

The New Secret Weapon

Supercomputing is part of the corporate arsenal to beat rivals by staying one step ahead of the innovation curve. It allows companies to design products and analyze data in ways once unimaginable.

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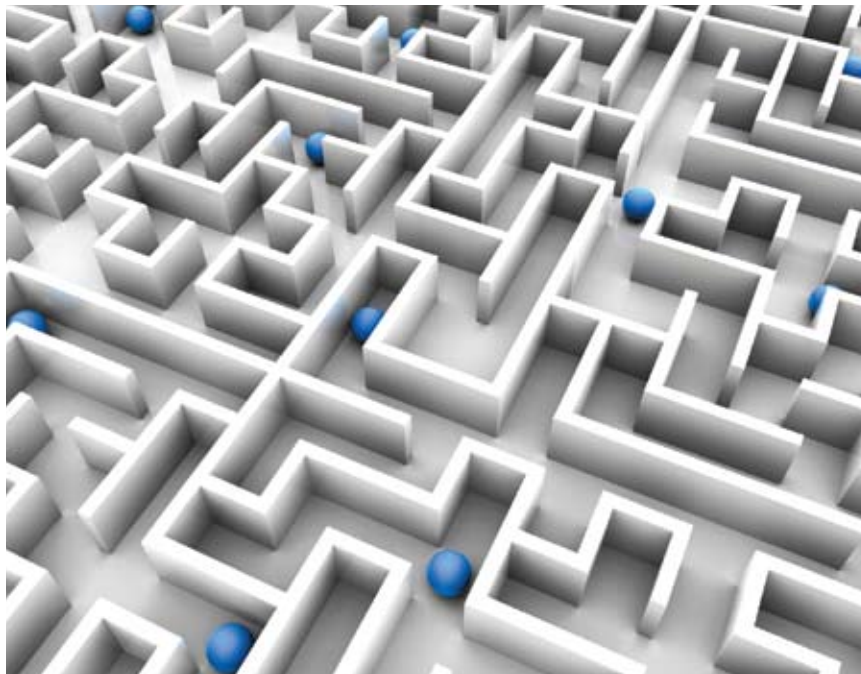


It's doing everything from designing high-performance bathing suits for Olympic swimmers to developing plants that can cope with all types of environmental problems.

Blame it on *Star Trek* and Arthur C. Clarke: Most of us picture a supercomputer as a room-size contraption, surrounded by engineers in long coats tackling the most secret scientific problems. There's some truth to that—the world's most powerful computers still occupy a fair chunk of real estate, and they do work out all manner of classified conundrums. But with increasing frequency, they're also tackling problems that don't quite fit the space-age picture of high-performance computing, like figuring out how to package appliances so less damage occurs en route to the retailer, and how to optimize a global supply chain for maximum profitability.

At DuPont, high-performance computing, or HPC, is being used to discover what breeds of corn grow best in different environments. Via sophisticated simulations, DuPont can mix and match genes and "grow" new breeds on the computer, far faster than growing them in soil. "HPC lets us run a breeding program that is ten to 50 times the size of what would be possible otherwise," says William Neibur, vice president of DuPont Crop Genetics Research and Development. "That helps us find new plant products that are better able to cope with insects, diseases, weeds, and lack of water."

Everywhere, it seems, industry leaders are discovering HPC's trump card: It lets them model and simulate new designs without having to physically build and test them, and allows them to ana-



lyze the tsunami of data that is flooding most firms. That doesn't just save time and money. It also enables companies to investigate more possibilities, be more creative—and get new products to market faster.

New Drivers

"Modeling, simulation, and massive data analysis are the next huge game-changing drivers for innovation," says Deborah Wince-Smith, president of the Council on Competitiveness, a Washington, D.C.-based organization of corporate CEOs, university presidents, and labor leaders working to enhance U.S. competitiveness. "HPC lets companies collapse their design and prototyping process. That's important for advanced industrial countries like the U.S. that can't compete on wages and need to be at the frontier of discovery."

Not surprisingly, the biggest boosters—and beneficiaries—of HPC have been in industries like aerospace and energy that have long relied on cutting-edge technologies to get the job done. By using HPC to analyze a massive amount of seismic data, Chevron, for ex-

ample, was able to "see" under a huge layer of salt in the Gulf of Mexico. That helped find a new oil field that may ultimately yield billions of barrels of oil.

But other uses of HPC are emerging. Discovering that too many of its appliances arrived at the store with dents, Whirlpool turned to HPC to simulate new packaging, and homed in on a design that has saved millions. Even sunglasses have benefited from HPC. Teaming with the Pittsburgh Supercomputing Center, PPG Industries modeled new photochromic dyes that enable its Transitions lenses to darken in the presence of ultraviolet (UV) rays. The result: a new generation of more effective lenses.

