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The Superwoman of Supercomputing

As director of the San Diego Supercomputing Center, Francine Berman is on the cutting edge of several disciplines -- and loving it

Francine Berman is the reigning teraflop queen. As director of the San Diego Supercomputing Center (SDSC), she's the top executive in a 400-person organization housed at the University of California, San Diego, that programs and maintains a machine called DataStar. Built by IBM (IBM), DataStar can whip through approximately 10 trillion calculations per second, ranking it among the 20 most powerful supercomputers in the world.

At present, Berman is the only woman on the planet in charge of a supercomputer facility. She's also considered among the best in cutting-edge software design to make supercomputers run more reliably and faster.

That's a rarefied neighborhood. In the info-tech geek hierarchy, supercomputer jocks are the equivalent of NASA rocket scientists. It's one of the rare academic jobs that's insanely cool. "For a lot of us, it's like working at a Toys 'R' Us for scientists," says Berman.

BEHIND THE GRID. And not just any scientists. Berman manages an elite cadre of researchers and tech luminaries who are pushing the envelope of computing. "She's one of the leaders in the area of advanced infrastructure for computational science -- that is, supercomputers and the software to make supercomputers do the kinds of things that scientists and engineers need in advanced research projects," says Peter Freeman.

He would know. Freeman heads the computer information, science, and engineering program at the National Science Foundation, the U.S. governmental body that will hand out more than $5 billion in scientific grants during fiscal 2004, including a significant portion of SDSC's $80 million annual budget.

According to Freeman, Berman's academic work on grid-computing ranks among the must-read references in the field. It's a red-hot territory right now: Grid-computing allows companies or universities to link fleets of desktop machines and use their idle time to work on big problems in a manner similar to that of supercomputers.

HEAD OF THE PACK. Berman ended up in supercomputers when, during a stint as a professor at Purdue, her research in theoretical computer science and mathematics drew her toward the field of parallel computing, or crunching big piles of numbers using arrays of processors working in tandem. Supercomputers generally use parallel-processing techniques to solve multiple parts of problems simultaneously.

Writing software and configuring these constellations of machines to handle data sets from disparate fields such as geophysics, astronomy, and economics, remains fiendishly difficult. That's where Berman and San Diego shine, says Freeman. "They're generally considered to be one of the leaders, if not the leader in the country, in dealing with massive amounts of data," says Freeman.

While Berman may be a giant among geeks, she has a widely praised egalitarian approach to supercomputing. "We have collaborations with astrophysicists that help us understand the evolution of the universe, and projects with geoscientists that help us understand the evolution of the continents. We have projects with biologists that help us understand the evolution of the human species," she says.

"POINT OF THE SPEAR." And even though academics in different disciplines often have very specialized vocabularies, Berman is "able to facilitate a productive discussion among people who have five different priorities and speak five different languages," says Virginia McFerran, chief technology officer of the Salk Institute for Biological Studies in San Diego. Salk and SDSC closely collaborate on biological computing.

Beyond running her own shop, Berman is a leading light in the discussions to plot a course for America's cyber-infrastructure. She believes that scientists have always been ahead of the curve in these discussions and should help determine what will be needed to make data akin to power and water in terms of availability -- and in the near future.

This new data infrastructure will show up first in the scientific community. "Science has always been the point of the spear," says Berman. "Scientists had e-mail first. The Internet came out first in the science community. Today, we have a deluge of data from all kinds of sources and we need tools to better deal with that."

COMPUTING POWERHOUSE. One of the new cyber infrastructure's most impressive components could be the TeraGrid project, an effort to link supercomputers and high-powered computing clusters around the country with blazing fast 40-gigabit-per-second fiber-optic links. The goal is to create the largest and fastest distributed computing grid on Earth -- an unmatched testbed for scientific problem-solving.

SDSC will be one of the principal players, with Berman providing key leadership and technology knowhow to the project. She can do that partly because of her experience working with research shops at tech powerhouses such as Microsoft (MSFT), Sun Microsystems (SUNW), and Qwest Communications (Q).

Dealing with data isn't the only area where Berman has proven proficient. She has also been a regular public speaker on the difficult task of balancing family and career for female tech leaders.

IMPROVING THE SITUATION. Berman has two teenagers and is married to another academic, biochemist Mark Miller. She has also been an eager mentor to graduate students and has dedicated time to promoting the role of women in tech. "A lot of us have spent many years trying to make the situation better," she says. "It's important to provide a role model."

That's what Berman is. After all, whoever controls the most teraflops is in some sense the queen of the hill.

By Alex Salkever