

**Statement of Dr. Christopher L. Greer  
Director, National Coordination Office for  
Networking and Information Technology Research and Development  
to the Committee on Science and Technology  
U.S. House of Representatives  
April 1, 2009**

Good morning. I am Chris Greer, Director of the National Coordination Office (NCO) for Networking and Information Technology Research and Development (NITRD). With my colleague, Dr. Jeannette Wing of the National Science Foundation (NSF), I co-chair the NITRD Subcommittee of the National Science and Technology Council's (NSTC) Committee on Technology. I want to thank Chairman Gordon, Ranking Member Hall, and the members of the Committee for the opportunity to come before you today to discuss the multiagency NITRD Program and the Committee's draft Networking and Information Technology Research and Development Act of 2009.

The NITRD Program – now in its 18<sup>th</sup> year – represents the Government's portfolio of unclassified investments in fundamental, long-term research and development (R&D) in advanced networking and information technology (IT). The Program's current research areas are high-end computing, large-scale networking, cyber security and information assurance, human-computer interaction and information management, high-confidence software and systems, software design and productivity, and socioeconomic, education, and workforce implications of IT. IT R&D advances in these areas further our nation's goals for economic competitiveness, energy and the environment, health care, national defense and national security, science and engineering leadership, and other national priorities.

IT R&D research is performed in universities, Federal research centers and laboratories, Federally funded R&D centers, private companies, and nonprofit organizations across the country. The NITRD agencies – including 13 member agencies and a number of other participating agencies and offices – work together to ensure that the impact of their efforts is greater than the sum of the individual agency investments. This is accomplished through interaction across the government, academic, commercial, and international sectors using cooperation, coordination, information sharing, and joint planning, to identify critical needs, avoid duplication of effort, maximize resource sharing, and partner in investments to pursue higher-level goals.

**Program history in brief**

The 18-year history of the NITRD Program includes three previous legislative inputs. The first, the bipartisan High-Performance Computing (HPC) Act of 1991 (Public Law 102-194), launched the program, establishing a powerful, resilient framework that combined ambitious research goals with specific requirements for interagency cooperation, collaboration, and partnerships with industry and academia. This visionary framework has withstood the test of time, enabling the Program to fulfill its responsibilities under legislation to:

- (A) establish the goals and priorities for Federal high-performance computing research, development, networking and other activities; and*
- (B) provide for interagency coordination of Federal high-performance computing research, development, networking, and other activities undertaken pursuant to the Program.*

The next two inputs – the Next Generation Internet Research Act of 1998 (Public Law 105-305) and the America COMPETES Act of 2007 (Public Law 110-69) – formally extended the scope of responsibilities for interagency coordination to include human-centered systems; flexible, extensible, interoperable, and accessible network technologies and implementations; education, training, and human resources; and other areas.

In its first annual report to the Congress in 1992, the program then called High Performance Computing and Communications (HPCC) reported an estimated 1991 multiagency investment of nearly \$490 million across eight Federal agencies and four Program Component Areas (PCAs). Today, the NITRD Program coordinates among 13 member agencies that, together, invest more than \$3 billion across eight PCAs. (See Appendices 1 and 2 on pages 10-11 for a list of the current NITRD agencies and PCAs and a NITRD organizational chart.)

While these numbers reflect a sustained commitment to progress, the success of the Program lies in more than just the sum of the investments. The vision of previous amending legislation and of NITRD Program participants and leadership over the years has been for a balanced, comprehensive portfolio of investments – a portfolio that recognizes that hardware innovations are constrained without corresponding advances in software; the use of advanced networks will be limited without improvements in security and reliability; massive data sets will not drive progress if the data cannot be preserved, accessed, and used for increased understanding; etc.

The recent recommendations of the President’s Council of Advisors on Science and Technology (PCAST) for adjustments in technical priorities and increases in large-scale, long-term investments underscore the need to continuously rebalance the NITRD portfolio in a fast-moving IT landscape. I urge the Committee to continue its history of legislating a NITRD framework that avoids a static imbalance and, instead, ensures the portfolio of investments can respond to our nation’s changing IT needs and opportunities.

