Update: NITRD Agencies Implement *Federal Plan for High-End Computing*

Since the May 2004 release of the *Federal Plan for High-End Computing* by the White House Office of Science and Technology Policy (OSTP), the NITRD HEC agencies together have implemented key recommendations of the *Federal Plan* that are changing the face of the Federal high-end computing enterprise. Notable developments of national significance include the opening of the Government's highest-capability computing platforms to the broader research communities in academe, industry, and other Federal agencies and the launch of a new multiagency program of academic R&D in HEC system software and software development environments.

These and other steps to implement the *Federal Plan* are being fostered by the HEC Interagency Working Group (HEC IWG), which coordinates high-end computing policy, strategies, and programs across NITRD member and participating agencies. The *Federal Plan* was developed by the High-End Computing Revitalization Task Force (HECRTF), chartered in 2003 under the National Science and Technology Council (NSTC) to develop a plan for undertaking and sustaining a robust Federal high-end computing program to maintain U.S. leadership in science and technology. Highlights of NITRD agencies' implementation activities include the following:

High-End Computing University Research Activity (HEC-URA): NSF, DARPA, DOE/SC, and NSA launched this research effort in operating systems, languages, compilers, libraries, software tools, and development environments in 2004. In 2006, NSF and other agencies began funding research in file systems, storage, and I/O, kicking off the new focus with national workshops to spur thinking among researchers about the R&D agenda. Beginning in 2007, NSF is expanding funding in research in parallel language and programming environments. In 2007, DOE/SC will conduct a recompete of the FAST-OS activity (HEC operating system research).

DARPA High-Productivity Computing System (HPCS) Program: Now in its final and prototyping phase (Phase III), this program begun in 2001 to pioneer a new generation of innovative, highly productive, and economically viable HEC systems was opened by DARPA for participation by other agencies, becoming the first activity in which the HEC agencies could work collaboratively to implement the *Plan's* recommendations for development of new HEC requirements analyses, performance metrics, and assessment tools (such as means of calculating the total cost of ownership). Agencies involved in these activities included DOE/NNSA, DOE/SC, NASA, NSA, NSF, and OSD. NSA, DOE/SC, and DOE/NNSA are providing Phase III funding support.

Leadership Systems: The *Federal Plan* proposed that HEC agencies support "leadership high-end computing systems" – leading-edge computing facilities that could be opened to the national research community to enable breakthrough computational science and engineering. Today, this concept has been implemented by DOE/SC at four of its national laboratories through its INCITE program and by NASA through its National Leadership Computing Systems (NLCS) initiative. The two agencies have completed their second round of open solicitations for leadership-class computing resources, and they plan to conduct additional solicitations on a recurring basis. In FY 2007 and beyond, DOE/SC will allocate 80% of its leadership systems at ORNL and ANL for such research.

In 2006, NSF initiated its petascale and near-petascale high-end computing system acquisition and deployment activity consistent with the agency's "Cyberinfrastructure Vision for 21st Century Discovery" document. The strategy calls for a two-track approach: Track 2 deploys near-petascale systems and Track 1 will deploy a sustained petascale system in 2011, both targeted for the open science and engineering communities. Other agencies are planning similar procurements of leadership-class systems in the near future.

Approaching the Petascale: The HEC agencies are at the forefront of U.S. R&D to understand how to scale high-end computing technologies to the petascale (10^{15}) levels needed to investigate the world's most complex scientific and engineering problems. As they move toward acquisition in the next several years of petascale systems that may involve 100,000 or more processors, DOE/NNSA, DOE/SC, and NSF are collaborating in research activities focused on issues in petascale architectures, software, programming environments, and applications.

System Performance Assessment: The *Federal Plan* recommended that agencies work together to develop more precise ways to measure, compare, and assess system performance. DARPA, DOE/SC, NSF, and OSD (HPCMP) are participating in collaborative activities to improve the effectiveness of HEC system procurements.

Production Software Inventory: The HEC agencies are currently developing an inventory of production infrastructure software, including operating systems, middleware, tools, numerical and I/O libraries, and applications software. This inventory will enable the agencies to better understand and respond to common software issues, dependence on open source software, and gaps that may require future research, as well as to identify opportunities to leverage individual agencies' production software investments and experience.