Statement of Dr. Keith Marzullo
Director, National Coordination Office for the
Networking and Information Technology Research and Development Program,
to the Subcommittee on Research and Technology of the
Committee on Science, Space, and Technology
U.S. House of Representatives
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Good morning. My name is Keith Marzullo and I am the Director of the National Coordination Office (NCO) for the Networking and Information Technology Research and Development (NITRD) Program. With my colleague, Dr. James F. Kurose of the National Science Foundation (NSF), I co-chair the NITRD Subcommittee of the National Science and Technology Council (NSTC) Committee on Technology (CoT). I want to thank Chairwoman Comstock, Ranking Member Lipinski, and members of the Subcommittee for the opportunity to come before you today to talk about the role of the NITRD Program in federally funded research and development (R&D) in advanced networking and information technology (IT). I also look forward to discussing the recent review of the NITRD Program by the President's Council of Advisors on Science and Technology (PCAST).

I became Director of the NCO for NITRD in June 2015, and was at the National Science Foundation (NSF) prior to that for five years, as well as previously a professor and department chair of Computer Science and Engineering at the University of California San Diego. While at NSF, I directed the Division of Computer and Network Systems in the Directorate of Computer and Information Science and Engineering (CISE). Also while at NSF, I had the privilege of co-chairing two NITRD Senior Steering Groups, one of which focused on R&D in cybersecurity and the other on cyber-physical systems. I bring these experiences to my current position, which has shaped my enthusiasm for the great work being done by the NCO and the NITRD Program.

The NITRD Program

Authorities and Purpose: The NITRD Program is now in its 25th year, having been authorized by the High Performance Computing Act of 1991 (Public Law 102-194), which established the Program, and set forth a framework that combined research goals with specific provisions for interagency cooperation, collaboration, and partnerships with academia and industry. Two additional acts – the Next Generation Internet Research Act of 1998 (Public Law 105-305) and the America COMPETES Act of 2007 (Public Law 110-69) – reauthorized the Program and extended its scope in various ways.

The NITRD Program provides for coordination across the Government's portfolio of unclassified investments in fundamental, long-term R&D in advanced information technologies in computing, networking, and software. NITRD research supports both the missions of our Federal agencies and the Nation's broader goals to accelerate the development and deployment of advanced information technologies for science, engineering, national defense, homeland security, the U.S. economy, our environment, and the health, education, and quality of life of the American people.

NITRD Agencies: NITRD member agencies are Federal agencies that conduct or support R&D in advanced networking and information technologies, report their IT research budgets in the NITRD crosscut, and provide support for the NCO. NITRD participating agencies are Federal agencies that participate in NITRD activities and have mission interests that involve applications or R&D in advanced networking and information technologies. I am pleased to report that membership continues to grow and now stands at 21 member agencies with the recent addition of the National Institute of Justice. Appendix A lists NITRD member and participating agencies.

Budget Requests and Reporting: Annually, the NCO produces the NITRD Supplement to the President's Budget,[1] which is delivered to the Congress as part of the President's budget request. The Supplement provides a budget crosscut by agency and by NITRD Program Component Area (PCA). The PCAs are the major subject areas under which related projects and activities carried out under the NITRD Program are grouped. In support of the budget request, the Supplement provides information about the strategic priorities, highlights, plans, and activities that agencies plan to coordinate under the PCA in the upcoming fiscal year.

Agencies currently coordinate their NITRD research activities and plans in eight PCAs. The current PCAs are:

- Cybersecurity and Information Assurance (CSIA)
- High Confidence Software and Systems (HCSS)
- High End Computing Infrastructure and Applications (HEC I&A)
- High End Computing Research and Development (HEC R&D)
- Human Computer Interaction and Information Management (HCI&IM)
- Large Scale Networking (LSN)
- Social, Economic, and Workforce Implications of IT and IT Workforce Development (SEW)
- Software Design and Productivity (SDP)

This PCA structure has hardly changed over the last 15 years. In response to the 2015 PCAST recommendations, the NCO is currently coordinating with NITRD member agencies in a process to modernize the PCAs. (See the section on the 2015 PCAST Review on page 8.)