### **Response to the Committee Request**

The invitation to testify from this House Committee included a request to address one topic and two specific questions. Responses are provided in the numbered sections that follow.

**Topic 1. *“provide an update (since your last testimony before the Committee in July, 2008) of any significant changes to the NITRD Program and any actions the NITRD agencies have taken or plan to take in response to the recommendations of the 2007 PCAST report.”***

We view the PCAST recommendations and the Committee’s proposed 2009 NITRD legislation as helpful in further improving the NITRD framework. Our goal, as yours, is to enable this successful Federal enterprise to serve the nation even more effectively in the future. Our activities over the past eight months in response to the PCAST recommendations are summarized by topic below.

#### ***a) Strategic Planning***

The NITRD Program is engaged in a robust process, including extensive public input, for developing a comprehensive, five-year strategic plan. Details of this process are described below in response to the Committee’s additional questions on this topic. The contents of this strategic plan will guide our subsequent roadmapping process, including review of the structure of the NITRD Program. We expect the strategic plan to be complete later this fiscal year.

***b) Education and workforce issues***

With regard to the PCAST's education and workforce recommendations, SRI International is nearing completion of a NITRD-commissioned fast-track study of international education and workforce trends that we will use to inform the NITRD strategic plan.

We also moved ahead last summer, under the aegis of the Social, Economic, and Workforce implications of IT (SEW) Coordinating Group, to convene a September 2008 workshop of individuals in many Federal agencies who have responsibilities related to education and workforce development. Since that meeting, a task force of the participants has been working with SEW to develop content for the strategic plan on the Federal role in education and workforce development.

Moreover, a major cross-cutting theme of our proposed strategic plan framework is "Cyber Capable," a concept that encompasses not just technologies and applications but the educational preparation of both technology workers and technology users. We devoted the first session of the public forum to this theme to emphasize its central role in our thinking.

***b) Rebalancing the NITRD portfolio***

Our responses to the PCAST recommendations to increase emphasis on large-scale, long-term efforts and on cyber physical systems, software, digital data, and networking are summarized individually below.

- i) **Large-scale, long-term efforts:** The draft framework for the NITRD strategic plan is explicitly designed to target PCAST recommendations on portfolio balance and emphasis areas such as large-scale, long-term, and high-risk investments. The framework thus is cast at a high level that encompasses the strategic plans of our member agencies but focuses very directly on challenges that no single agency can meet on its own. In fact, we view the identification of these challenges as the principal goal of the NITRD strategic planning process and the necessary foundation for setting multiagency NITRD priorities and roadmapping specific research thrusts to execute under the plan. We anticipate developing roadmaps by NITRD research area, as PCAST recommended, and will provide these separately rather than in the strategic plan, allowing different update cycles for the different types of plans.
  
- ii) **Cyber-physical systems:** A comprehensive plan for assessing national R&D needs in the complex life- and safety-critical technologies called cyber-physical systems was initiated prior to the PCAST assessment and is yielding good results. In this plan, the High Confidence Software and Systems (HCSS) CG has the leadership role in convening researchers and companies across select sectors and industries comprising medical devices, transportation systems (air, rail, auto), and energy (to include SCADA control systems). Our goals in identifying R&D challenges in each sector are to identify both opportunities for targeted investments and, more importantly, fundamental challenges common to all sectors and meriting large-scale, long-term, multi-agency investments. The first full-sector report has just been published for high-confidence medical systems (March 2009). The participants' report from the November 2008 transportation sector workshop (one of a series in this sector) is expected in April 2009 with the NITRD analysis to follow. An energy sector workshop is slated for June 2009 and follows a previous SCADA control systems meeting. These sector reports will be used to conduct an analysis of common challenges that are potential targets for multiagency and interagency investments.

