

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION**

HEARING CHARTER

*Oversight of the Networking and Information Technology Research and Development Program
and Priorities for the Future*

**Wednesday, September 21, 2011
2:00 p.m. - 4:00 p.m.
2318 Rayburn House Office Building**

1. Purpose

On Wednesday, September 21, 2011, at 2:00 p.m. the Subcommittee on Research and Science Education will hold a hearing to review the networking and information technology research and development (NITRD) program to ensure U.S. leadership in networking and information technology and to discuss priorities for the future.

2. Witnesses

Dr. George Strawn, Director, National Coordination Office, Networking and Information Technology Research and Development (NITRD) Program

Dr. Edward Lazowksa, Bill & Melinda Gates Chair in Computer Science & Engineering, University of Washington

Dr. Robert Sproull, Director of Oracle Labs, retired

Dr. Robert Schnabel, Dean, School of Informatics, Indiana University

3. Overview

- Advances in networking and information technology (NIT) continue to transform the world in which we live. We increasingly rely on the systems, tools, and services of this ever-growing and ever-changing domain. It is not only as a matter of convenience in our daily lives, but critical to our future economic prosperity, health, and security.
- The Networking and Information Technology Research and Development (NITRD) Program is the federal government's mechanism for coordinating the Nation's unclassified NIT research and development (R&D) investments. NITRD's formal membership consists of 14 federal agencies while many additional agencies participate in program activities.
- NITRD was originally authorized in the High-Performance Computing Act of 1991 to help coordinate ongoing high-performance computing programs throughout the federal

government. The Act was amended in 1998 and 2007. In the 111th Congress, the U.S. House of Representatives passed the Networking and Information and Technology Research and Development Reauthorization Act twice. The Senate did not take up H.R. 2020 and removed the language in the 2010 America COMPETES Reauthorization Act.

- As required by law, in December 2010, the President's Council of Advisors on Science and Technology (PCAST) released its report, *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology*. The report finds that "NITRD is well coordinated and that the U.S. computing research community, coupled with a vibrant NIT industry, has made seminal discoveries and advanced new technologies that are helping to meet many societal challenges," but also notes the need for more accurate accounting and additional investments in basic research.¹
- The Fiscal Year 2012 (FY12) budget request for agency programs captured under NITRD is \$3.9 billion, roughly \$200 million more than the FY10 actual amount.

4. Background

Federal support for research and development in networking and information technology (NIT) originally stemmed from an interest in and the challenge of developing computers capable of addressing complex problems, primarily those focused on national security and global competition. Now, several decades after the dawn of the digital revolution, NIT encompasses a broad array of technologies from smart phones to digital libraries and cloud computing. Having changed the way we listen to music, drive our cars, and communicate with each other, this ever-growing field has led to the creation of many of the technologies and systems we rely on daily.

Additionally, research and development (R&D) in NIT provides a greater understanding of how to protect essential systems and networks, systems and networks that support fundamental sectors of our economy, from emergency communications and power grids to air-traffic control networks and national defense systems. NIT R&D works to prevent or minimize disruptions to critical information infrastructure, to protect public and private services, to detect and respond to threats while mitigating the severity of and assisting in the recovery from those threats, in an effort to support a more stable and secure Nation.

Networking and Information Technology Research and Development Program (NITRD)

The Networking and Information Technology Research and Development (NITRD) program is the main federal R&D investment portfolio in networking, computing, software, cyber security, and related information technologies. NITRD coordinates this unclassified R&D across 14 federal agencies (see Table 1).

¹ President's Council of Advisors on Science and Technology, Report to the President and Congress December 2010, *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology*, p. v

Table 1²

NITRD Member Agencies

The following Federal agencies, which conduct or support R&D in advanced networking and information technologies, report their IT research budgets in the NITRD crosscut and provide support for program coordination: •

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

Additional agencies that do not contribute funding also participate in NITRD planning activities (see Table 2).

