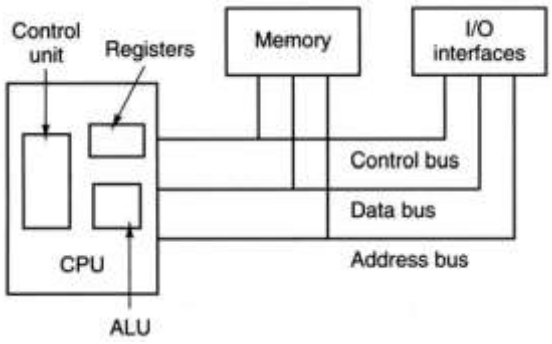
Answer

Computer architecture has undergone incredible changes in the past 20 years, from the number of circuits that can be integrated onto silicon wafers to the degree of sophistication with which different algorithms can be mapped directly to a computer's hardware. One element has remained constant throughout the years, however, and that is the ***von Neumann*** concept of computer design. Von Neumann architecture is composed of 5 distinct components (or sub-systems): ***a central processing unit (ALU/CU), memory, and input/output (I/O) interfaces***.

Figure 2.1 Basic Computer Components.

1. The CPU, which can be considered the heart of the computing system, includes three main components: the ***control unit*** (CU), one or more ***arithmetic logic units*** (ALUs), and various *registers*. The control unit determines the order in which instructions should ***be executed and controls*** the retrieval of the proper operands. It interprets the instructions of the machine. The execution of each instruction is determined by a sequence of ***control signals*** produced by the control unit. In other words, the control unit governs the flow of information through the system by issuing control signals to ***different components***. Each operation caused by a control signal is called a microoperation (MO). ***ALUs*** perform all mathematical and Boolean operations. The registers are ***temporary storage*** locations to quickly store and transfer the data and instructions being used. Because the registers are often on the same chip and directly connected to the CU, the registers have faster access time than ***main memory***. Therefore, using registers both as the source of operands and as the destination of results will improve the performance. A CPU that is implemented on a single chip is called a ***microprocessor***.
2. The computer's *memory* is used to store ***program instructions and data***. Two of the commonly used type of memories are ***RAM (random-access memory) and ROM (read-only memory). RAM*** stores the data and general-purpose programs that the machine executes. ***RAM*** is temporary; that is, its contents can be changed at any time and it is erased when power to the computer is turned off. ***ROM*** is permanent and is used to store the initial boot up instructions of the machine.



3. The ***I/O interfaces*** allow the computer's memory to receive information and send data to output devices. Also, they allow the computer to communicate to the user and to secondary storage devices like disk and tape drives.

The preceding components are connected to each other through a collection of signal lines known as a ***bus***. As shown in Figure 2.1, the main buses carrying information are the ***control bus, data bus, and address bus***. Each bus contains several wires that allow for the parallel transmission of information between various hardware components. The address bus identifies either a memory location or an I/O device. The data bus, which is bidirectional, sends ***data*** to or from a component. The control bus consists of ***signals*** that permit the CPU to communicate with the memory and I/O devices