

INTEL® 4004 PROCESSOR CELEBRATES 40TH ANNIVERSARY

On November 15, 1971 Intel created the world's first microprocessor: the Intel® 4004.

- Comparing the speed of the first microprocessor's transistor with the latest generation transistors, is like comparing the speed of a snail (5 meters per hour) with the speed of the Kenyan runner [Patrick Makau Musyoki](#) in his record-breaking marathon run (42,195 meters at 2:03:38 hours or an average of 20,6 km/h last month in Berlin). The fastest processors in the world can achieve frequencies of about 4GHz. They compare to the 4004 processor like the sprinter Usain Bolt to a snail.
- Today, the average annual energy cost to power a modern laptop is about EUR 25. If the energy consumption had remained unchanged since 1971, today's laptops would consume 4,000 times more energy and cost about 100 000 euro per year. At that cost, not many people could afford to operate a home computer...
- The die of the 4004 processor consisted of 2,300 transistors. The current 2nd gen Intel® Core™ processor has almost one billion transistors. This is like comparing the population of a large village to the population of China.
- Had today's 2nd gen Intel Core processor (actual size: 216mm² / equals 0.33 sq. inch) been manufactured in the historic 10µm process technology it would be as large as 21m² (equals 227 sq. ft.). Or roughly 7m x 3m (equals 23ft x 10ft). Can you imagine a monster like that inside your laptop?

- Fortunately, the size of transistors has shrunk at the pace of Moore's Law, which states that the amount of transistor on a chip roughly doubles every 2 years.
- The Intel 4004 microprocessor ran at 740 kilohertz (the current 2nd generation of Intel Core processors achieves almost 4 GHz. If the speed of cars had increased at the same pace since 1971, it would take about one second to drive from San Francisco to New York (or from Lisboa in Portugal to Moscow in Russia assuming the car speed in 1971 was 60 miles/hour and the distance between San Francisco and New York is 3 000 miles).
- The current Intel Core processor has 995 million transistors. If each transistor were a grain of rice, it would be enough to prepare a rice meal for all people in Poznan (Poland), Stuttgart or Düsseldorf (Germany), Glasgow (UK) or any city with approximately 567 thousand citizens.
- Compared to Intel's first microprocessor, the 4004, Intel's current 32nm CPU runs almost 5000 times faster and each transistor uses about 5000 times less energy. In the same period, the price of a transistor has dropped by a factor of about 50,000.
- The original transistor built by Bell Labs in 1947 was large enough that it was pieced together by hand. By contrast, more than 100 million 22nm tri-gate transistors could fit onto the head of a pin.¹
- More than 6 million 22nm tri-gate transistors could fit in the period at the end of this sentence.²

¹ A pin head is about 1.5 mm in diameter.

² A period is estimated to be 1/10 square millimeter in area.