

Nine Things to Know About Super Computers



Ever wondered what is the big deal about a supercomputer? Is it only about bragging rights or is there more to it? India's premier space-research body ISRO sometime back unveiled India's fastest supercomputer.

Here's unravelling the world of supercomputers.

India's fastest supercomputer

Indian Space Research Organisation, the country's premier space-research institution, unveiled India's fastest supercomputer, SAGA-220.

SAGA-220 is three times faster than Isro's previous fastest machine. And it is 1.5 times faster than Eka (Sanskrit for one) -- the previous fastest in India, made by the Tata Sons-owned Computational Research Laboratories in Pune.

What is a Supercomputer?

It's a computer that tries to do a voluminous job -- like analysing several trillion data points -- in quick time. It looks like columns of cupboards stacked against a wall. Back in the 1950s, a supercomputer took up half-a-football field.

Today, because of the march of technology, the black boxes and cables can fit into a master bedroom.

A top-of-the-line supercomputer, today, would be like two million laptops working in sync. They share work and exchange information in real time via high-capacity bandwidth. Ashok Tripathy, business head, Wipro Systems and Technology Division, compares it to a shoal of fish, swimming together. "Each fish is like a small computer," he says. "Together, they form a supercomputer to perform a specific task."

What is the speed of Supercomputer?

A supercomputer is about speed. Its processing speed is measured in floating point operations per second (flops), or the number of calculations a supercomputer can perform in a second. For example, ISRO's SAGA-220 logs in at 220 teraflops -- 10 followed by 12 zeroes.

There are computers going into petaflops (15 zeroes) and the future is zetaflops (21 zeroes). To put this in perspective, the speed of a normal PC is 1 kiloflop (three zeroes). On the same lines, supercomputers need enormous speeds to process and transfer data within its various parts.

Most PC users Internet speeds of less than 1 mbps. Banks and telecom companies use 4 gbps lines to, say, maintain ATM networks or billing systems. Supercomputers need speeds of 20 gbps.

At what point a computer becomes a supercomputer?

There's no formal point at which a computer becomes a supercomputer. It is need-based and quite dynamic --- today's supercomputers tend to become tomorrow's ordinary computers. The desktop we use today is equivalent to a supercomputer of the 1970s. In that evolution curve, computers will become more sophisticated. And so will supercomputers.

What are supercomputers used for?

Anything that is calculation-intensive. Take oil exploration. It costs a company \$10 million to \$30 million to dig a well onshore and \$100 million in the deep seas. After spending all this money, it could still not find any oil.

So, before digging an oil well, geologists study an area and generate several million data points on metrics like temperature, density and pressure. Supercomputers can process this data for preliminary findings, helping companies decide whether and where to dig.

The utility of a supercomputer is endless. It can be used to forecast the weather (crunching 250 million data points every day) to simulate an aircraft wing's performance when flying over land, sea and ice-caps; to compute the structure and properties of chemical compounds during drug discovery; to do stress tests on a financial system; to find out the possibility of life on other planets.

ISRO will primarily use SAGA-220 for space research and rocket modelling.

When was the first supercomputer built?

In 1960, by Seymour Cray, an American electrical engineer, at Control Data Corporation (CDC). It was called the CDC 1604. Known as the "father of supercomputing", Cray later founded his own company Cray Inc, which dominates the supercomputer market even today. It has four supercomputers in the list of the world's 10 fastest supercomputers.

Today, companies like IBM and HP, as well as research institutes around the world, make supercomputers.

What goes inside a supercomputer?

Yes and no. There are two parts to it: hardware and software. The hardware is the easy part. It can be assembled using off-the-shelf parts, much like with a desktop. That is what Isro has also done.

The software, which ensures the supercomputer optimises usage of the hardware, is the greater challenge. It calls for high-tech expertise in designing the system, doing the technology architecture, and integrating it to meet the desired goal.

Which country leads in supercomputers?

The US is the clear leader, accounting for 274 of the 500 fastest supercomputers in the world. China comes second, with 41 supercomputers. India has 40 supercomputers.

Of this, only 4 are in the top 500 list of fastest supercomputers, ranking India at number 15. This data is according to Top500.org, which ranks and details the 500 most powerful computer systems in the world. Started in 1993, the project updates its list of supercomputers twice a year: in June and November.

The pace of change can be gauged from the fact that Eka, made by the Tata Sons-owned lab, was among the world's top 10 when it was made in 2008. Today, it has slipped to number 47 in processing speed. Param -- India's first supercomputer, made by the Centre for Development of Advanced Computing (CDAC), Pune -- does not even figure in the top 500.

Which is the world's fastest supercomputer?

Tianhe-1 A, owned by the National Supercomputing Centre, China. It has a hard-disk memory of 227,396 GB --about 1,400 times that of the average desktop -- and uses 14,336 Intel Xeon processors.

Tianhe (or Milky Way), which cost \$88 million, entails an annual running cost of \$20 million and has a fulltime staff of 200 engineers. It is used to solve to determine outcomes in oil exploration and aircraft simulation.