

DOE Awards \$25.4 Million in Contracts for Exascale Supercomputer Interconnect Design

Jon Bashor, NERSC and Berkeley Lab

Washington, DC -- The Department of Energy's (DOE) Office of Science and the National Nuclear Security Administration (NNSA) have awarded \$25.4 million in research and development contracts to five leading companies in high-performance computing (HPC) to accelerate the development of next-generation supercomputers.

Under DOE's new DesignForward initiative, AMD, Cray, IBM, Intel Federal and NVIDIA will work to advance extreme-scale, on the path to exascale, computing technology that is vital to national security, scientific research, energy security and the nation's economic competitiveness.

"Exascale computing is key to NNSA's capability of ensuring the safety and security of our nuclear stockpile without returning to underground testing," said Robert Meisner, director of the NNSA Office of Advanced Simulation and Computing program. "The resulting simulation capabilities will also serve as valuable tools to address nonproliferation and counterterrorism issues, as well as informing other national security decisions."

As the nation's largest funder of basic scientific research, DOE provides thousands of researchers at national labs and universities with access to some of the world's most powerful supercomputers. These systems, which have peak speeds of quadrillions of calculations per second, are helping scientists study climate change, develop renewable energy sources, understand the makeup of our universe and develop new materials. But taking these research missions to the next level will require supercomputing systems that are 1,000 times faster than today's systems.

"In an era of fierce international HPC competition, the development of exascale computing becomes critical not only to our national security missions but to the nation's economic competitiveness in the global marketplace," said William Harrod, FastForward Program Manager and Research Division Director for DOE's Advanced Scientific Computing Research program. "This partnership between industry, the DOE Office of Science and NNSA supports the development of technology to overcome the obstacles on the road to exascale systems."

The DesignForward contracts, which cover a two-year performance period, will support the design and evaluation of interconnect architectures for future advanced HPC architectures. Such interconnects will tie together hundreds of thousands or millions of processors, as building blocks of supercomputers to be used in studying complex problems in unprecedented detail. The DesignForward focus will be on developing interconnects that are energy efficient, have high bandwidth, and minimize the time to move data among processors.

“A major disruption is facing high performance computing because energy constraints are causing our building blocks, microprocessors and memory to change dramatically,” said Sudip Dosanjh, Director of the National Energy Research Scientific Computing Center at Lawrence Berkeley National Laboratory (Berkeley Lab). “We need to collaborate with computer companies to ensure that future supercomputers meet DOE's mission needs in science, energy and national security. Berkeley Lab is pleased to place these contracts on behalf of DOE and its laboratories.”

Under the new contract, Intel will focus on interconnect architectures and implementation approaches, Cray on open network protocol standards, AMD on interconnect architectures and associated execution models, IBM on energy-efficient interconnect architectures and messaging models and NVIDIA on interconnect architectures for massively threaded processors.

“We’re honored to be selected for this research program and to continue our work with DOE to shape the future of high-performance computing, started last year with FastForward,” said Alan Lee, AMD’s Corporate Vice President of Research and Advanced Development. “This public-private partnership extends AMD’s research into the use of next generation APUs to meet the demands of extreme-scale computing. We believe this program will benefit the DOE and provide technology insights into challenges throughout the computing industry.”

“U.S. leadership in HPC is essential to meeting the mission-critical needs of DOE and other federal agencies,” noted Dave Patterson, President of Intel Federal. “We are proud to have been chosen by DOE as a continued partner in their strategic work toward the advancement of next-generation supercomputing technology,” he said. “Intel has a long standing commitment to science, research and innovation, from supercomputing to personal computing.”

The vendors will collaborate with DOE's Exascale Co-design Centers to determine how changes in the system architectures will affect how well the scientific applications perform.

“Partnerships and collaborations are an important element of exploring new ideas and overcoming the challenges of exascale computing, and we look forward to working with the DOE researchers and playing a role in the co-design efforts that will be key to the success of the DesignForward program,” said Peg Williams, Cray’s Senior Vice President of High Performance Computing Systems.

“Exascale computing is vitally important for U.S. scientific research and economic competitiveness, and NVIDIA’s expertise in massively-parallel heterogeneous systems will play a critical role in reaching exascale,” noted Bill Dally, Chief Scientist and Senior Vice President of Research at NVIDIA. “Interconnection networks are a key component of exascale systems. We are excited to collaborate with other DesignForward recipients to enable an open ecosystem for next-generation high-performance system interconnects.”

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DesignForward is the follow-on to DOE's FastForward project, a public-private partnership between DOE and HPC industry to advance extreme scale computing technologies with the ultimate goal of funding innovative, critical R&D technologies needed to deliver next generation capabilities within a reasonable energy footprint. FastForward is funded by DOE's Office of Science and NNSA, and technically managed by seven national laboratories:

Argonne National Laboratory, Berkeley Lab, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, and Sandia National Laboratories.

DOE's Office of Science is the single largest supporter of basic research in the physical sciences in the United States, provides open scientific user facilities -- including some of the world's most powerful supercomputers -- as a resource for the nation, and is working to address some of the most pressing challenges of our time. For more information, please visit the [Web](#) [1].

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. NNSA maintains and enhances the safety, security, reliability and performance of the U.S. nuclear weapons stockpile without nuclear testing; works to reduce 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. Visit the [Web](#) [2] for more information.

Berkeley Lab is a U.S. Department of Energy national laboratory located in Berkeley, California. It conducts unclassified scientific research and is managed by the University of California.

For more information visit <http://www.lbl.gov/> [3]

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