NITRD Coordination and Working Groups: As noted previously, agencies coordinate their NITRD research activities and plans in PCAs. For each PCA, agency representatives meet in an Interagency Working Group (IWG) or a Coordinating Group (CG) to exchange information and collaborate on research plans and activities such as testbeds, workshops, and joint solicitations. Such activities enable agencies to coordinate and focus their R&D resources on important, shared problems and common goals.

The NITRD coordinating structure also includes Senior Steering Groups (SSGs) to focus on emerging science and technology priorities. The SSGs enable senior-level individuals who have the authority to affect or shape the R&D directions of their organizations to collaborate on

[1] For the FY 2016 budget request, see *The Networking and Information Technology Research and Development Program Supplement to the President's Budget – FY 2016*, February 2015, National Science and Technology Council: https://www.nitrd.gov/pubs/2016supplement/FY2016NITRDSupplement.pdf.

developing effective R&D strategies for national-level IT challenges. The NITRD Program also supports Communities of Practice (CoPs) that function as forums to enhance R&D collaboration and promote the adoption of advanced IT capabilities developed by government-sponsored IT research. Collectively, we refer to the NITRD IWGs, CGs, SSGs, CoPs, and their sub-teams as the NITRD Working Groups. Appendix B lists the NITRD Working Groups.

Overall NITRD Program coordination is carried out by the Subcommittee on Networking and Information Technology Research and Development, under the aegis of the Committee on Technology (CoT) of the National Science and Technology Council (NSTC). The NITRD Subcommittee convenes three times a year and the NITRD Working Groups each meet approximately 12 times annually. In my role as co-chair of the NITRD Subcommittee, I keep in contact with NITRD agency representatives on NITRD matters and chair the Subcommittee meetings with my colleague and the Subcommittee's other co-chair, Dr. James F. Kurose, NSF Assistant Director for Computer and Information Science and Engineering.

I note that, in addition to responding to the PCAST's recommendations to modernize the PCAs, the NCO is also taking up PCAST's recommendations on the NITRD groups. (See the section on the 2015 PCAST Review on page 8.)

National Coordination Office: The NCO was first established in September 1992 and was initially called the National Coordination Office for High Performance Computing and Communications (NCO/HPCC). Its name has changed several times over the years; as of July 2005, it is referred to as the National Coordination Office for Networking and Information Technology Research and Development (NCO/NITRD).

The NCO provides overall support for the planning, coordination, budget, and assessment activities of the NITRD Program, including the work of the NITRD Subcommittee, and its working groups. The NCO serves as the focal point for the NITRD Program and the 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.

The NCO, in cooperation with OSTP, OMB, the NITRD agencies and working groups, prepares, publishes, and disseminates the annual NITRD Supplement to the President's Budget, Federal networking and IT R&D plans, and IT research needs reports.

The NCO provides technical subject matter expertise for each of the NITRD Working Groups, as well as managerial, logistical, IT, and administrative support of the interagency meetings, workshops, and conferences. Regular day-to-day NCO activities include responding to inquiries and requests for information about the Program and doing outreach through web-based social media. The NCO Director maintains close communications with OSTP, OMB, and the NITRD agencies, and represents the Program in presentations to organizations both nationally and internationally.

Benefits of the NITRD Program

For decades, the investments of the Federal Government in basic IT research have helped the Nation make good progress on difficult, grand challenge problems and address national priorities. Some basic IT research has led to significant innovations, to new start-ups and small businesses, the birth of entirely new industries, and sometimes to disruptive technological change. Notable successes of "translating research into practice" have helped spur economic growth and improve American competitiveness across the global economy. One often-cited example of basic IT research paying off extraordinary dividends to the economy and society is the evolution of DARPA's ARPANET to NSF's NSFNET and then to the commercial Internet. [2] There are many other examples that demonstrate the multiplier effect of federally funded research in creating economic opportunities.

