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 18th year – provides a coordinated view of the Government's portfolio of unclassified investments in fundamental, long-term research and development (R&D) in advanced networking and information technology (IT). All of the research reported in this portfolio is managed, selected, and funded by one or more of the 13 member agencies under their own individual appropriations. 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, and science and engineering leadership.

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 – consisting of the 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 synergy is accomplished through interaction across the government, academic, commercial, and international sectors using cooperation, coordination, information sharing, and joint planning, in selected areas where the agencies can identify significant leverage, 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 acts. The first, the High-Performance Computing (HPC) Act of 1991 (Public Law 102-194), launched the Program, establishing a framework that combined research goals with specific requirements for interagency cooperation, collaboration, and partnerships with industry and academia. This framework has withstood the test of time, enabling the Program to address 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 acts – 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 computing; 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, each coordinated by an Interagency Working Group (IWG) or Coordinating Group (CG) of member and participating agency program managers. (See Appendices 1 and 2 on pages 9-10 for a list of the current NITRD agencies and PCAs and a NITRD organizational chart.)

While these numbers reflect sustained and significant budgetary growth over the past 18 years, I believe that the Program is more than just the sum of the investments. The vision of previous amending legislation and of the NITRD agencies over the years has been for a balanced 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 support a framework that enables the NITRD portfolio of investments to respond to our nation's changing IT needs and opportunities.

Response to the Committee Request

The invitation to testify here today included a request to address one topic and respond to two specific questions. Responses are provided in the numbered sections that follow.

Topic 1. *"[P]rovide 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 recommendations of the 2007 PCAST report assessing the NITRD Program[1] as helpful in further improving the NITRD framework. Our goal, as yours, is to enable the NITRD Program 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.

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[1] *Leadership Under Challenge: Information Technology R&D in a Competitive World.* President's Council of Advisors on Science and Technology, August 2007, Washington, D.C. Available at http://www.nitrd.gov/Pcast/reports/PCAST-NIT-FINAL.pdf.

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 the response to the Committee's 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 completed later this year. However, it is important to remember that this strategic plan must complement and integrate the legislatively mandated strategic plans of the member agencies.

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 (CG), to convene a September 2008 workshop of Federal program managers who have responsibilities related to networking and information technology 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 IT education and workforce development.

Moreover, in the strategic planning process we are discussing 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 education issues to emphasize their role in our considerations.

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 strategic planning process is explicitly designed to target PCAST recommendations on portfolio balance and emphasis areas such as large-scale, long-term, and high-risk investments. The planning thus is cast at a high level that can build on the existing strategic plans of our member agencies by focusing 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 to enable the member agencies to establish NITRD priorities and initiate roadmaps for specific research thrusts 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**: We appreciate the Committee's interest in cyber-physical systems and agree with the Committee on their importance. As we detail below, there are a number of ongoing activities under existing NITRD structures that are focusing on this area already. However, we are concerned with the precedent of including a specific application of NITRD research in this bill.

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 positive results. In this plan, the High Confidence Software and Systems (HCSS) CG has a leadership role in convening researchers and companies across three selected sectors and industries comprising medical devices, transportation systems (air, rail, auto), and energy (which includes 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 across the sectors that may merit large-scale, long-term, multi-agency investments. The first sector report – on high-confidence medical systems – has just been published (March 2009). For high-confidence transportation systems, the first in a series of workshop reports is expected in April 2009 with the NITRD analysis to follow that. An energy sector workshop is slated for June 2009; it follows a previous workshop on SCADA systems. These sector reports will be used to analyze common challenges that are potential targets for interagency investments.

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. This is an example of the broad outreach being undertaken by the NITRD Program.

iii) **Software**: The NITRD Program's Software Design and Productivity (SDP) CG is revitalizing its collaborative agenda and interagency 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 make 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.

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.[2] The document serves as an overarching guide for planning and coordination in the LSN Coordinating Group. For example, DOE/SC and NSF, with LSN and NCO support, hosted a "Networking Research Challenges" workshop shortly after the plan's issuance to elicit the views of the broader industry and academic networking research communities about the plan and key R&D priorities. The report of that workshop is currently being prepared for publication.

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.

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. However, the planning process is mindful of the need to complement and integrate the legislatively mandated strategic plans of the member agencies.

The process currently in place 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 either go forward with a final version – if minor revisions are required – or re-release for public comment – if major revisions are needed.

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*

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[2] *Federal Plan for Advanced Networking Research and Development,* Interagency Task Force on Advanced Networking Research and Development, September 2008. Available at http://www.nitrd.gov/Pubs/ITFAN-FINAL.pdf.

the NCO responded to the 2007 PCAST recommendation for improved communication with and outreach to outside groups?"

The PCAST concluded that the NCO had been "effective" in its support of the NITRD Program. I believe that the main areas of the NCO's effectiveness are in its role 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 team of 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 the NITRD Program and OSTP and OMB on NITRD issues

A 2008 self-study of a 20-month period revealed that in an average month the NCO: supports more than seven IWG, CG and community of practice meetings; supports an average of one and a half workshops; participates in one workshop; supports two writing projects; and supports two 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: coordination with State IT R&D activities and coordination of the proposed task force.

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 the responsibilities that are appropriate for the NCO. The plan will be shared with the NITRD community, with NSTC, OSTP, and OMB, and then with the public. I 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. Since the Administration is still in the process of formulating its research and development priorities, it would be premature for me to comment in detail on the relative priorities implied in the draft legislation. Therefore, my comments below focus on the organizational elements of the draft legislation.