Table 2³

NITRD Participating Agencies

Representatives of the following agencies with mission interests involving networking and information technology research and development and applications are active participants in NITRD activities:

- Defense Information Systems Agency (DISA)
- Department of Energy/Office of Electricity Delivery and Energy Reliability (DOE/OE)
- Department of Health and Human Services/Office of the National Coordinator for Health Information Technology (HHS/ONC)
- Department of State (State)
- Department of the Treasury (Treasury)
- Department of Transportation (DOT)
- Federal Aviation Administration (FAA)
- Federal Bureau of Investigation (FBI)
- Federal Highway Administration (FHWA)
- Food and Drug Administration (FDA)
- General Services Administration (GSA)
- Intelligence Advanced Research Projects Agency (IARPA)
- National Telecommunications and Information Administration (NTIA)
- National Transportation Safety Board (NTSB)

² The Networking and Information Technology Research and Development Program Supplement to the President's FY 2012 Budget, p. vi

³ The Networking and Information Technology Research and Development Program Supplement to the President's FY 2012 Budget, p. vi

Nuclear Regulatory Commission (NRC) U.S. Department of Agriculture (USDA) U.S. Geological Survey (USGS) Veterans Administration (VA)

The NITRD program has played a role in several important technological advances including the computational decoding of the human genome; modeling and simulation of complex physical systems (aircraft, automobiles, power grids, and pharmaceuticals); unmanned aerial vehicles, search-and-rescue robots; and computer-based education and training.

The Subcommittee on NITRD of the National Science and Technology Council (NSTC) is the internal deliberative organization for NITRD policy, program, and budget guidance. The NITRD Subcommittee includes representatives from each participating agency, as well as the Office of Management and Budget (OMB). The Subcommittee coordinates the planning, budgeting, implementation, and reviews of NIT R&D across the NITRD member agencies to help assure continued U.S. leadership, satisfy the needs of the federal government for advanced IT capabilities, and accelerate development and deployment of new technologies.⁴

NITRD research activities are organized in eight Program Component Areas (PCAs). The PCAs also align the NITRD program budget categories. The eight PCAs include: Cyber Security Information Assurance (CSIA); Human Computer Interaction and Information Management (HCI & IM); High Confidence Software and Systems (HCSS); High End Computing Infrastructure and Applications (HEC I&A); High End Computing Research and Development (HEC R&D); Large Scale Networking (LSN); Software Design and Productivity (SDP); and Social, Economic, and Workforce Implications of IT and IT Workforce Development (SEW).⁵ However, NITRD research areas and activities shift regularly as the NIT field creates and develops new R&D challenges.

The NITRD National Coordination Office (NCO) provides staff support for the NITRD program. The NCO provides program and financial management services, technical and subject matter expertise in facilitation, strategic planning, technical writing, networking and information technology services, and administrative staff support for the NITRD Subcommittee and other NITRD subgroups. The National Science Foundation (NSF) serves as the host agency for the NCO.⁶

Legislative History

Congress originally authorized NITRD in the High-Performance Computing Act of 1991 (P.L. 102-194), after recognizing that a number of federal agencies had ongoing high-performance computing programs without a coordinating body. The Act established that coordinating body to improve interagency coordination, cooperation, and planning among

⁴ About the Subcommittee on Networking and Information Technology Research and Development (NITRD Subcommittee), <http://www.nitrd.gov/subcommittee/program.aspx>

⁵ NITRD Program PCA Definitions, <http://www.nitrd.gov/subcommittee/pca-definitions.aspx>

⁶ About the Subcommittee on Networking and Information Technology Research and Development (NITRD Subcommittee), <http://www.nitrd.gov/subcommittee/program.aspx>

those agencies with high-performance computing programs. In addition, it authorized a multi-agency research effort, called the High-Performance Computing and Communications program, to accelerate progress in the advancement of computing and networking technologies and to support leading edge computational research in a range of science and engineering fields. The statute established a set of mechanisms and procedures to provide for the interagency planning, coordination, and budgeting of the research and development activities carried out under the program. The Act has since been amended through the Next Generation Internet Research Act of 1998 and the America COMPETES Act of 2007.