The NITRD Program is completely involved in this exciting and rapidly changing research and innovation ecosystem due, in large part, to the Program's mechanisms that facilitate interagency coordination and collaboration on federally funded research activities. These mechanisms include:

- Regular meetings of the NITRD Working Groups
- Formal reports, including the annual NITRD Supplement to the President's Budget and strategic planning documents
- Workshops and events, with participants from government, academia, and industry
- Support for interagency collaborations, such as joint research solicitations and testbeds
- Contributions to the research and innovation ecosystem
- Outreach to Federal agencies, academia, industry, and the public

I will illustrate these with some examples and highlights.

Meetings: The regular meetings of the NITRD Working Groups enable information sharing and awareness. Information sharing is a fundamentally important practical benefit of participating in the Program. Being aware of the programs and activities of other agencies enables participants to work better together, build on their respective strengths, and avoid duplication of effort. Over the course of 2014, the NCO supported nearly 250 meetings, including regularly scheduled and ad-hoc gatherings. Additionally, many of the Working Groups hold Annual Planning Meetings (APMs) to share agency program information and plans for the upcoming year, and to coordinate strategic priorities for the PCAs.

We believe that agencies see the NCO as both an effective, neutral convener that fosters interagency dialogue and as a steady, experienced partner that can incubate cross-agency efforts to coordinate emerging IT R&D interests. For example, the agencies in the Video and Imaging

[2] For examples, the Committee may wish to refer to the National Research Council's "tire tracks" chart and study. In 2003, the National Research Council's Computer Science and Telecommunications Board (CSTB) updated the original 1995 tire tracks figure from the *Evolving the High Performance Computing and Communications* report in a new report, *Innovation in Information Technology*, which summarized eight prior CSTB studies on the subject. See also the examples of companies created from Federal agency-funded research in the 2013 report of the Science Coalition, *Sparking Economic Growth 2.0: Companies Created from Federally Funded University Research, Fueling American Innovation and Economic Growth*.

Analytics (VIA) Coordination Group came to the NCO and asked it to help transition their ad-hoc, grassroots effort, formed in the aftermath of the 2013 Boston Marathon attacks, to a sustainable entity that could support their coordination of R&D on video and imaging analytics of the visible world. The VIA CG joined the NITRD Program last year.

Reports and Strategic Plans: The NCO supports the NITRD Program in a number of strategic planning and coordination activities. The development and release of the 2011 Cybersecurity R&D Strategic Plan is one exemplar of that process.[3] A notable aspect of the 2011 strategy was that it broadened the research focus in an important way: instead of focusing solely on technology, it called for the development of effective incentives, affecting both individuals and organizations, to make cybersecurity ubiquitous. Such incentives can involve market-based, legal, regulatory, or institutional interventions. Developing such incentives requires advances in understanding the motivations and vulnerabilities of both markets and humans, and how these factors affect and interact with technical systems. This Plan has had a number of impacts in the R&D community, which I will highlight later, and continues to be relevant to the strategic planning process today. In fact, earlier this year the NITRD CSIA R&D SSG issued a Request for Information (RFI) to solicit feedback on the 2011 plan and inputs for updating the strategy. The SSG is currently developing an updated strategic plan that incorporates the RFI comments and responds to the Cybersecurity Enhancement Act of 2014 (Public Law 113-274).

Two additional important strategic planning efforts are underway. One is on privacy R&D and the other is on Big Data R&D. The privacy effort is being led by the CSIA R&D SSG to help address concerns about the evolving impacts of IT on privacy, as detailed in recent White House and PCAST reports.[4] The Big Data effort is a follow-on activity of the Big Data SSG's leadership in the national Big Data R&D Initiative (launched in March 2012) and has goals to advance R&D in Big Data technologies and applications and grow the field of data science.

