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Advanced Simulation and Computing (ASC)

IBM Research: BlueGene project

Into the Wild Blue Yonder with BlueGene/L, *Science & Technology Review*, April 2005

Top500 list

National Nuclear Security Administration (NNSA)

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NNSA awards IBM contract to build next generation supercomputer

WASHINGTON, D.C. - The Department of Energy's National Nuclear Security Administration (NNSA) announced today a contract with IBM to bring world-leading supercomputing systems to its Lawrence Livermore National Laboratory to help continue to ensure the safety and reliability of the nation's aging nuclear deterrent.

"The longstanding partnership of NNSA, Lawrence Livermore National Laboratory, and IBM is ushering in an era of multi-petaflops computing," said NNSA Administrator Thomas D'Agostino. "These powerful machines will provide NNSA with the capabilities needed to resolve time-urgent and complex scientific problems, ensuring the viability of the nation's nuclear deterrent into the future. This endeavor will also help maintain U.S. leadership in high performance computing and promote scientific discovery."

Kim Cupps, LLNL High Performance Systems Division leader, and Mark Seager, LLNL assistant department head for New Technologies, inspect a newly installed rack for Dawn, a 500 teraFLOP/s (trillion floating operations per second) IBM BlueGene/P system. Dawn will help lay the foundation for the 20 petaFLOP/s (quadrillion floating operations per second) Sequoia system.

Photo by Jacqueline McBride/LLNL

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IBM will deliver two systems: Sequoia, a 20 petaflop (quadrillion floating operations per second) system based on future BlueGene technology, to be delivered starting in 2011 and deployed in 2012; and an initial delivery system called Dawn, a 500 teraflop (trillion floating operations per second) BlueGene/P system, scheduled for delivery in the first quarter of 2009. Dawn will lay the applications foundation for multi-petaflops computing on Sequoia.

With a speed of 20 petaflops Sequoia is expected to be the most powerful supercomputer in the world and will be approximately over 10 times faster than today's most powerful system. To put this into perspective, if each of the 6.7 billion people on earth had a hand calculator and worked together on a calculation 24 hours per day, 365 days a year, it would take 320 years to do what Sequoia will do in one hour.

Sequoia and Dawn will serve NNSA's tri-lab Advanced Simulation and Computing (ASC) program, which unites the scientific computing resources and expertise of Los Alamos, Sandia and Lawrence Livermore National Laboratories. The Sequoia systems will be focused on strengthening the foundations of predictive simulation through running very large suites of complex simulations called uncertainty quantification (UQ) studies. In addition, the machines will be used for weapons' science calculations necessary to build more accurate physical models. This work is a cornerstone of NNSA's Stockpile Stewardship program to ensure the safety, security and reliability of the U.S. nuclear weapons stockpile today and into the future without underground testing.

Sequoia will have 1.6 petabytes of memory, 96 racks, 98,304 compute nodes, and 1.6 million cores. Though orders of magnitude more powerful than such predecessor systems as ASC Purple and BlueGene/L, Sequoia will be 160 times more power efficient than Purple and 17 times more than BlueGene/L.

Founded in 1952, Lawrence Livermore National Laboratory is a national security laboratory, with a mission to ensure national security and apply science and technology to the important issues of our time. Lawrence Livermore National Laboratory is managed by Lawrence Livermore National Security, LLC for the U.S. Department of Energy's National Nuclear Security Administration.

Established by Congress in 2000, NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science in the nation's national security enterprise. NNSA maintains and enhances the safety, security, reliability, and performance of the U.S. nuclear weapons stockpile without nuclear testing; reduces the global danger from weapons of mass destruction; provides the U.S. Navy with safe and effective nuclear propulsion; and responds to nuclear and radiological emergencies in the U.S. and abroad.