Introduction to computer organization and computer evolution

Technology, Computer

Examples of architectural attributes include the instruction set, the number f bits used to represent various data types (e. G. , numbers, characters), 1/0 mechanisms, and techniques for addressing memory. Computer Organization refers to the operational units and their interconnections that realize the architectural specifications. Examples of organizational attributes Include those hardware details transparent to the programmer, such as control signals; Interfaces between the computer and peripherals; and the memory technology used.

As an example, It Is an architectural design Issue whether a computer will have a multiply Instruction. It Is n organizational Issue whether that Instruction will Implemented by a special multiply unit or by a mechanism that makes repeated use of the add unit of the system. The organizational decision may be based on the anticipated frequency of use of the multiply instruction, the relative speed of the two approaches, and the cost and physical size of a special multiply unit.

Historically, and still today, the distinction between architecture and organization has been an important one. Many computer manufacturers offer a family of computer models, all with the same architecture but with differences in organization. Consequently, the different models in the family have different price and performance characteristics. Furthermore, a particular architecture may span many years and encompass a number of different computer models, Its organization changing with changing technology. A prominent example of both these phenomena Is the IBM System/370 architecture.

This architecture was first Introduced In 1970 and Included a number of models. The customer with modest requirements could buy a cheaper, slower model and, if demand increased, later upgrade to a more expensive, faster model without having to abandon software hat had already been developed. These newer models retained the same architecture so that the customers software investment was protected. Remarkably, the System/370 architecture, with a few enhancements, has survived to this day as the architecture of Vim's mainframe product line. II.

Structure and Function A computer Is a complex system; contemporary computers contain millions of elementary electronic components. The key Is to recognize the hierarchical nature of most complex systems, Including the computer. A hierarchical system Is a set of interrelated subsystems, each of the latter, in turn, hierarchical in structure until we yester is essential to both their design and their description. The designer need only deal with a particular level of the system at a time. At each level, the system consists of a set of components and their interrelationships.

The behavior at each level depends only on a simplified, abstracted characterization of the system at the next lower level. At each level, the designer is concerned with structure and function: Structure: The way in which the components are interrelated ; Function: The operation of each individual component as part of the structure The computer system will be described from the top down. We begin with the major components of a computer, describing their structure and function, and proceed to successively lower layers of the hierarchy.

Function Both the structure and functioning of a computer are, in essence, simple. Figure 1. 1 depicts the basic functions that a computer can perform. In general terms, there are only four: ; Data processing: The computer, of course, must be able to process data. The data may take a wide variety of forms, and the range of processing requirements is broad. However, we shall see that there are only a few fundamental methods or types of data processing. Data storage: It is also essential that a computer store data. Even if the computer is processing on the fly (I. E. Data come in and get processed, and the results go out immediately), the computer must temporarily store at least those pieces of data that are being worked on at any given moment. Thus, there is at least a short-term data storage function. Equally important, the computer performs a long-term data storage function. Files of data are stored on the computer for subsequent retrieval and update. ; Data movement: The computer must be able to move data between itself and the outside world. The computer's operating environment consists of devices that serve as either sources or destinations of data.

When data are received from or delivered to a device that is directly connected to the computer, the process is known as input-output (1/0), and the device is referred to as a peripheral. When data are moved over longer distances, to or from a remote device, the process is known as data communications. ; Control: Finally there must be control of these three functions. Ultimately, this control is exercised by the individual(s) who provides the computer with instructions. Within the computer, a intro unit

manages the computer's resources and orchestrates the performance of its functional parts in response to those instructions.