Workshops: The NCO supports and conducts workshops as a proven tool for convening and engaging stakeholders in dialogue on critically important topics and issues. Workshops also provide the intellectual time and space for participants to work out approaches and solutions to problems. In addition to these benefits, the workshop materials and resulting reports serve as important artifacts for the participants and the broader community to reference long after the event is over. I'd like to highlight three NITRD areas in which workshops have helped us make significant progress (see the NITRD website at www.nitrd.gov for the workshop reports):

- *Software-Defined Networking (SDN) Workshops*. In computer networking architecture, SDN is an approach that separates the network control and data planes. While SDN is already being adopted by industry, emerging SDN technologies will enable the creation of a new form of distributed infrastructure that can support advanced applications for

[3] *Trustworthy Cyberspace: Strategic Plan for the Federal Cybersecurity Research and Development Program,* December 2011, National Science and Technology Council: http://www.whitehouse.gov/sites/default/files/microsites/ostp/fed_cybersecurity_rd_strategic_plan_2011.pdf.

[4] *Big Data: Seizing Opportunities, Preserving Values,* May 2014, The White House: https://www.whitehouse.gov/sites/default/files/docs/big_data_privacy_report_may_1_2014.pdf and *Report to the President Big Data and Privacy: A Technological Perspective*, May 2014, President's Council of Advisors on Science and Technology: https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_big_data_and_privacy_-_may_2014.pdf..

scientific, research, and commercial needs. SDN workshops held in December 2013 and July 2015, with leadership and support from the NCO and NITRD LSN CG, reviewed SDN research programs and advanced a roadmap for operating SDN-based networks.

- *Wireless Spectrum R&D (WSRD) Workshops*. There is an ever-increasing demand on available spectrum from the rapidly growing number of wireless devices, networks, and applications in our world today. Spectrum supports many types of critical government communications, and is the basis of the wireless revolution that is enabling new businesses and new ways to connect in our daily lives. Since 2010, agencies in the NITRD WSRD SSG have been funding R&D in spectrum-sharing technologies to enable more efficient use of radio spectrum. The SSG has held seven public-private workshops to identify and address significant issues in spectrum-sharing. The most recent workshop, "Federal - Commercial Spectrum Sharing: Models, Application, and Impacts of Incentives for Sharing," was held in March 2015.
- *Privacy R&D Workshop*. In February 2015, the National Privacy Research Strategy workshop was held by the NITRD National Privacy Research Forum (NPRF) as part of the process of developing a national privacy R&D strategy. A broad range of stakeholders participated, including privacy researchers, technology experts, communications experts, corporate representatives, legal scholars, sociologists, and philosophers. The participants in this workshop considered and debated different focus areas and objectives for a federal privacy R&D strategy.

Interagency collaborations: Interagency collaboration is difficult, but agencies working together can sometimes make a much broader impact with their R&D investments than can be accomplished by a single agency alone. An exemplar of such activity fostered through the NITRD Program is the joint solicitation for foundational research in cyber-physical systems (CPS).[5] Through interagency coordination enabled by NITRD, an NSF program solicitation on CPS was expanded to include DHS and DOT. For FY 2015 the solicitation expanded further to include NSF, DHS, DOT, NASA, and NIH. This joint solicitation allows the agencies and the community of researchers they fund to benefit from the synergy created by research on core CPS technologies and research applied to their mission domains.

The CPS SSG also collaborated with experts from the White House Presidential Innovation Fellows program on the SmartAmerica and Global City Teams Challenges.[6] These projects are spurring innovation in CPS and the Internet of Things (IoT) through public-private partnerships. Additionally, this past summer, the CPS SSG developed a multiagency framework for Smart Cities and Connected Communities to help coordinate Federal agency investments and outside collaborations. The framework focuses on foundational research and the entire R&D pipeline to transition new Smart City technologies into scalable and replicable approaches. This framework from the NITRD Program contributes to the goals of the Administration's Smart Cities Initiative (launched in September 2015) to promote research and innovation in this area.