The real surprise, however, is that many companies have yet to embrace HPC. "Our research has validated that companies using HPC find it essential to survival, but we've also found that HPC is not permeating through the supply chain," says Wince-Smith.

And that's stalling innovation. *Reveal*, a 2008 study by the Council on Competitiveness and the market research firm IDC, found that 57% of companies that were using desktop workstations had problems

A High-Performance Network for HPC



There's a reason it's called high-performance computing: The technology is built to perform, solving crucial problems at blazing speeds. But in today's HPC world, processing power is just part of the equation. Clusters of computers, servers, and storage devices need to be linked together if they're going to work together—and too often, the network just can't keep up. So problems get solved a little slower, and the world takes a little longer to change.

Building the fastest links for the fastest computers is what we do at Foundry Networks. But unlike the competition, we don't do it using closed, proprietary, expensive technologies that can require a lot of specialized—read: hard to find—talent to manage. Instead, we base our industry-leading solutions on the world's best-known, most pervasive networking technology: Ethernet. It's the same standard that powers networks in homes and businesses all over the globe. And because Ethernet is a well-understood open technology, it's easy to deploy, can be managed by the network professionals you already have, and costs less than specialized solutions.

But there is one big difference between our Ethernet and the one you now use. Ours is faster—more than 1,000 times faster, and soon it'll be far faster still. Foundry was the first company to come to market with Gigabit Ethernet products, and the first with 10-Gigabit Ethernet. That's fast enough for the most powerful supercomputers to do what they were designed to do—not sit around waiting for the network to catch up.

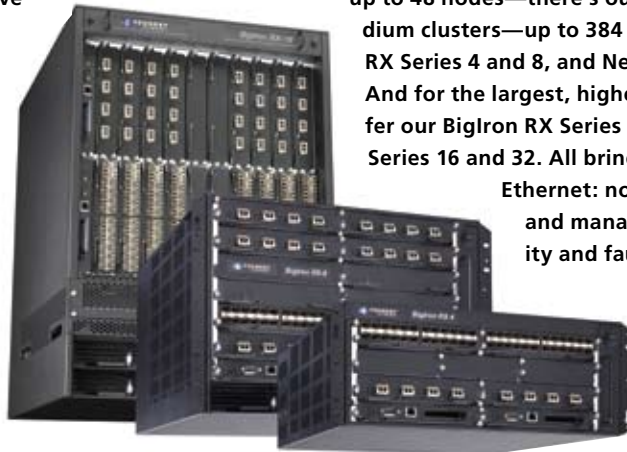
Little wonder that Gigabit and 10-Gigabit Ether-

net is the No. 1 interconnect technology choice among the world's top 500 computing facilities. And when tomorrow's revolutionary machines deploy—moving from terascale (trillions of floating-point operations per second) to petascale (quadrillions of operations)—Foundry will be ready. We're working with international standards bodies on some revolutionary technology, too: 100-Gigabit Ethernet. And we expect to be, once again, the first to market with products.

Of course, as supercomputing moves beyond government and university labs and becomes a standard business tool, networking solutions will have to handle different types and sizes of HPC installations. That's why Foundry offers a wide variety of product lines designed for a wide variety of users. For small clusters—up to 48 nodes—there's our FastIron family. For medium clusters—up to 384 nodes—there's our BigIron RX Series 4 and 8, and NetIron MLX Series 4 and 8. And for the largest, highest-density clusters, we offer our BigIron RX Series 16 and 32, and NetIron MLX Series 16 and 32. All bring the key advantages of

Ethernet: not just ease of deployment and management but better reliability and fault tolerance (no small considerations when a node in the cluster suddenly fails). And Foundry's solutions are eco-friendly, too, offering best-in-class power efficiency.

Benefits like these have made Foundry's solutions the choice for more than a quarter of the world's top 20 supercomputer sites. Our customers include the Department of Energy and the European Weather Service, along with companies like BP and BMW. The problems they're solving—from climate modeling to simulating how automobiles will behave—may be different, but they've all got one thing in common: Their supercomputers are hitting milestones—not roadblocks.



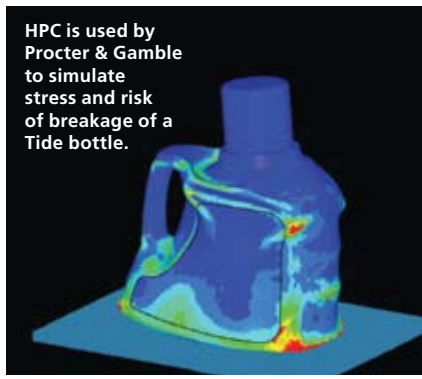
On the fast track: The BigIron RX switch family

they couldn't solve. As a result, they were often scaling down those problems, or putting them aside altogether.

