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analog to digital is nearly complete

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As of 2007, we stored 295 trillion megabytes of information, scientists say

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The tipping point came in 2002 — that was when the world began storing more information in digital than in analog format, or so estimate the researchers who recently completed an inventory of the world's technological capacity.

As humanity races toward completing its shift from analog to digital data communication and storage, scientists can look back at how fast the transition has been. In 2000, three-quarters of the world's information was still in analog form. By 2007, all but 6 percent had been preserved digitally.

At this rate, [computers by the end of the century](#) will have the "computational power and ability to store as much information as that which can be stored in the molecules of all humankind's DNA," said one of the researchers, Martin Hilbert from the University of Southern California.

Current capacity is still only enough for 0.33 percent of the information that can be stored in all [DNA molecules](#) of one human adult, Hilbert said.

It represents an immense number nonetheless. As of 2007, the latest year that Hilbert reviewed, humankind was able to store 295 trillion optimally compressed megabytes, to communicate almost 2 quadrillion megabytes, and to carry out 6.4 trillion MIPS (million instructions per second) on general-purpose [computers](#).

Have a hard time imagining 295 trillion megabytes? Hilbert suggests thinking of it this way: "If we would use a grain of sand to represent one bit each of the 295 trillion, we would require 315 times the amount of sand that is currently available on the world's beaches."

For a better idea of what these numbers all mean, Hilbert and his colleague, Priscila López of the Open University of Catalonia, express the information through other analogies.

295 trillion megabytes is roughly:

- Equivalent to 61 CD-ROMs per person on Earth. Piling up the imagined 404 billion CD-ROMs would create a stack that would reach the moon and a quarter of this distance beyond.
- Enough that, if printed in newspapers that sold for \$1 each, the United States' entire global gross domestic product would not be enough to buy them all. (The cost would be 17 percent beyond the GDP.)
- Enough information to cover the entire area of the United States or China in 13 layers of books.

Hilbert and López surveyed [60 categories of analog and digital technologies](#) during the period from 1986 to 2007, and the results reflect our near complete transition from the analog to the digital age.

Over the course of their research, they started to home in on the tipping point.

"In the year 2000, 75 percent of all information was still in analog format, mainly analog [video cassettes](#) (like VHS)," Hilbert said, "and in 2007, 94 percent of our global technological memory consisted of [digital bits and bytes](#). This is nothing more than a blink of an eye in historical perspectives."

The year when digital information became dominant was 2002, they estimated.

Hilbert and López also estimated that the world's technological capacity to compute information via application-specific devices (such as electronics' microcontrollers or graphic processors) roughly doubled every 14 months over the past decades, while the capacity of the world's general-purpose computers (such as PCs and [mobile phones](#)) has doubled every 18 months.

Despite our lessening reliance on analog technologies, Hilbert feels that they won't disappear forever.

"In the long run, analog technologies will continue to exist as part of our historic past, and for hobby technicians," he said. "In some parts of the world they will still play an important role for many years to come, but they won't be the main tool."

The research paper was published online Thursday by the journal Science.

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