Contributions to the research and innovation ecosystem: There are a number of ways that demonstrate the contributions of the NITRD Program to the larger research and innovation

[5] Cyber-Physical Systems Joint Program Solicitation, http://www.nsf.gov/pubs/2015/nsf15541/nsf15541.htm.
[6] Smart America Challenge: https://www.whitehouse.gov/blog/2014/06/10/smartamerica-challenge-harnessing-power-internet-things; Global City Teams Challenge: https://www.us-ignite.org/globalcityteams/partners/.

ecosystem. One way is to consider all the myriad R&D activities generated by implementing strategic plans. Another is by making open Federal data accessible. For example, the NCO has taken data collected by Federal entities and developed web-based portals to provide access to that data. I will give two examples that demonstrate the Program's impact in these ways:

- *Implementing an R&D Strategic Plan*. The 2011 Cybersecurity R&D Strategic Plan called for Federal investments that aligned with four research themes[7] and for follow-on coordination activities to bring promising research to practice. A year after the Plan's release, the NCO prepared a progress report on the implementation across Federal agencies.[8] Notable impacts were evident in, for example, the NSF Secure and Trustworthy Computing (SaTC) Program and the DHS S&T Moving Target Defense Program, including such research activities as:
    - Trustworthy Health and Wellness (THaW), a project led by Dartmouth College to tackle the challenges of providing trustworthy information systems for health and wellness given that sensitive information and health-related tasks are being increasingly pushed to mobile devices and cloud-based services.
    - Usable Privacy Policy Project, led by Carnegie Mellon University to develop scalable technologies for extracting key privacy policy features semi-automatically from website privacy policies, thereby helping users understand the privacy provided by websites before disclosing their information. This project includes transitioning their technology into open source browsers.
    - Funding of 12 new cybersecurity education research projects. Among these are a healthcare-based cybersecurity competition designed to bring young women into the field; a "build it, break it, fix it" competition to encourage not just breaking into, but also improving systems; a cybersecurity education center targeted toward veterans; and an effort focused on curriculum development for cyber-physical systems security and privacy education. Cybersecurity education research extends to research on the teaching and learning of cybersecurity. In addition to cybersecurity education research, funding is provided to institutions with strong existing academic programs in cybersecurity to award scholarships to students in cybersecurity in exchange for their taking a position in a government agency.
    - DHS S&T made four awards under an FY 2011 Broad Agency Announcement (BAA) in the topic area of Moving Target Defense, plus an additional three awards under other BAAs. In addition, a total of seven Small Business Innovation Research (SBIR) awards were made in the topic area. The work reported included innovative hardware cache designs to increase resiliency, novel bio-inspired approaches to intrusion and anomalous behavior detection, a multi-kernel OS architecture that increases system resilience, IP-hopping utilizing IPv6, and Multi-layer Ever-changing Self-defense Services (MESS) that are both resilient and manageable.

[7] The research themes are: Designed-In Security, Tailored Trustworthy Spaces, Moving Target, and Cyber-Economic Initiatives.

[8] *Report on Implementing the Federal Cybersecurity Research and Development Strategy*, June 2014, Networking and Information Technology Research and Development Subcommittee: https://www.nitrd.gov/PUBS/ImplFedCybersecurityRDStrategy-June2014.pdf.

- *Wireless spectrum-sharing testbed inventory*. With data gathered from the WSRD SSG agencies, the NCO created a unique online testbed information portal that shows the locations and capabilities of existing spectrum testing facilities, and indicates the status and availability of each facility to Federal, academic, and private sector researchers. By being aware of these testbeds, agencies can consider ways to share testbed resources. The economic and engineering benefits of sharing IT testbed environments can be substantial, including avoiding the expense of duplicate facilities.

Outreach: The NITRD Program uses a variety of mechanisms to reach out to researchers, private-sector developers, resource providers, and end users. Examples include two groups under the LSN CG: the Joint Engineering Team (JET) and Middleware and Grid Interagency Coordination (MAGIC) group, which have academic and industry members; the Faster Administration of Science and Technology Education and Research (FASTER) Community of Practice (CoP), which seeks exchanges of information with the private sector and new technologies to streamline the management of Federal research; and the multisector NITRD research workshops held in all the PCAs. Additionally, the NCO has an active social media presence to promote agency announcements and events and to share digital content of interest to the NITRD community and the general public.

