NERSC NEWS

Berkeley Lab

Office of Science US Department of Energy

News from the National Energy Research Scientific Computing Center June 2004

Benchmarking Team from LBNL/NERSC Makes News in Japan

Late last year, four researchers from the NERSC Center and Lawrence Berkeley National Laboratory's Computational Research Division spent nearly one week at the Earth Simulator Center in Japan. Their objective was to run a series of scientific applications on the Japanese supercomputer, in part to assess the viability of the Earth Simulator's vector architecture for codes important to the DOE Office of Science mission.

The visit merited an article and photo in the Japanese-language "ES News" newsletter. Here is a translation of the

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NERSC News

Welcome to the June 2004 issue of NERSC News, highlighting achievements by staff and users of DOE's National Energy Research Scientific Computing Center. NERSC News is distributed every other month via email and may be freely distributed. NERSC News is edited by Jon Bashor, JBashor@lbl.gov or 510-486-5849.

INCITE Update: Turbulence Researchers Find Smooth Sailing at NERSC

There are real advantages in computing at NERSC, and a project led by Professor P. K. Yeung of the Georgia Institute of Technology to study "Fluid Turbulence and Mixing at High Reynolds Number" now wants to take full advantage of those advantages.

The project, one of three selected by DOE's INCITE program, was initially awarded 1.2 million processor hours at NERSC. The project team was also awarded a similar allocation at an NSF computing center. Because the two grants had different expiration dates, the team planned to do their first calculations on the NSF system, then complete the project at NERSC.

"Unfortunately, our progress at the other center has been affected by some issues concerning system reliability and job scheduling," Yeung noted. "The recent NERSC announcement about a 50 percent discount on charging for jobs using 512 or more processors has now created a great opportunity for us to perform our 2048^3 simulation for a decent length entirely using NERSC resources alone."

The team is conducting a simulation of rotating turbulent flow subject to Coriolis forces in the equation of motion. As a lead-in to full simulations, Yeung has been running a number of jobs at 1024^3 grid resolution. "While further analyses of the data are to be performed, preliminary results indicate that the major features of the flow are similar to those previously obtained at lower grid resolutions but at a higher Reynolds number, which implies increased relevance to actual turbulent flows in engineering applications," he reported.

Although turbulence is a phenomenon that has applications in a wide range of natural and human activities, it is not well under-

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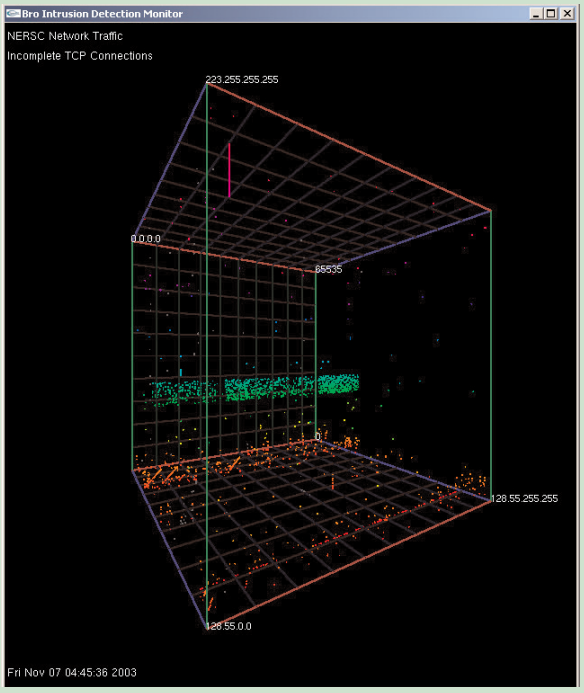
NERSC's Spinning Cube of Doom Takes a Turn in the Spotlight



When Stephen Lau of NERSC's networking and security team created a graphical display to highlight the many malicious scans and threats lurking in cyberspace, he christened it the "Spinning Cube of Potential Doom." Developed to increase awareness of the level of malicious traffic on the Internet, the Cube is a visual display of network traffic collected using the Bro Intrusion Detection System developed by Berkeley Lab's Vern Paxson. Bro monitors network links, searching for traffic that potentially violates a site's access and usage policies.

