U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY

HEARING CHARTER

Oversight of the Networking and Information Technology Research and Development (NITRD) Program

Thursday, July 31, 2008
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Thursday, July 31, 2008, the Committee on Science and Technology will hold an oversight hearing to review the multi-agency, coordinated Networking and Information Technology Research and Development (NITRD) program. The hearing will examine the current program in light of the recent assessment of the President's Council of Advisors on Science and Technology (PCAST) and explore whether additional legislative adjustments to the program are needed.

2. Witnesses

Dr. Chris L. Greer, Director, NITRD National Coordination Office (NNCO).
The NNCO provides staff support for the subcommittees and working groups of the National Science and Technology Council that are responsible for planning and coordinating the NITRD program and serves as the interface with the public for the NITRD program.

Dr. Daniel A. Reed, Director of Scalable and Multicore Computing, Microsoft.
Dr. Reed is a member of PCAST and of the PCAST committee that carried out the recent assessment of the NITRD program. He previously served as a member of the President's Information Technology Advisory Committee.

Dr. Craig Stewart, Associate Dean, Research Technologies, Indiana University, and representing the Coalition for Academic Scientific Computation (CASC).
CASC members are academic and government computer centers that support computational research in science and engineering and that are involved in applications requiring high-performance computers and networks and advanced software development.

Mr. Don C. Winter, Vice President - Engineering and Information Technology, Phantom Works, the Boeing Company.
Mr. Winter has been involved in a planning effort with others from industry and academia to develop a research agenda and roadmap in the area of cyber-physical systems, which is one of the key research areas the PCAST assessment calls out for increased funding under the NITRD program.

3. **Overarching Questions**

- Do the objectives of the NITRD program address the most important information technology R&D issues? Are the R&D objectives prioritized and are the resources allocated appropriately to achieve the objectives?

- Are there significant research opportunities that the NITRD program is not pursuing?

- Is the overall funding level for the NITRD program adequate for maintaining US leadership in this important technology field?

- Are any changes needed to the planning, coordination, and prioritization mechanisms of the NITRD program in order to make them function more effectively?

- Does the research community – both academe and industry – have a voice in influencing the research priorities under the NITRD program? Are improvements needed in the external advisory process for the NITRD program?

- Do the recommendations of the recent PCAST assessment of the NITRD program encompass all of the key issues necessary to make the NITRD program more effective and relevant to research needs and opportunities in information technology?

4. Background

NITRD Program

The High Performance Computing Act of 1991 (P.L. 102-194), which the Science and Technology Committee was instrumental in enacting, authorized a multi-agency research program, called the High Performance Computing and Communications program, to accelerate progress in the advancement of computing and networking technologies and to support leading edge computational research in a range of science and engineering fields. The name of the program has evolved to the Networking and Information Technology Research and Development (NITRD) program. The statute established a set of mechanisms and procedures to provide for the interagency planning, coordination, and budgeting of the research and development activities carried out under the program.

For FY 2009, 13 Federal agencies will contribute funding to the NITRD program and additional agencies that do not contribute funding participate in planning activities. The FY 2009 budget request for the NITRD program is $3.548 billion, an increase of $0.207 billion or approximately 6 percent, over the FY 2008 level of $3.341 billion. A summary of the major research components of the program and funding levels by major component and by agency is available at: http://www.nitrd.gov/pubs/2009supplement/index.htm

Assessment of NITRD by the President's Council of Advisors on Science and Technology (PCAST)

P.L. 102-194 provided for an external advisory committee for the NITRD program. A

subsequent executive order created the President's Information Technology Advisory Committee (PITAC). The current Administration allowed that committee to expire and in its place assigned the advisory function for the NITRD program to PCAST. Last August PCAST completed an assessment of the NITRD program and issued a report, "Leadership Under Challenge: Information Technology R&D in a Competitive World" [http://www.nitrd.gov/pcast/reports/PCAST-NIT-FINAL.pdf].

The PCAST report includes several findings and recommendations related to the research content of the program, as well as suggestions for improving the program's planning, prioritization and coordination. The recommendations from the PCAST report include:

- Federal agencies should rebalance their NITRD funding portfolios by increasing support for important problems that require larger-scale, longer-term, multidisciplinary R&D and increasing emphasis on innovative and therefore higher-risk but potentially higher-payoff explorations.

- As new funding becomes available for the NITRD program, disproportionately larger increases should go for:
    - research on NIT systems connected with the physical world (which are also called embedded, engineered, or cyber-physical systems);
    - software R&D;
    - a national strategy and implementation plan to assure the long-term preservation, stewardship, and widespread availability of data important to science and technology; and
    - networking R&D, including upgrading the Internet and R&D in mobile networking technologies.