This analysis of R&D challenges in assuring the safety, reliability, and security of next-generation cyber-physical systems is proving especially effective. It is wholly multidisciplinary and is engaging an unusually broad mix of research, technical, and commercial practitioners and experts from academia, industry, and government. Through its workshop series, HCSS is establishing communities of interest for the first time – such as among researchers, medical clinicians, hospital administrators, industry representatives, and government regulators with a stake in improving the quality and increasing the capabilities of IT-enabled medical devices and systems, and among designers, safety experts, engineers, and academic researchers involved in the aviation, automotive, and rail sectors. These communities of interest can also function in promoting technology transfer, providing a model for achieving this goal in other NITRD Program areas.

- iii) **Software:** The NITRD Program’s Software Design and Productivity (SDP) group is retooling its collaborative agenda and activities under new leadership from NSF and NIST. I participated last week in an NSF-sponsored “software sustainability” conference that signals that agency’s continuing high interest in the challenges of improving the quality, performance, and cost-effectiveness of software. The reality that these challenges slow advances across the spectrum of networking and information technology applications is a leitmotif of NITRD strategic planning discussions
  
- iv) **Digital Data:** A number of NITRD agency representatives participated in, and served as co-chairs for, the Interagency Working Group on Digital Data (IWGDD) chartered by the NSTC in 2006 to “develop and promote the implementation of a strategic plan for the Federal government to cultivate an open interoperable framework to ensure reliable preservation and effective access to digital data for research, development, and education in science, technology, and engineering.” Such a plan, with NITRD participation, was recommended by PCAST. The IWGDD, representing more than two dozen agencies, delivered its report – *Harnessing the Power of Digital Data for Science and Society* – to the NSTC in January 2009. The report addresses the substance of the PCAST recommendation. It provides essential conceptual foundations and proposes structural scaffolding for rationalizing Federal roles and responsibilities in managing and maintaining critical scientific data on behalf of the nation.

The IWGDD report, which calls for ongoing close cooperation with the NITRD Program, draws a distinction between NITRD’s mandate for “invention,” or fundamental R&D, and the need to establish other Federal mechanisms for designing and implementing a structural framework for stewardship of government data. The IWGDD document recommends an initial set of steps toward such a framework.

- v) **Networking:** PCAST endorsed the development of a Federal Plan for Advanced Networking Research and Development. That plan, prepared by a task force of NITRD agency members and others pursuant to a January 2007 charge from the Director of OSTP, was posted in draft on the NCO Web site in August 2007 for public comment and published in final form by the NCO in September 2008. The document serves as an overarching guide for planning and coordination in the LSN

In its plans for FY 2009-2010, the LSN Coordinating Group also is addressing PCAST's recommendations on strengthening the infrastructure for large-scale data resources and increasing network security and reliability. The group is coordinating cross-domain performance measurement to enable improved management and security on networks. It is also fostering the development, use, and sharing of standardized tools and infrastructure for large-scale distributed access, data transfer, and collaborations including the Large Hadron Collider (LHC), the Earth System Grid in support of the Intergovernmental Panel on Climate Change (IPCC), and health care applications such as NIH's Biomedical Informatics Research Network (BIRN) and cancer Biomedical Informatics Grid (caBIG).

**Question 1. *“The NITRD subcommittee of the National Science and Technology Council is in the midst of developing a strategic plan. Please describe those efforts and how, if at all, they address the requirements for strategic planning as described in the legislation. In particular, what are the particular mechanisms for industry and academic input into the planning process, and how is the NITRD subcommittee addressing the need for the NITRD program to place more emphasis on higher-risk, long-term projects? What is the timeline for completing the strategic plan?”***

We believe the strategic planning process currently underway addresses the requirements for strategic planning as described in the draft legislation. The process provides for public input at each phase of the planning effort. Input at the outset was obtained through a Request for Information published in the Federal Register in August 2008, posted on our web site, and announced through a broad distribution to the community. This input and discussions by the NITRD strategic planning team were used to define an initial conceptual framework for the plan. Input on this conceptual framework was obtained at a public, webcast forum held in February 2009. The input we have received has been excellent and we are using this to significantly revise the framework and develop draft text for public comment in June/July 2009. Depending on the nature of the comments, we may go forward with a final version if minor revisions are required, or re-release for public comment if major revisions are needed.

