UCSD Supercomputer Center receives NSF Grant for "Data Superhighway"

June 15, 1990

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SAN DIEGO SUPERCOMPUTER CENTER AT UCSD RECEIVES NSF GRANT FOR "DATA SUPERHIGHWAY"

Four major scientific institutions, including the San Diego Supercomputer Center at the University of California, San Diego, will receive more than $1 million over the next three years to develop a high-speed computer network to help demonstrate the feasibility of a proposed national "data superhighway."

This network, called CASA, will harness the vast computer resources of the four centers to study several important scientific problems. These include a more accurate model for global climate, a way to forecast earthquakes and the simulation of chemical reactions that might yield powerful lasers.

Besides the San Diego Supercomputer Center (SDSC), which houses a CRAY Y-MP8/64 -- the most powerful supercomputer available today -the other three centers participating in the network are Los Alamos National Laboratory, California Institute of Technology, and the Jet Propulsion Laboratory.

Gerard Newman, a project leader from SDSC, said the research goal of CASA is to demonstrate that it is possible to combine the power of a variety of high-performance computers at different centers to help solve complex and time-consuming problems.

To bring these combined forces together requires a much wider communications highway than now exists.

Many computers today are linked over wide networks that operate at 1.5 million bits per second. What is proposed are optical-fiber networks capable of transmitting information at rates roughly 700 times faster, or about one billion bits per second (1 gigabit).

"It's the difference between a dirt road and 1-405," said Newman.

The wider highway would permit scientists hundreds or even thousands of miles away to work with the same information at roughly the same time to construct three-dimensional models of such things as chemical reactions, weather conditions, seismic disturbances or medical images. The pictures on both screens would be of movie-like quality, with each researcher capable of simultaneously exchanging information and manipulating the images.

"What we have now allows us to do remote logins and file transfers to remote locations to a reasonable degree," said Newman. "It does not provide us with sufficient bandwidth to do things like interactive visualization. Hopefully by deploying these gigabit per second networks, we will enable scientists to do exactly that."

The CASA network is one of five proposed networks that are being funded with $15.8 million by the National Science Foundation and the Defense Advanced Research Projects Agency. The lead agency for the program is the non-profit Corporation for National Research Initiatives in Reston, Va.

The project is the brainchild of Robert E. Kahn, a pioneer of the nation's first computer network experiment, Arpanet, and David J. Farber, a computer scientist at the University of Pennsylvania. Kahn is president of the Corporation for National Research Initiatives.

In addition, several private companies including GTE, IBM, AT&T and MCI Communications are being asked to contribute their expertise and technology to the effort. These resources may total $100 million.

Supporters hope the three-year project will pave the way toward a national data highway. A bill sponsored by Sen. Albert Gore Jr. (D- Tenn.) would finance such a highway that would link most of the nation's supercomputers.

One of the primary research goals of CASA (which doesn't stand for anything) is to show that so-called parallel computers -- which work by dividing and distributing a problem to a team of processors -can be linked to traditional supercomputers to greatly decrease the amount of time it takes to perform highly complex calculations. In essence, this would show that computational work can be divided among a variety of high-performance systems, taking advantage of each system's unique design or architecture.

The development of a three-dimensional seismic profile, under the direction of scientists from the Jet Propulsion Laboratory, shows the potential advantage of such a computer collaboration. In this project, the researchers hope to merge archived data, including large quantities of seismic data collected from oil companies, with imaging data from satellites to create models of fault zones and plate movements.

The computational requirements for this project are enormous, exceeding the capabilities of both the network and available processor resources. By combining the computer resources of parallel and traditional computers, however, scientists hope to be able to combine raw seismic data out of an archive with new satellite information to create cutaways of the earth's surface showing fault zones and major plate thrusts.

Another project, directed by Carlos R. Mechoso of UCLA, will mesh the computational abilities of the CRAY Y-MP at SDSC with the massively parallel CM-2 Connection Machine at Los Alamos National Laboratory to create an ocean-atmospheric model for climate studies.

This project will combine existing ocean and atmospheric models to create a more accurate picture of climate formation. The problem will run simultaneously on the two systems, with information continuously exchanged across the CASA network.

The third CASA project, under the direction of Paul Messina and Aron Kuppermann at Caltech, will study the chemical reaction between fluorine and hydrogen, which has implications for the development of highly powerful chemical lasers. Simulating this reaction requires the calculation and exchange of large blocks of information between the CRAY Y-MP at SDSC, the CM-2 Connection Machine at Los Alamos and the 128-processor Mark IIIfp at Caltech.

SDSC, one of four national supercomputer centers established by the NSF to serve the U.S. research and development community, is administered and operated by General Atomics. The center serves some 2,700 researchers and educators at more than 140 institutions in 40 states and the District of Columbia. Although the center program was established for the academic research community, computer resources also are provided for industry use.

(June 15, 1990)