the telephone lines.



6. Cables and connectors Cable is a transmission media used for transmitting a signal.

There are three types of cables used in transmission:

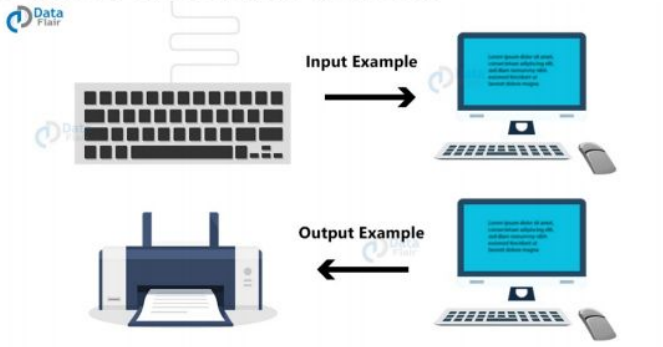
- Twisted pair cable
- coaxial cable
- Fibre optic cable

A connector is **a device that terminates a segment of cabling or provides a point of entry for** networking devices such as computers, hubs, and routers.

Input, Output & Processing Device of Computer:

Input and Output devices are a major part of the computer. They are a type of hardware device that makes up the computer system. These allow the system to function properly with external help. They both deal with data but in different ways.

The input allows the user to send data while the output completes the task related to the data. These all are auxiliary devices that connect to the device and complete all the tasks accordingly. Keyboards, mouse, scanners, etc. are some of the input devices while printers, monitors, headphones, etc. are some of the output devices.



Input Devices of Computer:

As mentioned above the input devices allow the users to send signals to the computer to perform a certain task. The receiver at this end is the Central Processing Unit (CPU) which then sends the signal to the output devices. Input devices further classify according to modality like visual or audio, discrete or continuous, and is it direct or indirect.

Some of the classifications are: -

1.Keyboard:

The most basic input device to enter data on the system or any other device with the help of the keys is a keyboard. They establish a connection with the computer either by Wi-Fi or by a USB system. There are keys for everything – numbers, letters, characters, and functions. The typing keys are A – Z and number keys till 09. The numeric keypad has 17 keys allowing users to perform different calculations. Then there are function keys for special computer features at the top row. The control keys have arrow signs on them allowing users to scroll on the page and select. Then there are special-purpose keys like space, enter, shift, etc.

2. Mouse: -

A hand-supported input device that allows users to move the cursor on the screen is a mouse. It works on a flat surface with a wheel between the left and right buttons. Laptops have a touchpad as does the function of a mouse. The invention of the mouse took place in 1063 by Douglas C. Engelbart. The earliest version of the mouse had a rollerball underneath, but the modern ones are made with optical technology with a light beam. The port of the mouse connection depends on the computer and mouse type.

Output Device of Computer:

1. Monitor: -The visual display units are the most important output device responsible for showing the visual made of pixels to the user. The pixels decide the image sharpness. There are two types of viewing screen on the monitor. They are:-

a) Cathode-Ray Tube (CRT) Monitor

- The pixels make up the image on the CRT display. The smaller pixels mean the image is more clear. Even a single character like ‘k’ is made of numerous pixels on the screen. A screen can have limited pixels at once, it is usually 80 by 20 characters horizontally and vertically.

Disadvantages of CRT Monitor −

- Large Size
- Power consumption is high

b) Flat-Panel Display Monitor

- These are high-level video devices with low volume, lightweight, and low power requirements. From wall hanging to smartwatches, they are everywhere. There are either emissive displays or non-emissive displays. Emissive displays convert electrical energy into light like LEDs in plasma panels. While the non-emissive display converts sunlight to light energy like LCDs.

2. Printer : -

A printer is an output device that prints paper documents. This includes text documents, images, or a combination of both. The two most common types of printers are inkjet and laser printers. Inkjet printers are commonly used by consumers, while laser printers are a typical choice for businesses. Dot matrix printers, which have become increasingly rare, are still used for basic text printing.

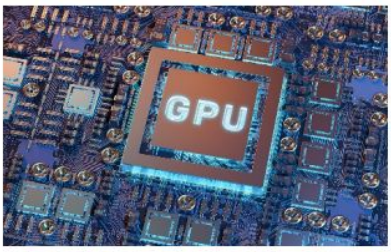
Processing Device of Computer:

The processing device is the computer's hardware component that helps to handle the storage and retrieval of the information. In the Computer, processing devices play major role in the processing operations. These devices are used to process the data with using of instructions from the program. CPU is capable to execute all instructions, which can be input and output operations or logical comparisons or numerical.

There are list of different types of processing devices of computer below: -

GPU stands for "**Graphics Processing Unit**" that is a computer integrated chip that helps to render the graphics and images with using of performing rapid mathematical calculation. It is used for both purposes in personal and professional computing. GPU has responsibility for getting to render 2D and 3D images, video and animations.

1. **GPU**: -



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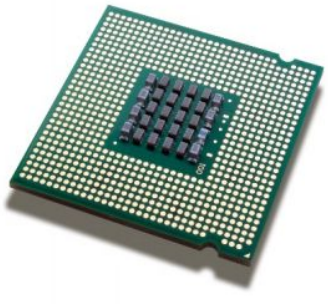
2. **Microprocessor**:



Microprocessor is a heart of the computer that is installed as a single integrated circuit inside the computer. It has responsible for performing all arithmetic and logical operations.

3. **Sound Card**: -

Sound card is a hardware component of computer that is installed on the motherboard, and it delivers the audio input and output capabilities. Mostly, sound card has at least single analog line input and one stereo line output connection.

4. **Video Card**: -

Video card is an expansion card that is embedded on the computer's motherboard. Video card has other alternative names like as "Display Adapter ", "Graphics Card ", "Video Adapter ", "Video Board ", or "Video Controller ". It is used to display the images on the monitor because without it, user would not be able to see any pictures. Mostly, gamer prefer the video card for getting extra processing power and high-definition graphic.

5. **CPU (Central Processing Unit)**: -

CPU is a primary component of the computer system that helps to perform all types of data processing operations. It has responsible to manage operations of all components of computer.

6. **Motherboard**: -

Motherboard is the main circuit board of the computer system, and it is also called the “Main board or Logic board”. Every motherboard consists of the group of chip and controller known as chipset.