History of the Microprocessor

Introduction

A *microprocessor* is one of the most central parts of a modern personal computer or, in fact, any advanced computer device. It integrates the functions of a *central processing unit* , the portion of a computer responsible for carrying out programmed instructions, onto a single integrated circuit that couples the important thinking devices of the machine with the electrical infrastructure needed to support them. Microprocessor design is able to incorporate a tremendous amount of processing power in a very small space. Perhaps more than any other component of the modern computer, the microprocessor has a long and storied history, and an almost mythological status thanks to its great importance. Each step of the way to modern microprocessing has spurred more triumphs, innovations, and competition.

Early Inventions

Before the development of the microprocessor, there were a variety of early technologies for simulating logic functions in computing devices. Many of these early inventions were spurred by wartime necessity during World War II. These early technologies were extremely expensive, slow, and prone to failure ;€“ and

by todayâ€™s standards their capabilities were amazingly primitive. Computing technologies based on vacuum tubes and transistors helped make IBM a giant in the large-scale computing industry, but were not realistic for business or home use due to their prohibitive costs and intensive maintenance schedules. Early integrated circuits appeared in calculators, of all things, in the early 1960s; years before Intel began work on the first recognizable microprocessor.

Great Moments in Microprocessor History: Cross-referenced overview of the history of microprocessor technology from the 1960s to the present.

History of the Microprocessor: Another view of the history of the microprocessor from a more technical perspective, focusing on the different companies and competition involved at various stages of microprocessor design.

Microprocessor Timeline Diagram: Graphical timeline giving a family tree of different microprocessor units and their creators from 1971 to the late 1990s.

4-Bit Chips

Though IBM was a titan in the early huge-scale computing race, it was Intel, founded in 1968, that provided much of the pioneering work associated with first-generation microprocessor technology. The power of a given microprocessor was, and still is, measured in *bits*. Put simply, this refers to the most basic unit of coded instructions, expressed in a string of binary 1s and 0s, which the computer interprets to carry out tasks. The more powerful the processor, the more instructions it can carry out at one time, leading to faster processing and more effectiveness at complex tasks. Though 4-bit chips were fairly simple, they gave weight to the prophetic prediction known as *Moore's Law*, predicting that the capacity of integrated circuits (and thus, of computers) would double every two years.

Microprocessors Throughout the Ages: Illustrated view of the development of the microprocessor and its importance, provided by Plymouth State University in New Hampshire.

Intel 4004 35th Anniversary Project: Fan project for the Intel 4004, a 4-bit microprocessor that revolutionized the early personal computing industry.

The Intel 4004: Overview about the Intel 4004 focusing on the contribution of its designer, Federico Faggin, and the historical importance of the chip in context.

8-Bit Chips

Intel remained a forerunner in early microprocessor technology, releasing its first 8-bit microprocessor, the 8008, in 1972. Many of the same engineers involved with the original 4-bit models contributed ideas and design specifications to this new generation of chips, which had taken only about four years to develop. By this time, other companies were becoming increasingly interested in the microprocessor field, thanks largely to Intel's own evangelization of the potential benefits. By the middle of the decade, Intel's new 8080 microprocessor made major inroads in catching the eye of computer developers and engineers and the ascent of microprocessors was only beginning.

Intel 8008 Microprocessor Oral History Panel: Oral history transcript with interviews of individuals who contributed to the design of the Intel 8008 8-bit microprocessor chip, including Federico Faggin above.

The Evolution of a Revolution: Graphical timeline of microprocessor development with basic technical specifications and other information, provided by Intel.

The Evolution of the Computer: Heavily illustrated, detailed guide to computer development, with the development of the microprocessor in context with other major events before and after.

16-Bit Chips

In the mid-1970s, National Semiconductor entered the field of microprocessor development, enticed by the fast pace of breakthroughs at Intel. Unfortunately, the era of 16-bit chips was short, even by the standards of such an industry. 16-bit microprocessors including National Semiconductor's PACE were relatively slow, though more advanced iterations like the Motorola 6800 found their way into early Macintosh systems and others. By the time 16-bit chips were living up to their potential, the 32-bit era had already begun to arrive and 16-bit technology was destined to be eclipsed by the next big thing a foretaste of

things to come in an industry where research never ends.

The First 16-bit Microprocessor: Information on the first 16-bit computer

parts.