As described above, the framework for the NITRD strategic plan is explicitly designed to target the PCAST recommendation on large-scale, long-term, and high-risk investments. We have designed the framework at a high level to encompass the strategic plans of our member agencies and allow us to focus on challenges that no single agency can meet on its own. The identification of these challenges is the principal goal of the NITRD strategic planning process.

**Question 2. *“Please describe the current responsibilities and activities of the National Coordination Office (NCO). How do these responsibilities and activities compare to the responsibilities and activities required for the NCO in the legislation? In particular, how has the NCO responded to the 2007 PCAST recommendation for improved communication with and outreach to outside groups?”***

The NCO serves as:

- The focal point for coordination and policy development for the Federal NITRD program, facilitating the various Program elements (e.g., CGs and IWGs) and activities and fostering collaboration among Federal agencies, university researchers, industry, and other members of the IT community.
- A source of timely, high-quality, technically accurate, in-depth information on IT R&D accomplishments, new directions, and critical challenges that IT leaders, policy makers and the public can use to maximize social and economic benefits.
- A highly effective team of independent, technically expert, service-oriented professionals committed to advancing the mission of the NITRD Program.

The categories of activities the NCO supports are:

- Logistical/staff and expert technical support for regular meetings of the IWGs and CGs
- Expert technical and professional writing support for the annual NITRD supplement to the President's budget
- Logistical/staff and expert technical support for annual planning meetings of the PCAs to assess progress and identify priorities and activities for the coming year
- Logistical/staff, expert technical, and professional writing and graphics support for task groups and others developing Federal reports and strategic plan documents for IT R&D; includes support for the Senior Steering Group developing coordination and leap-ahead plans for the Federal Comprehensive National Cybersecurity Initiative (CNCI)
- Expert technical and management support for procurement, management, and oversight of contracted studies, reviews, and reports
- Logistical/staff, expert technical, and professional writing support for public and government workshops and other meetings
- Expert outreach through participation in appropriate government and non-government meetings and workshops and on-site visits to industrial, academic, and non-profit entities
- Expert outreach through response to requests for information from corporate, academic, international, and other inquirers
- Liaison between Program participants and OSTP and OMB on NITRD issues

A 2008 self-study of a 20-month period revealed that in an average month NCO: supports more than 7 IWG, CG and community of practice meetings; supports an average of 1 1/2 workshops; participates in 1 workshop; supports 2 writing projects; and supports 2 studies or reviews.

In 2008, more than 350 government employees participated in NCO-supported NITRD events. Highlights for the past 12 months include producing the President's Budget Supplement, creating the coordination and leap-ahead plans for the CNCI effort, publishing the Federal Plan for Advanced Networking Research and Development and the High Confidence Medical Devices reports, producing a lessons-learned report for PCAST, launching an SRI study of the IT education/workforce landscape, publishing four requests for information (RFIs) in the Federal Register for public input to the NITRD strategic plan and the CNCI cyber leap year activities, and conducting a webcast public forum for input to the NITRD strategic plan.

This range of activities and responsibilities is similar to that envisioned in the Committee's draft 2009 NITRD legislation with the exception of two areas for possible increases in the intensity of NCO activities. These areas are coordination with "State computing and networking technology programs" and promoting "access to and early application of the technologies, innovations, and

expertise derived from Program activities.” Depending on the scale of these activities, additional resources may be required. The formation of a task force to evaluate options for a consortium as envisioned in the draft legislation would be a new area of responsibility for NCO and the NITRD Program. Note that NCO previously provided support (with dedicated resources and budget) for the PCAST assessment, a function analogous to that for support of the Advisory Committee envisioned in the draft legislation.

In its 2007 assessment, the PCAST recommended that the NCO “*develop and implement a plan for supporting the development, maintenance, and implementation of the NITRD strategic plan and R&D plans.*” In response, NCO supported a two-day kickoff retreat for strategic planning by the NITRD community and supports bimonthly meetings of the NITRD strategic planning team. The team issued an RFI for public input in August 2008, developed a conceptual framework for the plan based on this input, conducted a webcast public forum for input on the framework, is now organizing a forum of government participants for similar input, and is entering the writing phase to produce text for public comment. Similar support for the roadmapping process is planned for the second half of this calendar year.

