

## СЕКЦІЯ СТУДЕНТІВ ІV КУРСУ THE HISTORY OF MICROPROCESSORS

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A **microprocessor** incorporates most or all of the functions of a central processing unit (CPU) on a single integrated circuit (IC). The first microprocessors emerged in the early 1970s and were used for electronic calculators, using Binary-coded decimal arithmetic on 4-bit words. The integration of the CPU onto a single chip therefore greatly reduced the cost of processing capacity. From their beginnings, continued increases in microprocessor capacity have rendered other forms of computers almost completely obsolete, with one or more microprocessor as processing element in everything from the smallest embedded systems and handheld devices to the largest mainframes and supercomputers. Since the early 1970s, the increase in capacity of microprocessors has been known to generally follow Moore's Law, which suggests that the complexity of an integrated circuit, with respect to minimum component cost, doubles every two years.

In 1968, Garrett AiResearch, were invited to produce a digital computer to compete with electromechanical systems then under development for the main flight control computer in the US Navy's new F-14 Tomcat fighter. The design was complete by 1970, and used a MOS-based chipset as the core CPU. This chip was Intel 4004, released on November 15, 1971, the first 4-bit microprocessor.

The 4004 was later followed in 1972 by the 8008, the world's first 8-bit microprocessor. These processors are the precursors to the very successful Intel 8080 (1974), Zilog Z80 (1976), and derivative Intel 8-bit processors. A low overall cost, small packaging, simple computer bus requirements, and sometimes circuitry otherwise provided by external hardware allowed the home computer "revolution" to accelerate sharply in the early 1980s, eventually delivering such inexpensive machines as the Sinclair ZX-81, which sold for US\$99.

The first multi-chip 16-bit microprocessor was the National Semiconductor IMP-16, introduced in early 1973. Other early multi-chip 16-bit microprocessors include one used by Digital Equipment Corporation in the LSI-11 OEM board set and the packaged PDP 11/03 minicomputer,

and the Fairchild Semiconductor MicroFlame 9440, both of which were introduced in the 1975 to 1976 timeframe.

The world's first single-chip fully-32-bit microprocessor, was the AT&T Bell Labs *BELLMAC-32A*, with first samples in 1980, and general production in 1982. These microprocessors were used in the 3B2, the world's first desktop supermicrocomputer; in the "Companion", the world's first 32-bit laptop; and in "Alexander", the world's first book-sized supermicrocomputer.

While 64-bit microprocessor designs have been in use in several markets since the early 1990s, the early 2000s saw the introduction of 64-bit microchips targeted at the PC market.

With AMD's introduction of a 64-bit architecture backwards-compatible with x86, x86-64 (now called AMD64), in September 2003, followed by Intel's near fully compatible 64-bit extensions the 64-bit desktop era began. Both versions can run 32-bit legacy applications without any performance penalty as well as new 64-bit software.

A different approach to improving a computer's performance is to add extra processors, as in symmetric multiprocessing designs which have been popular in servers and workstations since the early 1990s. The microprocessor manufacturers looked for other ways to improve performance, in order to hold on to the momentum of constant upgrades in the market.

And in 2005, the first mass-market dual-core processors were announced and as of 2007 dual-core processors are widely used in servers, workstations and PCs while quad-core processors are now available for high-end applications in both the home and professional environments. A multi-core processor is simply a single chip containing more than one microprocessor core, effectively multiplying the potential performance with the number of cores.