2015 PCAST Review of NITRD and Recommendations to the NCO

As the Committee is aware, this past year the PCAST conducted a review of the NITRD Program. The PCAST released its report in August 2015[9] and its review, in my view, was quite positive overall. We invited Dr. Susan Graham, a PCAST member and co-chair of the PCAST NITRD Working Group, to the August meeting of the NITRD Subcommittee at which time she briefed the Subcommittee members about PCAST's findings and recommendations. Since the release of the report, the NCO has coordinated a number of activities with NITRD stakeholders to facilitate further discussion and respond to the recommendations.

Recommendations 1-9: I agree with the PCAST that the IT landscape changes rapidly, and we need to focus R&D and the needs for education and workforce on the areas PCAST identified. The NCO will be coordinating with stakeholders on how to respond to these recommendations. I should note that we were delighted to see that Congress explicitly included computer science in the recent STEM Education Act of 2015 (Public Law 114-59) and thank Chairman Smith and the full House Committee on Science, Space, and Technology for bringing this legislation forward.

Recommendation 10: I agree with the PCAST that the NITRD Program must evolve its PCAs in step with national priorities, and that the PCAs should be in the vanguard of foundational IT research and development activities that lead to future innovations. Over the years, many of the agency experts who participate in the NITRD Working Groups have anticipated shifts in the frontiers of IT and managed to adapt the focus of R&D activities under the existing PCAs without us redefining them. I agree with the PCAST, however, that it is time to take a different approach. The NCO currently has a process underway with OSTP, OMB, PCAST, NITRD Subcommittee members, and agency representatives in the NITRD Working Groups to address

[9] *Report to the President and Congress Ensuring Leadership in Federally Funded Research and Development in Information Technology*. August 2015, President's Council of Advisors on Science and Technology: https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/nitrd_report_aug_2015.pdf.

changes to the PCAs. We look forward to working with all NITRD stakeholders to improve the Program for the future.

Recommendation 11: I agree with the PCAST's recommendations on developing a transparent process for creating, chartering, monitoring, and tasking NITRD groups. The NCO is currently coordinating with OSTP, PCAST, NITRD Subcommittee members, and agency representatives in the NITRD Working Groups to address the PCAST's recommendations on the group structure and process.

Future Directions

As I stated previously, I agree wholeheartedly with the PCAST's observations on the changing nature of IT across the broad spectrum of computing, networking, and storage technologies. I believe that in its first nine recommendations, PCAST identified a set of key R&D areas that, with sustained and cross-agency support, will lead to significant progress in addressing national priorities. There are three areas, though, that I would like to call out as having particularly strong leverage with many of these national priorities. These are the areas where I especially would like to see the NITRD Program have an increased focus:

- Big Data and data-intensive computing: We recognized some time ago that scientific breakthroughs are increasingly powered by advanced computing capabilities that help researchers manipulate and explore massive datasets. Breakthroughs are now possible in education, urban services, critical infrastructure, healthcare, and disaster preparedness, prevention, response, and recovery. However, Big Data raises important issues with respect to storage and curation as well as to privacy. With the emergence of novel techniques and technologies for advancing both the foundations and applications of data science and engineering, a continued cross-agency focus will help accelerate our progress.
- High-capability computing for discovery, security, and commerce: In this point, I echo the call in the Executive Order for a National Strategic Computing Initiative. Previous investments in high-performance computing (HPC) have contributed substantially to national economic prosperity and rapidly accelerated scientific discovery, but the path for continued progress is quite steep. We very much need fundamentally new approaches in HPC. Delivering exascale computing presents several hard technical challenges, and further progress will require us to overcome the physical limitations imposed by current semiconductor technology. These technical challenges require a whole-of-government approach in which NITRD can play a key role.
- Cyber-human systems: The role of people in network and information technology is increasingly important, and vice versa. The use of robotics is moving from constrained environments like factory floors to open environments like people's homes; cyber-physical systems increasingly include people in the loop; and the devices that are communicating with each other in the "Internet of Things" are increasingly doing so as part of systems that fundamentally involve people (for example, traffic, environmental monitoring, and aging in place). Cross-agency collaboration is required to make progress in the computing-enabled human interaction and communication that enhances the modes, richness, and effectiveness of interchange among individuals and computing-enabled devices. Cross-agency collaboration is also required to make progress in

computing-enabled augmentation to enhance human capabilities and to provide improved learning, education, and training in all fields.

