

China retakes the crown from U.S.

BY DON CLARK

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SAN FRANCISCO>> China took back a coveted computing crown from the United States on Tuesday, ratcheting up a fierce technological competition that has implications for science, national security and geopolitics.

LineShine, a massive computing system in Shenzhen, China, was declared the world's fastest by a group of researchers using a set of standard tests for supercomputers. Besides raw speed, the system stood out because it uses only standard microprocessors and not the special-purpose chips called graphics processing units, which most high-end supercomputers rely on for heavy number crunching.

That underlying design could point to a better way to blend artificial intelligence with traditional scientific tasks, said Jack Dongarra, an organizer of the so-called Top500 list of the world's most powerful supercomputers.

Dongarra, a professor of computer science and electrical engineering at the University of Tennessee, recently inspected the new machine, at the Shenzhen Cloud Computing Center. LineShine's test results were more than 20% faster than those of El Capitan, a system at Lawrence Livermore National Laboratory in California that has topped a twice-yearly ranking of supercomputer performance since November 2024. China had not placed a machine at the top of the list since 2017.

"It's an impressive system," Dongarra said of LineShine. "They upped us by developing a system that is not reliant on GPUs."

The new supercomputer adds to the race between China and the United States for technological supremacy. U.S. tech giants like OpenAI, Anthropic and Google have developed leading AI models, while another American company, Nvidia, has become the world's dominant supplier of AI chips. China has tried to innovate in different ways, with the Chinese startup DeepSeek releasing a cutting-edge artificial intelligence model last year using just a tiny fraction of specialized AI chips.

To prevent China from catching up, President Donald Trump has imposed tariffs and at times placed limits on AI chip exports. But China's use of standard microprocessors, which are known as CPUs, rather than GPUs to create an ultrafast supercomputer suggests a potential way to get around those roadblocks.

"The U.S. government should have stronger controls on the export and manufacturing of CPUs for the China market," said Jimmy Goodrich, a senior fellow at the University of California Institute on Global Conflict and Cooperation. "It is a loophole in the current regulations."

Supercomputers, a term for the largest machines dedicated to science, have been used since the 1960s for tasks such as creating climate models, cracking codes and designing nuclear weapons. They typically use high-precision mathematics, expressing numbers with 64 bits of data. Commercial AI systems from companies like Google and OpenAI, by contrast, can be even faster. They can use approximations for tasks such as identifying images or selecting the next word in a sentence, relying on what are known as four-bit and eight-bit numbers that allow the systems to make many simpler calculations at once.

"It is notable and impressive what China has done here, but they can't hold a candle to these massive AI supercomputers that have been built by American AI labs" and others, Goodrich said.

U.S. national labs, which are the main buyers of some of the largest supercomputers, are eager to use AI to accelerate aspects of their scientific work. So they are adopting more of these less precise calculations, along with the 64-bit variety.

Though U.S. companies have historically dominated the ranks of the very largest supercomputers, foreign systems have sometimes vaulted to the top. A system in Japan, for example, ranked No. 1 on the list from 2020 to 2022.

“There’s a lot of talk that America is the only country capable of these systems,” said Addison Snell, an analyst at Intersect360 Research, a firm tracking the sector. “Then you find that other companies have capabilities, too.”

Powerful systems from China and Japan have regularly spurred the Department of Energy and other U.S. agencies to push for more funding for supercomputers. In November, the Trump administration started the Genesis Mission, which aims to exploit supercomputers at U.S. national labs, along with private companies, to supercharge AI and scientific research.

GPUs, primarily developed by Nvidia and Advanced Micro Devices, have been a critical weapon in the recent supercomputer race. These chips excel in doing many chores simultaneously, including so-called vector calculations used in science and matrix multiplication at the heart of many AI tasks.

When U.S. officials limited China’s access to GPUs and other powerful chips, as well as restricting exports of some machines for manufacturing the most advanced semiconductors, that caused it “to invest in developing architectures and technology to effectively have supercomputers that are at the same level as the U.S.’ highest-performing systems,” Dongarra said.

China’s LineShine system does not separate the traditional jobs of microprocessors and GPUs, as most high-end systems do. Instead, it builds in GPU-style tasks with specialized circuitry that accelerates matrix and vector calculations. That ability is embedded in chips that have a total of nearly 14 million computing cores, or tiny electronic brains, installed in 90 hardware cabinets.