The PCAST recommendation also provided that NCO should develop plans for supporting the “*planning and coordination of larger, longer-term multidisciplinary projects; greater interaction with academia, industry, and international entities; the planning of national workshops and preparation of workshop reports; and overall improved communication with NITRD NCO stakeholders.*” We have launched an all-hands effort to develop the first-ever NCO strategic plan to address and embrace these responsibilities. The plan will be shared with the NITRD community, with NSTC, OSTP, and OMB, and with the public. We have set a deadline of October 1, 2009 for completing this NCO plan.

### **Comments on draft NITRD 2009 legislation**

We greatly appreciate the Committee’s interest in NITRD and its continuing efforts to strengthen the Program. We share your commitment to the success of the NITRD enterprise. In the spirit of shared goals, we would like to offer a few comments intended to be helpful as the Committee considers legislation. The comments below focus on the major elements of the draft legislation: scope of the Program, cyber-physical systems, the advisory committee, and large-scale, long-term R&D. We will forward in a separate document a few more detailed suggestions on specific elements of the draft text.

#### ***a) Scope of the Program***

The Program’s founding legislation, the High-Performance Computing Act of 1991, focused principally on high-performance computing and networking. This focus was reflected in the extensive use of the phrase “high-performance computing” throughout. Subsequent amending legislation significantly broadened the scope of the program and facilitated rebalancing of the portfolio. While these previous amendments (and the current draft) redefined the meaning of the phrase “high-performance computing,” the phrase itself remains embedded in the text. As a result, a reader not attentive to special definitions and, instead, relying on the common meaning of the phrase may be misled. For example, Section 101(b)(1) (Advisory Committee) describes “an advisory committee on high-performance computing.” If the words are misinterpreted, the resulting committee may be too narrowly focused to serve the intended function.

We respectfully request that the Committee consider replacing the phrase “high-performance

computing” with “networking and information technology” wherever appropriate throughout the text. We understand this is a lot of work for the current draft, but the result could have significant value in clarifying current legislative intent and facilitating any subsequent legislation.

***b) Cyber-physical systems***

As evidenced in my description above of our extensive cyber-physical systems efforts, the NITRD agencies clearly share this priority. Significantly, however, we feel it is best addressed in the context of a balanced portfolio.

Because the scientific basis of networking and information technology is inherently multidisciplinary, the more complex the IT systems, the greater the number of cross-cutting technical issues. NITRD’s strength is that its research areas are not so narrowly focused that topics become isolated. Each PCA includes many interrelated subject matters, and a number of these – multidimensional modeling, for example, or system interoperability – are shared interests across the PCAs. Such interests often lead to collaborative planning activities and/or research projects drawing diverse technical contributions from different PCAs. For example, the National Security Agency (NSA) is an active participant in the HCSS workshop series, not due to a focus on cyber-physical systems per se, but rather on the design, certification, and operation of extremely secure and reliable software and systems; for NSA, cyber-physical systems represent one instantiation of technology with requirements it cares about.

In our view, a priority focus on this topic alone would run counter to the most effective characteristic of the NITRD framework. Placing cyber-physical systems within the full context of the NITRD Program could be achieved in the draft legislation by including the relevant text under Section 101(a)(2), which lays out the full scope of the Program.

A second point relevant to cyber-physical systems is the need to distinguish between the cyber-physical systems of today, which have been operational in some sectors (e.g., aviation, auto industry) for a number of years, and the next-generation, high-confidence systems that are the focus of NITRD research. In our separate document providing detailed comments, we offer some suggestions for refining the definition and including the phrase “advanced cyber-physical systems” at key points in the text to help achieve this distinction.

The consortium concept proposed in the reauthorization draft is interesting as a means to address the gap between NITRD research and wide adoption and deployment, including commercial development. We believe, however, that the charge should be broader than cyber-physical systems alone. There is a potential here to help address the “valley of death” technology transfer challenge across the breadth of the NITRD portfolio. We would welcome the opportunity to pursue that expanded charge.