- The NITRD agencies should:

    - develop, maintain, and implement a strategic plan for the NITRD program;
    - conduct periodic assessments of the major components of the NITRD program and restructure the program when warranted;
    - develop, maintain, and implement public R&D plans or roadmaps for key technical areas that require long-term interagency coordination and engagement; and
    - develop a set of metrics and other indicators of progress for the NITRD program, including an estimate of investments in basic and applied research, and use them to assess NITRD program progress.

- The NITRD National Coordination Office should support the development, maintenance, and implementation of the NITRD strategic plan and R&D plans for key technical areas; and it should be more proactive in communicating with outside groups.

Cyber-Physical Systems

The top recommendation of the PCAST report for new research investments in the NITRD program is in the area of computer-driven systems connected with the physical world – also called embedded, engineered, or cyber-physical systems (CPS). CPS are connected to the

physical world through sensors and actuators to perform crucial monitoring and control functions. Such systems would include the air-traffic-control system, the power-grid, water-supply systems, and industrial process control systems. On a more individual level, they are found in automobiles and home health-care devices.

Examples of CPS are already in widespread use but growing demand for new capabilities and applications will require significant technical advances. Such systems can be difficult and costly to design, build, test, and maintain. They often involve the intricate integration of myriad networked software and hardware components, including multiple subsystems. In monitoring and controlling the functioning of complex, fast-acting physical systems (such as medical devices, weapons systems, manufacturing processes, and power-distribution facilities), they must operate reliably in real time under strict constraints on computing, memory, power, speed, weight, and cost. Moreover, most uses of cyber-physical systems are safety-critical: they must continue to function even when under attack or stress.

There is evidence that CPS will be an area of international economic competition. For example, the European Union's Advanced Research and Technology for Embedded Intelligence and Systems (ARTEMIS) program, funded by a public-private investment of 5.4 billion euros (over $7 billion in mid-2007 dollars) between 2007 and 2013, is pursuing R&D to achieve "world leadership in intelligent electronic systems" by 2016.

Recent Amendments to P.L. 102-194 [included in COMPETES Act]

In 1999, the PITAC released an assessment of the NITRD program ("Information Technology Research: Investing in Our Future") that found the research sponsored to be migrating too much toward support for near-term, mission focused objectives; that found a growing gap emerging between the power of high performance computers available to support agency mission requirements versus support for the general academic research community; and that found the total federal information technology investment inadequate. In response to that report, the Committee developed legislation that passed the House in similar form in the 108th (H.R. 4218) and 109th (H.R. 28) Congresses, but failed to be picked up in the Senate. It was finally incorporated in the COMPETES Act (section 7024(a)) in this Congress.

The COMPETES Act amends the 1991 Act in several ways:

> Program Planning. Specifies that the external advisory committee for the program, which must be re-constituted as a separate stand-alone committee, must carry out biennial reviews of the funding, content and management of the interagency R&D program and report its findings to Congress. Also, the annual report on the program prepared by the OSTP Director must now describe how the program has been modified in response to advisory Committee's recommendations.
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> High-End Computing. Requires OSTP to develop and maintain a roadmap for developing and deploying very high-performance computing (high-end) systems necessary to ensure that the U.S. research community has sustained access to the most capable computing systems.

Large Scale Applications. Clarifies that Grand Challenge problems supported under the interagency program are intended to involve multidisciplinary teams of researchers working on science and engineering problems that demand the most capable high performance computing and networking resources. Consistent with this requirement, the language also specifies that provision for access to high performance computing systems includes technical support to users of these systems.

5. Witness Questions

Dr. Greer was asked to provide an overview of the current planning and coordination mechanisms of the NITRD program, along with any recommendations on how to improve their effectiveness; a description of any actions by the NITRD agencies that have been taken, or that are in the planning stages, in response to the recommendations of the PCAST report ; a description of the role of the National Coordination Office in supporting the activities of the NITRD program; and his response to the findings and recommendations of the PCAST report related to the functioning of the NCO.

The other witnesses were asked to review and comment on the findings and recommendations contained in the PCAST report regarding both the administration and planning for the NITRD program and also the research priorities that the program should address. They were asked for their views on the merit of these recommendations and on what they see as the key steps to take that would strengthen the NITRD program, including any issues not addressed by the PCAST report.

Mr. Winter was particularly asked to provide his views on the PCAST recommendation related to the need for the NITRD program to place greater emphasis on research on cyber-physical systems.