A Brief History of Microprocessors: Summary of key events in microprocessor history up to the creation of the modern Intel Pentium processor.

32-Bit Chips

By the late 1970s, development of 32-bit microprocessors was in full swing and they began to appear on the mass market in the 1980s, courtesy of National Semiconductor and Hewlett-Packard. Desktop engineering devices entered a new phase with the inception of 32-bit processing. 32-bit microprocessors were relatively advanced and can be looked upon as the forerunner of modern microprocessors.

Microprocessor: Cited, encyclopedic article on the use, development, and importance of microprocessors.

Motorola 680×0 Resources: Internet resource page for the Motorola 680×0, an early 32-bit microprocessor that is still in use in some places today.

Intel iAPX -432: Detailed, fairly technical discussion on the invention and capabilities of this benchmark 32-bit chip, the first object-oriented microprocessor in wide usage.

64-Bit Chips

64-bit chips have been available since 1992, and are now in the mainstream of computer use. Much of the 64-bit microprocessor era has been dominated by the battle between Intel and AMD. The latter company was founded in 1969 and rose to prominence after inking a deal with IBM and Intel by which AMD would become the second source manufacturer of Intel-designed processors. From that humble agreement, prompted by IBM's internal policies at the time, was born legal controversy, corporate intrigue, and ultimately, the de

vigorous microprocessing market with two major superpowers and the potential for many more as technology develops.

AMD: Evolution of an Innovator: Timeline-based history focusing on the contributions of AMD to the development of microprocessors and other important computer technology, and the shared history of the AMD company with Intel.

Free Online Dictionary of Computing: Computer jargon and terminology dictionary supported by Imperial College, London. Includes information on microprocessing and many other processes and components of modern computers.

Chip Shots Gallery: Florida State University-supported site exploring microscopy of integrated circuits and offering information on a variety of microchip producers, past and present.

RISC Chips

RISC, standing for Reduced Instruction Set Computer, derives from an IBM research project dating back to the second half of the 1970s. RISC chips were intended to streamline computer programming by omitting the most complex instructions and relying more effectively upon the simpler, more common instructions that could be processed and acted upon more quickly. Such chips are still used today and have developed into a spectrum of full-fledged computing architectures in competition with CISC methods of development, which makes full use of complex instructions. RISC architecture is widely used in devices such as cellular phones and certain types of travel PCs.

RISC vs. CISC: Illustrated, accessible article on competing internal architectures in computing.

RISC Architectures: Historical view of the development, commercialization, and future of RISC architecture.

A Brief History of RISC: Another view of the subject, covering developments from the 1950s up to 2001.

Great Microprocessors of the Past and Present: Definitions and other information pertaining to RISC and CISC architecture, as well as historical information on microprocessor development available at the same site.

Microprocessors Today

Today's microprocessors are immensely powerful, capable of executing complex instructions at a faster rate than ever before. As computers grow ever more sophisticated, engineering science begins to run up against puzzling challenges. The continued forward march of microprocessor technology depends as much on pure computing research as it does on cutting edge developments in other fields of science. The engine of microprocessor development in the 21st century may well be the creation of new forms of miniaturization or new semi conductive alloys that permit ever more transistors to be placed on a microchip. Though it is not known if Moore's Law can stand up against these unprecedented technical challenges, it is indisputable that today's microprocessors are more powerful than anything that could have been imagined at the dawn of the computing age over half a century ago. As increasingly globalized societies demand better computing technology, more great advances are sure to be made.

How Modern Microprocessors Are Made: Illustrated, step-by-step guide to modern microprocessor manufacturing.

The Microprocessor Today: Far-ranging, illustrated article on the current state of microprocessor technology that originally appeared in *IEEE Micro*, an official journal of the Institute of Electrical and Electronics Engineers Computer Society.

The Future of Microprocessors: Another article original sourced from *IEE Micro* that discusses trends and potential future developments in the field of microprocessing and the challenges and costs associated with new microprocessor technology.

Future of Microprocessors: Huge Performance Gains Now a Reality: Scholarly article focusing on the performance gains possible within the near future of microprocessor technology.

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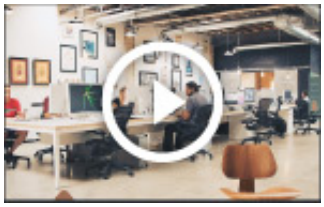

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