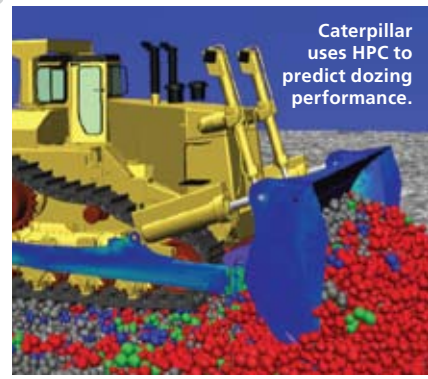
No doubt, HPC is costlier and more complex than desktop computing. But the bigger barrier is HPC's image: Too many companies still see it as that unwieldy machine in the lab, requiring too big an investment for too uncertain a result. Fortunately, some private- and public-sector players are working to change that perception.

Priming the Pump

At the Department of Energy, a program called INCITE—for Innovation and Novel Computational Impact on Theory and Experiment—allows anyone with a tough problem—be they companies, academic researchers, or government scientists—to submit proposals for time on the big DOE supercomputers, such as those at Oak Ridge National Laboratory in Tennessee and Argonne National Laboratory



HPC is used by Procter & Gamble to simulate stress and risk of breakage of a Tide bottle.



Caterpillar uses HPC to predict dozing performance.

in Illinois. The winners don't just get a bit of access but often millions of processor hours. The idea, says Dr. Raymond Orbach, DOE under secretary for science, is "to throw as many cycles as we can to really solve something." But INCITE also has another goal: to enable participants—which have included Boeing and Pratt & Whitney—to whet their appetite for HPC. "We're priming the pump," says Secretary Orbach, "getting industry to

see how profitable HPC can be."

Meanwhile, one of Europe's leading IT firms, Bull, is making supercomputing more accessible by making it more familiar and easier to use. "In the past, supercomputers were all built around what's called vector architecture, which was very powerful but very specialized, requiring a lot of special engineering talent to run," says Didier Lamouche, Bull's chairman and CEO. Bull takes a different



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approach, building supercomputers that are essentially giant clusters of smaller, linked machines that work as one—typically functioning faster and more cost-effectively than a single supercomputer.

Bull's clusters are easier to use because they are based on technologies already well understood in the business world. The company's NovaScale clusters, for example, don't use proprietary processors, but Intel multi-core chips. And Bull, which has more than 100 HPC customers in 15 countries, has been a pioneer in basing its products on Linux, an open-source platform that is hugely popular outside the HPC sphere. "From day one, our strategy has been to mainstream HPC," says Lamouche, "to make it more accessible and more powerful."

Clusters of linked computers require networks—extremely fast ones. In the past, these have been built on proprietary, often difficult-to-use technologies. But it no longer has to be that way. Foundry Networks, a leading provider of high-performance networking solutions, bases its HPC products on technology familiar to business and telecom carriers everywhere: Ethernet.

This, however, is *really* fast Ethernet. "A typical business network runs at probably 10 megabits per second. We can deliver 1,000 times that speed to an HPC network," says Ken Cheng, vice president and general manager of Foundry's high-end and service-provider systems business unit. Foundry was the first company to bring Gigabit Ethernet and 10-Gigabit Ethernet networking products to market, and it expects to be the first to offer 100-Gigabit gear, in 2010. This will enable HPC networks to keep up with the next generation of supercomputers.

"A lot of times, as the processors get faster, they generate data faster than the network can handle, and your supercomputer has to wait until the bottleneck clears," says Cheng. "With faster networks, your HPC can run like it's supposed to. And that means you can solve your problem—whether it's weather forecast-

ing, genome categorization, or designing a new pharmaceutical—as quickly and efficiently as possible."

Partnerships between industry and academia are also helping to mainstream HPC. At the University of Illinois' National Center for Supercomputing Applications (NCSA),

HPC is a game-changing technology; companies that fail to adopt it may be at a significant competitive risk.

researchers are helping to build the next groundbreaking supercomputer: the NCSA/IBM-designed Blue Waters, expected to run hundreds of times faster than today's top machines. They're also working with Microsoft, a member of the center's thriving private-sector program, to bring the most familiar of all software to HPC: Windows.

"The objective is to make the path from

workstation to HPC easier," says Merle Giles, director of the NCSA private sector-program. "In June we installed Windows Cluster Server software on our largest HPC system to get a feel for its performance on 10,000 processors. It exceeded our expectations and shows real promise for our business partners." NCSA is also working with independent software vendors to make sure modeling and simulation software—which hasn't always advanced as quickly as the machines they run on—receives the focus necessary to realize the breakthroughs that HPC promises.

"We need creativity if we're going to take advantage of what the new hardware will do," says Giles. "And the way to get that is to work together." ●

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