***c) Advisory Committee***

We believe that to perform its function the advisory committee should:

- (1) be charged with providing both strategic guidance and oversight;
- (2) possess deep technical expertise relevant to the full range of NITRD areas; and
- (3) be in position to provide its advice to the President.

The first of these criteria could be addressed in the draft legislation by adding to the current list of advisory committee responsibilities the strategic functions currently referenced elsewhere in the draft text. The second and third will be met by chartering the advisory committee as a



subgroup within PCAST. This is in keeping with the President's direction that external advice and guidance on science and technology should be considered through the PCAST mechanism. We believe this is also consistent with the text of the draft legislation.

***d) Large-scale research in areas of national interest***

The draft framework for the NITRD strategic plan is *explicitly designed* to target PCAST recommendations on portfolio balance and emphasis areas such as large-scale, long-term, and high-risk investments. However, for the reasons cited above for cyber-physical systems, we believe this emphasis area is best considered in the context of the full scope of the NITRD Program. In particular, investments that meet the relevant criteria should be considered across all of the PCAs and should be complementary to and supportive of other investments being made by the NITRD agencies and by others throughout the IT R&D landscape. This could be achieved in the draft legislation by including the relevant text under Section 101(a)(2), which lays out the full scope of the Program.

Section 104(b)(2) of the draft legislation provides that "projects shall be carried out by a collaboration of no fewer than 2 agencies participating in the Program." This could be interpreted to exclude or inhibit large-scale investments by any single NITRD agency or through partnerships between a NITRD agency and any non-NITRD entity. This may not be the intention of the Committee. Revision to clarify the Committee's intent would be very helpful.

Thank you for the Committee's interest in the NITRD Program and for this opportunity to appear before you today.

# Appendix 1: NITRD Agencies and Program Component Areas

## Member agencies

AHRQ – Agency for Healthcare Research and Quality  
DARPA – Defense Advanced Research Projects Agency  
DOE/NNSA – Department of Energy/National Nuclear Security Administration  
DOE/SC – Department of Energy/Office of Science  
EPA – Environmental Protection Agency  
NARA – National Archives and Records Administration  
NASA – National Aeronautics and Space Administration  
NIH – National Institutes of Health  
NIST – National Institute of Standards and Technology  
NOAA – National Oceanic and Atmospheric Administration  
NSA – National Security Agency  
NSF – National Science Foundation  
OSD and Service research organizations (Office of the Secretary of Defense and DoD Air Force, Army, and Navy research organizations)

## Participating agencies

CIA – Central Intelligence Agency  
DHS – Department of Homeland Security  
DNI – Office of the Director of National Intelligence  
DOE (OE) – Department of Energy Office of Electricity Delivery and Energy Reliability  
DOJ – Department of Justice  
DOT – Department of Transportation  
FAA – Federal Aviation Administration  
FBI – Federal Bureau of Investigation  
FDA – Food and Drug Administration  
GSA – General Services Administration  
IARPA – Infrastructure Advanced Research Projects Agency  
State – Department of State  
Treasury – Department of the Treasury  
TSWG – Technical Support Working Group  
USGS – U.S. Geological Survey

## Program Component Areas, Interagency Working Groups/Coordinating Groups/Teams

High End Computing Infrastructure and Applications (HEC I&A) – HEC IWG  
High End Computing Research and Development (HEC R&D) – HEC IWG  
Cyber Security and Information Assurance (CSIA) – CSIA IWG  
Human-Computer Interaction and Information Management (HCI&IM) – HCI&IM CG

Large Scale Networking (LSN) – LSN CG  
**LSN Teams:**  
Joint Engineering Team (JET)  
Middleware and Grid Infrastructure Coordination (MAGIC)  
High Confidence Software and Systems (HCSS) – HCSS CG  
Social, Economic, and Workforce Implications of IT and IT Workforce Development (SEW) – SEW CG  
Software Design and Productivity (SDP) – SDP CG

## Appendix 2: NITRD Program Structure

