HISTORY

The first documented computer architecture was in the correspondence between Charles Babbage and Ada Lovelace, describing the analytical engine. When building the computer Z1 in 1936, Konrad Zuse described in two patent applications for his future projects that machine instructions could be stored in the same storage used for data, i.e., the stored-program concept. Two other early and important examples are:

- John von Neumann's 1945 paper, First Draft of a Report on the EDVAC, which described an organization of logical elements; and
- Alan Turing's more detailed Proposed Electronic Calculator for the Automatic Computing Engine, also 1945 and which cited John von Neumann's paper.

The term “architecture” in computer literature can be traced to the work of Lyle R. Johnson and Frederick P. Brooks, Jr., members of the Machine Organization department in IBM's main research center in 1959. Johnson had the opportunity to write a proprietary research communication about the Stretch, an IBM-developed supercomputer for Los Alamos National Laboratory (at the time known as Los Alamos Scientific Laboratory). To describe the level of detail for discussing the luxuriously embellished computer, he noted that his description of formats, instruction types, hardware parameters, and speed enhancements were at the level of “system architecture”, a term that seemed more useful than “machine organization”.

Subsequently, Brooks, a Stretch designer, opened Chapter 2 of a book called Planning a Computer System: Project Stretch by stating, "Computer architecture, like other architecture, is the art of determining the needs of the user of a structure and then designing to meet those needs as effectively as possible within economic and technological constraints

Brooks went on to help develop the IBM System/360 (now called the IBM zSeries) line of computers, in which “architecture” became a noun defining “what the user needs to know”. Later, computer users came to use the term in many less explicit ways.

The earliest computer architectures were designed on paper and then directly built into the final hardware form. Later, computer architecture prototypes were physically built in the form of a transistor–transistor logic (TTL) computer—such as the prototypes of the 6800 and the PA-RISC—tested, and tweaked, before committing to the final hardware form. As of the 1990s, new computer architectures are typically "built", tested, and tweaked—inside some other computer architecture in a computer architecture simulator; or inside a FPGA as a soft microprocessor; or both—before committing to the final hardware form.

DEFINITION

Computer architecture is concerned with balancing the performance, efficiency, cost, and reliability of a computer system. The case of instruction set architecture can be used illustrate the balance of these competing factors. More complex instruction sets enable programmers to write more space efficient programs, since a single instruction can encode some higher-level abstraction (such as the x86 Loop instruction). However, longer and more complex instructions take longer for the processor to decode and can be more costly to implement effectively. The increased complexity from a large instruction set also creates more room for unreliability when instructions interact in unexpected ways.

The implementation involves integrated circuit design, packaging, power, and cooling. Optimization of the design requires familiarity with compilers, operating systems to logic design, and packaging.

COMPUTER ORGANIZATION

Computer organization helps optimize performance-based products. For example, software engineers need to know the processing power of processors. They may need to optimize software in order to gain the most performance for the lowest price. This can require quite detailed analysis of the computer's organization. For example, in a SD card, the designers might need to arrange the card so that the most data can be processed in the fastest possible way.

Computer organization also helps plan the selection of a processor for a particular project. Multimedia projects may need very rapid data access, while virtual machines may need fast interrupts. Sometimes certain tasks need additional components as well. For example, a computer capable of running a virtual machine needs virtual memory hardware so that the memory of different virtual computers can be kept separated. Computer organization and features also affect power consumption and processor cost.

PLAN

1. History
2. Categories
3. Definition
4. Computer organization
5. Conclusion

QUESTIONS

1. What you can say about Neumann architect?

   The Von Neumann architecture, also known as the Princeton architecture, is a computer architecture based on that described in 1945 by the mathematician and physicist John Von Neumann. He described an architecture for an electronic digital computer with parts consisting of a processing unit containing an arithmetic logic unit (ALU) and processor registers, a control unit containing an instruction register and program counter (PC), *a memory to store both data and instructions*, external mass storage, and input and output mechanisms. The meaning has evolved to be any stored-program computer in which an instruction fetch and a data operation cannot occur at the same time because they share a common bus.

2. Definition of computer architecture?

   Computer architecture is concerned with balancing the performance, efficiency, cost, and reliability of a computer system. The case of instruction set architecture can be used illustrate the balance of these competing factors.

3. Which categories have architecture?

   The discipline of computer architecture has three main subcategories:

   - Instruction set architecture (ISA): defines the machine code that a processor reads and acts upon as well as the word size, memory address modes, processor registers, and data type.

- Microarchitecture: also known as "computer organization", this describes how a particular processor will implement the ISA. The size of a computer's CPU cache for instance, is an issue that generally has nothing to do with the ISA.
- Systems design: includes all of the other hardware components within a computing system, such as data processing other than the CPU (e.g., direct memory access), virtualization, and multiprocessing

4. What include Computer hardware?

   Computer hardware includes the physical parts of a computer, such as the case, central processing unit (CPU), monitor, keyboard, computer data storage, graphics card, sound card, speakers and motherboard.

   By contrast, software is the set of instructions that can be stored and run by hardware. Hardware is so-termed because it is "hard" or rigid with respect to changes, whereas software is "soft" because it is easy to change.

   Hardware is typically directed by the software to execute any command or instruction. A combination of hardware and software forms a usable computing system, although other systems exist with only hardware.

5. What do you know about supercomputers?

   A supercomputer is a computer with a high level of performance as compared to a general-purpose computer. The performance of a supercomputer is commonly measured in floating-point operations per second (FLOPS) instead of million instructions per second (MIPS). Since 2017, there are

supercomputers which can perform over a hundred quadrillion FLOPS (petaFLOPS). Since November 2017, all of the world's fastest 500 supercomputers run Linux-based operating systems. Additional research is being conducted in China, the United States, the European Union, Taiwan and Japan to build faster, more powerful and technologically superior exascale supercomputers.