China takes lead as supercomputer race hots up

The world's great powers are racing against each other to build the world's most advanced thinking machine. The latest rankings show China in the lead. Should the rest of us be worried?

SCIENCE
DESIGN & TECHNOLOGY

Clash of the Titans: The US supercomputer which has just been eclipsed by China's Milky Way 2.

The Sputnik I satellite was launched from the Baikonur Cosmodrome in Soviet Kazakhstan on October 4th 1957 – the first manmade object to orbit the Earth. This triumph of Russian engineering caused a crisis of morale in the West. Alarmed by Russia's advances into space, US scientists embarked on the so-called Space Race, which ended with the successful 1969 mission that put Neil Armstrong and Buzz Aldrin on the Moon.

Four decades later, the US is facing another Sputnik moment. This time, the rival is China. The challenge: to build the fastest supercomputer in the world.

Until recently, the American 'Titan' held the title – a machine that runs at 17.6 petaflops (17,600 trillion calculations per second). But according to the latest rankings, the world's new supercomputer champion is China's Milky Way 2, which runs at double that speed. The US record has been not just beaten but smashed to bits.

Catching up may not be easy. The technology in supercomputers makes the spacecraft of the Sixties look like toys. The machine that put men on the moon had less computing power than a modern washing machine. Today's supercomputers are self-repairing, liquid-cooled behemoths that occupy huge purpose-built labs. The energy needed to run a supercomputer would be enough for 80,000 homes.

But the computer race matters for more than just national prestige. Supercomputers are vital tools in modern science. Given enough processing power, these machines can simulate complicated systems: diesel engines; the human heart; even the gravitational structure of the universe. Scientists working with the Mira supercomputer last year were able to watch billions of years of cosmological evolution unfold before their eyes – the fundamental laws of physics recreated in virtual space by the incredible computational power of the machine.

The supercomputer race could have darker implications too. The Sputnik mission was an advance for pure science, but the same technology could have been used to launch a nuclear warhead. Early supercomputers were used to simulate hydrogen-bombs. The possible military uses of modern machines can only be imagined.

POWER STRUGGLE

With the stakes so high, many Western policy-makers see China's progress in supercomputing as a real geopolitical threat. The US should take action, they say, to limit China's access to Western machines; to keep new advances secret and to invest however many millions of dollars it takes to regain the lead.

Scientists agree that investment is needed – but not all of them take such a hard line on foreign policy. Why compete, they wonder, when you could work together. China's brilliant new machine could be not a threat but an opportunity.

💬 Q & A

Q Would an ordinary person ever be allowed to play on a supercomputer?
A I don't think 'play' is quite the right word for what you do with a supercomputer. These machines are designed to crunch enormous strings of numbers – not to produce the sleek, polished graphics you see in films or video games. The best way to win yourself some supercomputer time is probably to devote yourself to high-level science: maybe particle physics or neurology. That said, you could just wait for supercomputers to come to you.

Q What do you mean?
A Computer technology is developing at a remarkable speed. Roughly speaking, the computing power you can squeeze onto a single chip doubles every year or so. That means that a top of the line supercomputer from the 1990s is about as powerful as an ordinary laptop today.

💬 SOME PEOPLE SAY...

'A single Chinese supercomputer is more dangerous than a thousand Chinese tanks.'

WHAT DO YOU THINK?

▶ China takes lead as supercomputer race hots up

📖 WORD WATCH

Soviet Kazakhstan – The Soviet Union, or USSR was dominated by Russia and ruled from Moscow but included several other 'Soviet Socialist Republics', from Ukraine and Belarus in the West to Georgia in the South and Kazakhstan in the East. When the USSR dissolved at the end of the Cold War in the 1990s, the republics gained independence, but Russia still uses the old Soviet space centre at Baikonur.

Fastest supercomputer – The short term speed target is one exaflop, equal to one thousand petaflops. China is expected to build the world's first exaflop computer by 2018. In the longer term, no one knows exactly how fast supercomputers could one day get. It will not be long before chip designers start hitting limits imposed by the fundamental laws of physics, with parts only a few hundred atoms wide.

Petaflops – FLOPS, in computing, stands for Floating-point Operations Per Second – a simple measure of computer speed. The 'peta' part comes from the standard system of counting in powers of one thousand. A speed of one kiloflops is a thousand operations per second. One megaflops is a million; one gigaflops is a billion; one teraflops is a trillion and one petaflops is a thousand trillion operations per second.

💬 YOU DECIDE

1. Which is more important: supercomputing or space flight?

2. Big science projects are good for national prestige – but does national prestige matter at all? If so, why?

🖱 ACTIVITIES

1. Write or improvise a science-fiction dialogue between supercomputer which is becoming self aware and the scientist who created it.

2. Supercomputers can be used to simulate complex systems, allowing experiments to be performed that could never be done in real life. If you had your own supercomputer, what would you simulate? Write a short article explaining what and why.

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✎ NOTES