I thank you for your interest in the NITRD Program and the opportunity to provide testimony before the Subcommittee on Research and Technology of the House Committee on Science, Space, and Technology. I will be happy to answer any questions you may have.

Appendix A – NITRD Agencies

NITRD Member Agencies

Department of Commerce (DOC)
- National Institute of Standards and Technology (NIST)
- National Oceanic and Atmospheric Administration (NOAA)

Department of Defense (DoD)
- Defense Advanced Research Projects Agency (DARPA)
- National Security Agency (NSA)
- Office of the Secretary of Defense (OSD)
- Service Research Organizations (Air Force, Army, Navy)

Department of Energy (DOE)
- National Nuclear Security Administration (DOE/NNSA)
- Office of Electricity Delivery and Energy Reliability (DOE/OE)
- Office of Science (DOE/SC)

Department of Health and Human Services (HHS)
- Agency for Healthcare Research and Quality (AHRQ)
- National Institutes of Health (NIH)
- Office of the National Coordinator for Health Information Technology (ONC)

Department of Homeland Security (DHS)

Department of Justice (DOJ)
- National Institute of Justice (NIJ)

Environmental Protection Agency (EPA)

National Aeronautics and Space Administration (NASA)

National Archives and Records Administration (NARA)

National Reconnaissance Office (NRO)

National Science Foundation (NSF)

NITRD Participating Agencies

Department of Commerce (DOC)
- National Telecommunications and Information Administration (NTIA)

Department of Defense (DoD)
- Military Health System (MHS)
- Telemedicine and Advanced Technology Research Center (TATRC)

Department of Education (ED)

Department of Health and Human Services (HHS)
- Centers for Disease Control and Prevention (CDC)
- Food and Drug Administration (FDA)
- Indian Health Service (IHS)

Department of Interior (Interior)
- U.S. Geological Survey (USGS)

Department of Justice (DOJ)
- Federal Bureau of Investigation (FBI)

Department of Labor (DOL)
- Bureau of Labor Statistics (BLS)

Department of State (State)

Department of Transportation (DOT)
- Federal Aviation Administration (FAA)
- Federal Highway Administration (FHWA)

Department of the Treasury (Treasury)
- Office of Financial Research (OFR)

Department of Veterans Affairs (VA)

Federal Communications Commission (FCC)

Federal Deposit Insurance Corporation (FDIC)

General Services Administration (GSA)

Nuclear Regulatory Commission (NRC)

Office of the Director of National Intelligence (ODNI)
- Intelligence Advanced Research Projects Activity (IARPA)

U.S. Agency for International Development (USAID)

U.S. Department of Agriculture (USDA)
- National Institute of Food and Agriculture (NIFA)

Appendix B – NITRD Working Groups

Interagency Working Groups (IWGs)

Cyber Security and Information Assurance (CSIA)

High End Computing (HEC)

Coordinating Groups (CGs)

High Confidence Software and Systems (HCSS)

Human Computer Interaction and Information Management (HCI&IM)

Large Scale Networking (LSN)
- LSN Teams:
  - Joint Engineering Team (JET)
  - Middleware and Grid Interagency Coordination (MAGIC) Team

Social, Economic, and Workforce Implications of IT and IT Workforce Development (SEW)
- SEW Teams:
  - SEW-Collaboration Team
  - SEW-Education Team
  - Social Computing Team

Software Design and Productivity (SDP)

Video and Image Analytics (VIA)

Senior Steering Groups (SSGs)

Big Data (BD)

Cyber Physical Systems (CPS)

Cybersecurity and Information Assurance R&D (CSIA R&D)

Wireless Spectrum R&D (WSRD)

Communities of Practice (CoPs)

Faster Administration of Science and Technology Education and Research (FASTER)

Health Information Technology R&D (HITRD)