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Q1: Describe the major components of a desktop or laptop personal computer that is not more than 3 years old. There should be four categories. Each category has many components. Some components, such as CPU has many more components. You must provide at least a complete sentence to describe this component. (50%)

A1: I purchased a DELL Inspiron 15 7000 in 2017. It is a laptop personal computer which I use for home. Components of a computer:

1. Hardware Components:
   1. CPU – Stands for Central Processing Unit. It is the brain of the computer, which takes the instruction from the input system, executes them, and outputs it. CPU also tells other components what to do. It is heavily dependent on the chipset to function efficiently. In case of my computer, intel core i7 is the CPU, which is otherwise called as processor. CPU has multiple sub-components. Here are three major ones.
      1. Control Unit (CU) – As the name suggests, it controls all the operations within the CPU. The memory, ALU and input-output systems are directed by the CU, based on the instructions provided to the processor.
      2. Arithmetic Logic Unit (ALU) – All the integer arithmetic and logical operations are performed within ALU. The main inputs to the ALU are the data words to be operated, the instruction code from CU and the status information from the previous operation. After the data is processed, the output is stored in a memory register.
      3. Address Generation Unit (AGU) – This unit calculates the addresses used by the CPU to access the main memory. It is executed in a separate circuitry so that data processing and memory calculation can be executed in parallel and that would enhance the performance of the entire CPU.
   2. Memory – Computer memory is a physical device that stores information. It can be any of the below ones.
      1. RAM – Random access memory is a memory that computer uses for processing data. This is also another integrated chip which consists of millions of registers and capacitors. The higher the RAM size is, the greater number of multitasking processes can be run concurrently. When the power is turned off, all the information stored in RAM is lost. In case of my computer the memory size of the RAM is 16 Gigabytes.
      2. ROM (Read only memory) – Unlike RAM, read only memory devices do not lose data when the power is turned off. They are a non-volatile type memory. They are also integrated chips but made of diodes. A type of ROM is programmable ROM. In case of computers they are used for the basic IO system (BIOS). CD-ROM is another type of ROM device, which is gradually going out of the market. In my computer I do not have a CD-ROM device.
      3. Flash memory – It is another EEPROM type ROM device. It can be programmatically erased. Their usage is very common now. Flash drives, memory cards are examples of flash memory type.
      4. Cache – Computers use cache memory to store the data that are used repeatedly, and to quickly access the data without processing the data. Also called as CPU memory.
      5. DMA – Direct memory access allows certain computer hardware to access the RAM, without going through the CPU.
      6. HDD – Hard disk drives are the data storage devices, which are in form of rotating disks and coated with magnetic material. The data is accessed using a read-write head. They have very large data storage capability. It is a Non-Volatile type memory. CPU accesses the data on an HDD in random-access manner.
      7. SSD (Solid State Drive) – SSDs do not have a rotating disk or a read-write head. They use integrated chips, typically flash memories. Since there is no rotation, the SSDs run silently with a quicker data access time and lower latency. My computer has an SSD type storage and has 1 terabyte of storage capacity.
   3. Other components of a computer are mouse, keyboard, monitor, network cards or inbuilt modems, CD/DVD drive, USB ports, printer, scanner, speakers, microphone, UPS (uninterrupted power supply).
2. Software Components:
   1. OS – An operating system is an interface between the computer and the user. There are different types of OS. Most common ones are Unix, MS Windows, macOs, Linux.
   2. Applications – They are collections of many software programs to perform a task requested by the user. An example is a calculator app within a computer.
   3. Drivers – Device drivers are group of programs that enable the external hardwares to communicate with the computer’s operating system. For example, to connect a printer, you must install the driver for it to work.
   4. Utilities – Utility software are additional capabilities provided within an operating system. Examples are notepads, print/scan capability, search functionality.
3. Communication Components: Open system interconnection (OSI) model is a framework which consists of 7 layers. Various networking standards like TCP/IP fits into.
   1. Communication Hardware Components.
      1. Layer 1 – The physical layer – It is the bottom most layer of the framework and can be a twisted pair cable or an optical fiber.
      2. Layer 2 – The datalink layer – In this layer the transmitted bits are translated into meaningful data packets. Computers connect to the cables through an ethernet input or via WiFi.
   2. Communication Software Components.
      1. Layer 2 – Software part of the datalink layer – For the computer to access the wifi or the ethernet, the drivers are installed.
      2. Layer 3 – The network layer handles the routing part of the communication from one computer to the other. The logical addresses are created and assigned to the computers which are called as IP addresses.
      3. Layer 4 – The transport layer ensures the data packets travel over the network without errors. TCP and UDP are two protocols act as the layer 4 of the communication.
      4. Application Layer – This is the topmost layer of the OSI model. Using this layer, the applications or the programs communicate with the internet. One such medium is HTTP.
4. Data Components:
   1. File systems – To organize the data in a computer the file systems are used. Without it, the data will be one huge piece of data. There are many types of file systems; NTFS, FAT32, etc.
   2. Data at rest – The data that stays in a computer or a server is called data at rest.
   3. Data in transit – In contrast to Data at Rest, the data in transit is the piece of data that is moving over a network.
   4. Encryption – For the purpose of data security, all the data must be encrypted. Data can be encrypted both at rest and in transit. The encryption key is used for both encryption and decryption.
   5. Compression – The media files are compressed using various techniques (lossy and lossless) to optimize the size for the web pages or uploading.
   6. Pulse Code Modulation (PCM) is used to convert the analog data to digital. Different techniques are used to convert the digital data to analog; such as Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK).

Q2: Draw the layout of the following components: CPU, cache, ROM, RAM, DMA, and I/O modules. Use the line to show the interaction between every two components. For example there is a line between CPU and cache and another line between CPU and ROM. You can’t draw a line in the middle with all components hanging from the line. No other components should be included in the answer. No need to provide additional description. (50%)

A2:

A close up of a map

Description automatically generated