

# THE EVOLUTION OF A REVOLUTION

EXPLORE THE INTEL TECHNOLOGY INNOVATIONS THAT HAVE CHANGED THE WORLD.

## The Revolution Begins

Throughout history, new and improved technologies have transformed the human experience. In the 20th century, the pace of change sped up radically as we entered the computing age. For nearly 40 years Intel innovations have continuously created new possibilities in the lives of people around the world.

### Moore's Law

In 1965, Intel co-founder Gordon Moore predicted that the number of transistors on a chip would double about every two years. Since then, Moore's Law has fueled a technology revolution as Intel has exponentially increased the number of transistors integrated into its processors for greater performance and energy efficiency.

Note: Number of transistors is an approximate number.

**1969** The Intel® 4004 processor, Intel's first microprocessor, powered the *Busicom* calculator and paved the way for the personal computer.

**1972** The Intel® 8008 microprocessor, based on the Intel® 8080 microprocessor, was the first successful home or personal computer.

**1976** An operator in an early bunny suit shows how a 4-inch wafer is prepared for a positive acid spin.

**1981** The Intel® 8088 microprocessor was selected to power the IBM PC.

**1983** The National Academy of Engineering named the microprocessor one of ten outstanding engineering achievements for the advancement of human welfare.

**1989** Released in the fall of 1989, the Intel® Pentium® Pro processor was designed to fuel 32-bit server and workstation applications, enabling fast computer-aided design, mechanical engineering and scientific computation.

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**1998** The Intel® Pentium® III Xeon® processor family was specifically designed for workstations and servers that utilize demanding business applications.

**2001** The Intel® Itanium® 2 processor is the first in a family of 64-bit products from Intel and is designed for high-end, enterprise-class servers and workstations.

**2003** Intel® Centrino® mobile technology brought high performance, enhanced battery life, and integrated Wi-Fi capability to thinner, lighter PCs.

**2005** Dual-core technology was introduced.

**2006** Intel launched four processors for servers under the Xeon 5300 brand, and another processor under the Core 2 Extreme series for high performance computing. These "quad-core" processors show improved performance over others with just one or two processing cores.

**2007** In the second half of 2007, Intel began production of the next generation Intel® Core™2 and Xeon processor families based on 45-nanometer (nm) H4-K metal gate silicon technology.

## The Revolution Continues

Intel continues to deliver on the promise of Moore's Law with the introduction of powerful multi-core technologies, transforming the way we live, work, and play once again.

Processor	Year	Initial Clock Speed	Number of Transistors	Manufacturing Technology
Intel® 4004 processor	1971	108 KHz	2,300	10µ
Intel® 8008 processor	1972	500-800 KHz	3,500	10µ
Intel® 8080 processor	1974	2 MHz	4,500	6µ
Intel® 8086 processor	1978	5 MHz	29,000	3µ
Intel® 8088 processor	1979	5 MHz	29,000	3µ
Intel® 286 processor	1985	6 MHz	134,000	1.5µ
Intel® 386 processor	1985	16 MHz	275,000	1.5µ
Intel® 486 processor	1989	25 MHz	1,200,000	1µ
Intel® Pentium® processor	1993	66 MHz	3,100,000	0.8µ
Intel® Pentium® Pro processor	1995	200 MHz	5,500,000	0.6µ
Intel® Pentium® III Xeon® processor	1998	300 MHz	7,500,000	0.25µ
Intel® Pentium® III processor	1999	500 MHz	9,500,000	0.18µ
Intel® Pentium® 4 processor	2000	1.5 GHz	42,000,000	0.18µ
Intel® Pentium® M processor	2002	1.7 GHz	55,000,000	90nm
Intel® Itanium® 2 processor	2002	1 GHz	220,000,000	0.13µ
Intel® Pentium® D processor	2005	3.2 GHz	291,000,000	65nm
Intel® Core™ 2 Duo processor	2006	2.93 GHz	291,000,000	65nm
Dual-Core Intel® Itanium® 2 processor 9000 series	2007	1.66 GHz	1,720,000,000	90nm
Quad-Core Intel® Xeon® processor (Pentium)	2006	2.66 GHz	582,000,000	65nm
Quad-Core Intel® Xeon® processor (Pentium)	2007	> 3 GHz	820,000,000	45nm

**The groundbreaking Intel® 4004 processor** was introduced with the same computing power as ENIAC.

The Intel® 8088 processor was twice as powerful as the Intel® 4004 processor.

The Intel® 8080 processor made video games and home computers possible.

The Intel® 8086 processor was the first 16-bit processor and delivered about ten times the performance of its predecessors.

A pivotal sale to IBM's new personal computer division made the Intel® 8088 processor the brain of IBM's new hit product—the IBM PC.

The Intel® 286 was the first Intel processor that could run all the software written for its predecessor.

The Intel® 386 processor could run multiple software programs at once and featured 275,000 transistors—more than 100 times as many as the original Intel® 4004.

The Intel® 486 introduced the integrated floating point unit. This generation of computers really allowed users to go from a command level computer into point and click computing.

The Intel® Pentium® processor, executing 112 million commands per second, allowed computers to more easily incorporate "real world" data such as speech, sound, handwriting and photographic images.

The Pentium® Pro processor delivered more performance than previous generation processors through an innovation called Dynamic Execution. This made possible the advanced 3D visualization and interactive capabilities.

The Intel® Pentium® processor's significant performance improvement over previous Pentium architecture processors was based on the seamless combination of the P5 microarchitecture and Intel MMX media enhancement technology.

The Intel® Pentium® III processor executed Internet Streaming 3D Extensions, entered the world of processor identification and utilized multiple low-power states to conserve power during idle times.

The Intel® Pentium® 4 processor ushered in the advent of the nanotechnology age.

The Intel® Pentium® M processor, the Intel® 955 chipset family, and the Intel® PRO/Wireless 2100 network connection are the three components of Intel® Centrino® processor technology. Intel® Centrino® processor technology was designed specifically for portable computing.

The Intel® Itanium® 2 processor is the successor of the first Itanium processor. The architecture is based on Explicitly Parallel Instruction Computing (EPIC). It is theoretically capable of performing roughly 8 times more work per clock cycle than other CISC and RISC architectures.

The Intel® Pentium® D processor features the first desktop dual-core design with two complete processor cores, that each run at the same speed, in one physical package.

Intel® Core™ 2 Duo processor optimizes mobile microarchitecture of the Intel® Pentium® M processor and enhanced it with many microarchitecture innovations. Intel® Centrino® Pro and Intel® Pro processor technology provide excellent performance from the Dual-Core Intel® Core™ 2 Duo processor.

Dual-Core Intel® Itanium® 2 processor 9000 series outperforms the earlier, single-core version of the Itanium 2 processors with more than 1.7 billion transistors and with two execution cores. These processors double the performance of previous Itanium processors while reducing average power consumption.

The unprecedented performance of the Intel® Core™ 2 Duo processor is made possible by each of the four complete execution cores delivering the full power of Intel Core microarchitecture. The Quad-Core Intel® Xeon® processor provides 50 percent greater performance than industry-leading Dual-Core Intel® Xeon® processor in the same power envelope. The quad-core based servers enable more applications to run with a smaller footprint.

Intel's next generation Intel® Core™ 2 processor family, codenamed "Penryn", contains industry-leading microarchitecture enhancements. Further, new SSE4 instructions for improved video, imaging, and 3D content performance and new power management features will extend "Penryn" processor family leadership in performance and energy efficiency.