"Although there are many tools available for displaying network traffic and potential security incidents, the vast majority of these tools are developed by network and security professionals for network and security professionals," Lau writes in the

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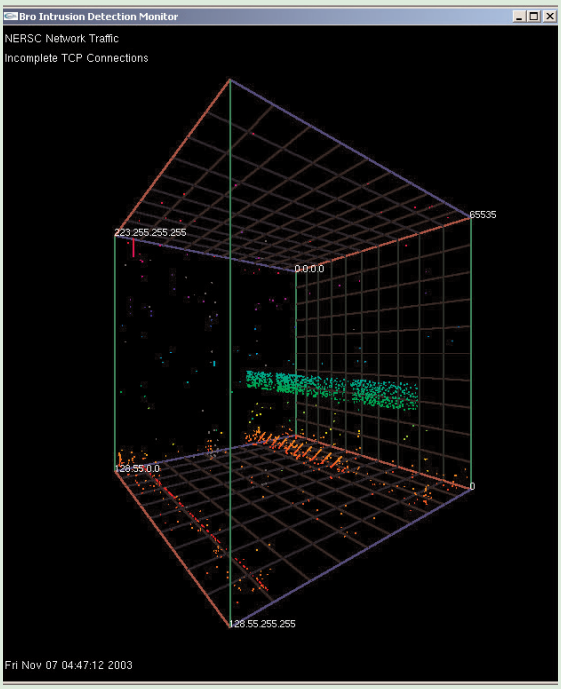
Spinning Cube of Doom (continued from p.1)

Perspective column of the June 2004 issue of *Communications of the ACM*. "The Cube attempts to display the overall level of malicious traffic in a fashion that can be easily understood by those without a computer security or networking background."

And it works. The Cube debuted at the SC2003 conference in Phoenix, and the large display attracted a steady audience of onlookers. Many of those pausing to watch seemed surprised at the level of malicious traffic on the Internet.

Here's a description of the Cube's data display from Lau's column, which also rated a mention on slashdot.org.

"The Cube leverages Bro's capability to log all instances of completed and attempted TCP connections, displaying this information within a three-dimensional cube. Each axis represents a different component of a TCP connection. The 'X' axis represents the local IP address space. The 'Z' axis represents the global IP addresses space. The 'Y' axis represents the port number. Port numbers are used in connections to locate services and coordinate communication (e.g., 22 for ssh and 80 for http).



"TCP connections, both attempted and successful, are displayed as single points for each connection. The successful connections (SYN/FIN) are shown as white dots. Incomplete TCP connections are displayed as colored dots. Incomplete connections are either attempts to communicate with nonexistent systems or systems that are not listening on that particular port number, e.g., SYN/RST or SYN with no response. The incomplete connections are colored using a rainbow colormap with the color varying by port number. This color mapping was used to assist the viewer in locating the point in 3D-space.

"The vast majority of colored dots can be considered to be malicious traffic searching for potentially vulnerable systems. A high number of connection attempts can be seen at the low end of the port range (0–1024), representing attempts to locate enabled well-known services (e.g., http, ssh, etc.). Although some of these attempted connections can be explained by misconfigured applications or hosts that have inadvertently crashed and are no longer listening for connections, the patterns that emerge from the data show that these 'false positives' are most likely in the minority."

For more information, contact SLau@lbl.gov.

INCITE Update (continued from p.1)

stood and is extremely difficult to model accurately on supercomputers. With improved modeling capability of fluid turbulence, scientists will gain greater insight into meteorology, astrophysics, oceanography, environmental quality, combustion, and propulsion, among other research areas. Because of the complexity of turbulence, it is difficult for scientists to accurately predict natural phenomena, such as severe storms, and engineering solutions in areas such as aircraft design, internal combustion engines and industrial flows. Improved models could lead to more efficient jet engines and cleaner-running automobiles.

NERSC staff worked with the research group to examine the code, concluding that "it is reasonably efficient and deemed ready for production, although we can always implement minor improvements when available," Yeung said.

The researchers also praised NERSC's scheduling of INCITE jobs.

"We really appreciate the priority privilege that has been granted to us in job scheduling," Yeung wrote to NERSC staff. "This has allowed most of our jobs to start relatively quickly compared to what we experience at other sites. We are excited at the prospect of the great opportunities so uniquely available to us."

Benchmark (continued from p.1)

article, courtesy of NERSC's Jonathan Carter, one of the participants.

Spearheading International Collaborative Research

"In the way that University of Tennessee Professor Dongarra commented 'The best researchers from all over the world will come to use the Earth Simulator–from Japan's point of view it is a wonderful chance', collaborative research with the Earth Simulator Center and well-known international research establishments is continuing.

"At the end of last year, three researchers from the U.S. Department of Energy's National Energy Research Computer Center (NERSC) came to Japan to use the Earth Simulator. We asked one of the three, Jonathan Carter, who had become well acquainted with Japan during business trips while working at IBM and continues to study Japanese as a hobby, his impression of the Earth Simulator. He told us that 'We prepared for this visit expecting that the Earth Simulator was a lot like an NEC SX-6, so at first we encountered various problems, but through collaboration with everyone here, we were able to overcome them. This is our first experience with a multi-node NEC computer, so on this visit we conducted various benchmark tests to gauge the ability of the system. On our next visit we are considering running some climate and combustion simulations.'"