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Supercomputing For Rent

Andy Greenberg, 06.22.09, 12:00 AM ET

Exa is streamlining the number-crunching business--and its customers' rides.

The hind end of a bobsled poses a thorny physics problem. When air slips over a four-man sled as it careens along an ice track at 80 miles per hour, it hits a wind pocket behind the tail and becomes a storm front of tiny vortices that drag on the fiberglass-composite shell.

So when the U.S. national bobsled team decided last year to revamp its sled's aerodynamics to compete in the world championship, no mere desktop computer could model that turbulent slipstream. A PC with a single Intel processor chip would have taken six weeks to simulate a mere three seconds of a one-minute run.

Instead, the team turned to an IBM supercomputer capable of crunching the same three-second simulation over the course of a single afternoon. But rather than pay $1 million to own that hunk of iron, the bobsledders hired Exa, a privately held 170-person outfit in Burlington, Mass., to do their processing.

Exa launched in 1992 as a software company selling programs that one of its founders developed as a professor at MIT to solve fluid dynamics problems. But five years ago Chief Executive Stephen Remondi realized he could reach a new set of clients by packaging his software with extra computing muscle. "The upfront cost of computing was a hurdle for a lot of our smaller customers," says Remondi, 44. "So we eliminated it."

Today Exa owns a network of 3,500 Intel and amd chips and rents thousands more, all housed in IBM's Poughkeepsie, N.Y. data center. Layering on its modeling software, Exa sells that processing as a service over the Internet, charging about a dollar per processor core per hour. That makes Exa one of a small number of companies offering supercomputers as a "cloud computing" option, much as Google lets users edit documents and spreadsheets on the Web or Amazon rents out simple processing and storage capacity.

To model the bobsled's air currents, Exa's program chopped time into millionth-of-a-second slices. The sled designers experimented with tiny changes in the vehicle's contours, the size of its tail fin, even the shape of its handles--tweaks that would have otherwise required finicky foam prototyping and wind tunnel testing. "We put complete, blind faith in their software," says Robert Cuneo, a designer who worked on the sled's chassis. "Everything that happened in the simulations happened on the racetrack."

In the March world championship, Exa says its redesign shaved a few tenths of a second off each of the sled's four one-minute runs. The U.S. won the four-man event, its first championship in 50 years, with a combined lead of nearly a second over the German silver medalists. Exa did much of the bobsled work pro bono; the commercial fee would have been about $100,000.

Two Exa customers, the Peugeot and Dodge auto-racing teams, design a new car model just once a year, hardly often enough to warrant owning a supercomputer. Tractor vendor Agco rents Exa's supercomputing time to predict the flow of heat through its engines. Those model redesigns, which allow the engines to incinerate diesel particulates at 1,100 degrees Fahrenheit without toasting components or the vehicle's driver, occur once every four years.

"These companies have very bursty demands," says Remondi. "We don't require any commitment. That's why this deal is such a peach for them."

Of Exa's $34 million in revenue in 2008, on-demand supercomputing accounted for $10.5 million, up 48% from 2007. Sales of software grew only 13% to $21 million last year.

Supercomputing as a service still represents a tiny fraction of the $9.8 billion market for high-performance computing, according to tech analysis firm IDC. But others are bringing the service to a new range of customers. In Houston Schlumberger packages Hewlett-Packard supercomputing time and sells it to small drillers that are trying to determine how best to squeeze oil out of underground reservoirs. The Ohio Supercomputing Center resells IBM computing time to small-business welders simulating complex fusions of metal.

Remondi expects that within five years rented supercomputing will account for half of Exa's revenues. It doesn't take a supercomputer to tell which way the wind is blowing.

The Science of Sleek

A snapshot of a supercomputer simulation of airflow over a bobsled shows areas of high-pressure air (orange) and lower pressure (blue). The air forms vortices behind the heads of the riders as well as along the sled's rails and tail fins, adding drag. To speed up the sled, designers streamlined its contours, thus minimizing those drag points.