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 in order to clarify current legislative intent.

b) Cyber-physical systems
As evidenced in my description above of our extensive cyber-physical systems efforts, the NITRD agencies are seriously engaged in this area. Significantly, however, we feel that cyber-physical systems are 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.

c) Advisory Committee
We believe that to perform its function the proposed advisory committee should:
   (1) be charged with providing strategic advice and not just Program assessment;
   (2) possess deep technical expertise relevant to the full range of NITRD areas; and
   (3) be in position to provide 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 could be met by chartering the advisory committee as a subcommittee to PCAST.

d) Large-scale research in areas of national interest
The NITRD strategic planning process is *explicitly designed* to target PCAST recommendations on portfolio balance and emphasis areas such as large-scale, long-term, and high-risk investments. However, 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.

The draft legislation also 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 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 and clarification of the Committee's intent would be very helpful.

Thank you for your interest in NITRD, your work on the reauthorization legislation, and for the opportunity to appear before you today. We look forward to working with you to strengthen the NITRD Program.

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 – Intelligence Advanced Research Projects Activity

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
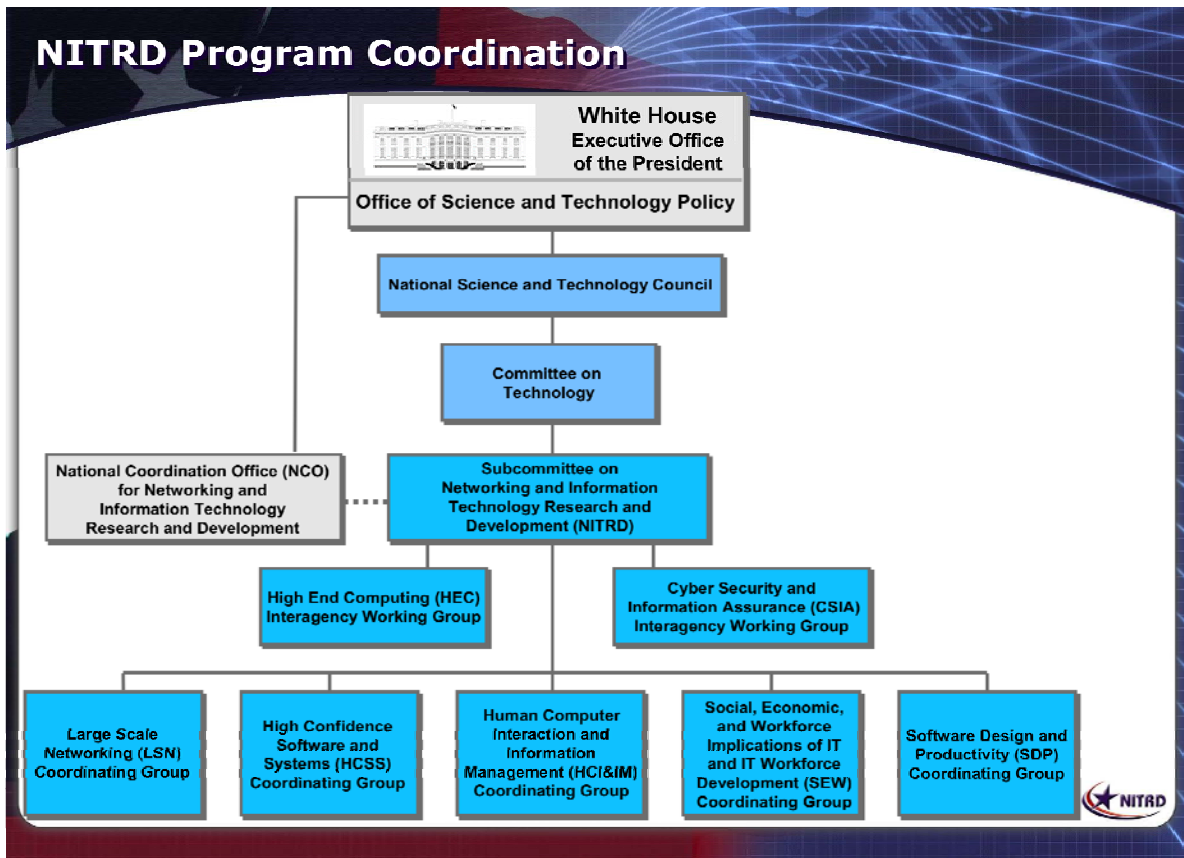
BIO

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Dr. Chris Greer is Director of the National Coordination Office (NCO) for the Networking and Information Technology Research and Development (NITRD) program. The NCO reports to the Office of Science and Technology Policy within the Executive Office of the President. Dr. Greer is on assignment to the NCO from his position as Senior Advisor for Digital Data in the NSF Office of Cyberinfrastructure. He recently served as Executive Secretary for the Long-lived Digital Data Collections Activities of the National Science Board and is currently Co-Chair of the Interagency Working Group on Digital Data of the National Science and Technology Council's Committee on Science. He is also a member of the Advisory Committee for the National Archives and Records Administration's Electronic Records Archive and a member of the Digital Library Council of the Federal Depository Library Program.

Dr. Greer received his PhD degree in biochemistry from the University of California, Berkeley and did his postdoctoral work at CalTech. He was a member of the faculty at the University of California at Irvine in the Department of Biological Chemistry for approximately 18 years where his research on gene expression pathways was supported by grants from the National Science Foundation, the National Institutes of Health, and the American Heart Association. During that time, he was founding Executive Officer of the RNA Society, an international professional organization.