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A 'Big Data' Freeway for Scientists

By John Markoff March 20, 2013 1:29 pm

The University of California, San Diego, this week plans to announce that it has installed an advanced optical computer network that is intended to serve as a "Big Data freeway system" for next-generation science projects in fields including genomic sequencing, climate science, electron microscopy, oceanography and physics.

The new network, which is funded in part by a $500,000 grant from the National Science Foundation and based on an optical switch developed by Arista Networks, a start-up firm founded by the legendary Silicon Valley computer designer Andreas Bechtolsheim, is intended to move from an era where networks moved billions of bits of data each second to the coming age of trillion-bit-per-second data flows. (A terabit network has the capacity to move roughly the equivalent of 2.5 Blu-ray videodiscs each second.)

However, the new ultrahigh speed networks are not just about moving files more quickly, or even moving larger files. Increasingly, computers used by scientific researchers are starting to escape the boundaries of a single box or even cluster and spread out to become "virtual," in some cases across thousands of miles.

The new network, known as Prism, is intended for a new style of scientific computing characterized both by "big data" data sets and optical networks that make it possible to compute on data that is stored at a distant location from the computer's processor, said Philip M. Papadopoulos, program director for computing systems at the San Diego Supercomputer Center, and the principal investigator for the new network.

The Prism network "enables users to simply not care where their data is located on campus," he said.

The Prism network is targeted at speeds of 100 billion bits a second and is intended as a bypass network that allows scientists to move data without affecting the performance of the normal campus network, which is based on a 10 billion-bit capacity and is near saturation.

There is a range of scientific users with requirements that have easily outstripped the capacity of current-day computer networks, he said.

For example he pointed to work being done in medicine by the National Center for Microscopy Imaging Research, with both light and electron microscopes that now generate three-dimensional images that may range up to 10 terabytes of data. The laboratory stores several petabytes (a petabyte is one thousand terabytes) and will require Prism to move data between different facilities on campus.

A previous optical network, known as Quartzite, was installed at San Diego beginning in 2004. That network was built on an earlier, less powerful, model of the Arista switch. The new version of the switch will handle up to 576 simultaneous 10 billion-bit connections. In some cases the links can be "bonded" to support even higher capacity data flows.

During an event last month to introduce the event on campus, Larry Smarr, an astrophysicist who is the director of the California Institute for Telecommunications and Information Technology, a U.C.S.D. laboratory that is the focal point for the new network, demonstrated the ability to share data and scientific visualization information with other scientists by holding a videoconference with researchers at the Electronic Visualization Laboratory at the University of Illinois at Chicago. At one point he showed a three-dimensional image created from an M.R.I. of his own abdomen, demonstrating how it was possible to view and manipulate the digital image remotely.

"The radiologists are used to reading the two dimensional scans and turning it into 3-D in their heads, but the doctors and surely the patients have never been able to see what is in their bodies," he said. "I'm turning the insides of my body into a

video game."

Correction: March 20, 2013

An earlier version of this post misstated the name of the organization where Philip M. Papadopoulos works as a program director. It is the San Diego Supercomputer Center, not the San Diego Computing Center. It also misstated the location of the University of Illinois' Electronic Visualization Laboratory. It is at the university's Chicago campus, not the Urbana-Champaign campus.

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