In 2007, the America COMPETES Act amended the existing statute in several ways:

- Specified that the external advisory committee for the program must carry out biennial reviews of the funding, content and management of the interagency R&D program and report its findings to Congress;
- Required the Office of Science and Technology Policy (OSTP) to develop and maintain a roadmap for developing and deploying high-performance computing (high-end) systems; and
- Clarified that grand challenge problems supported under the interagency program are intended to involve multidisciplinary teams of researchers working on science and engineering problems.

NITRD Reauthorization in the 111th Congress

In the 111th Congress, the U.S. House of Representatives passed H.R. 2020, the National Information and Technology Research and Development Reauthorization Act. (See Appendix A for details.) The bill sought to prioritize and strengthen federal information technology activities across the federal government by:

- Improving program planning and coordination through strategic planning and an Advisory Council with appropriate policy and technical expertise;
- Rebalancing portfolios to focus less on short-term goals and more on large-scale, long-term, interdisciplinary research with the potential to make significant contributions to society and US competitiveness;
- Requiring the program to support R&D in cyber-physical systems and human-computer interactions, visualization, and information management, including the convening of a university/industry task force to explore collaborative R&D activities with participants from universities, federal labs, industry and other partners; and
- Formally codifying the role of the NCO and specifying the source of funding for the office.

The Senate did not act on this legislation. H.R. 2020 was also made a part of the House-passed America COMPETES Reauthorization Act of 2010, but the language was removed by the Senate before enactment.

2010 PCAST Report on NITRD

In December 2010, the President's Council of Advisors on Science and Technology (PCAST) completed a legislatively required report on NITRD. The report, *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology*, found that "NITRD is well coordinated and that the U.S. computing research community, coupled with a vibrant Networking and Information Technology (NIT) industry, has made seminal discoveries and advanced new technologies that are helping meet many societal challenges."⁷

The 2010 report made several assessments about the role of the NIT field in answering the Nation's challenges and priorities:

- Advances in NIT are a key driver of economic competitiveness. They create new markets and increase productivity.
- Advances in NIT are crucial to achieving our major national and global priorities in energy and transportation, education and life-long learning, healthcare, and national and homeland security.
- Advances in NIT accelerate the pace of discovery in nearly all other fields.
- Advances in NIT are essential to achieving the goals of open government.⁸

Stressing the need that federal investments be in NIT basic research, since the private sector is heavily involved in the development side, the report suggests that an investment of at least \$1 billion annually will be required for new, potentially transformative research. The report also recognizes that in the current economic uncertainty, repurposing and reprioritization of funding will be necessary, but does not rule out new funding and indicates a lower level of investment "could seriously jeopardize America's national security and economic competitiveness."⁹

The PCAST report includes recommendations for increased investments in long-term, multi-agency research initiatives in health, energy and transportation, and cybersecurity. It emphasizes, "Where fundamental NIT advances are needed to support these initiatives, mission agencies should invest in fundamental research in NIT, either alone or in collaboration with NSF, and should not limit their programs to application-specific research."¹⁰

The report also calls for exercising leadership to bring about changes in K-12 STEM education; enhancing the effectiveness of government coordination of NIT research and

⁷ President's Council of Advisors on Science and Technology, Report to the President and Congress December 2010, *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology*, p. v

⁸ President's Council of Advisors on Science and Technology, Report to the President and Congress December 2010, *Designing a Digital Future: Federally Funded Research and Development in Networking and Information Technology*, p. vii

⁹ Ibid, p. x.

¹⁰ Ibid, p. xiii.

development; and redefining NITRD budget categories to separate NIT infrastructure for R&D in other fields from NIT R&D.

With specific regard to education, the report finds that “NIT is the dominant factor in America’s science and technology employment, and that the gap between the demand for NIT talent and the supply of that talent is and will remain large.”¹¹ The report recommends increasing the number of graduates in NIT fields at all degree levels and calls for the inclusion of computer science in K-12 education.

NITRD Fiscal Year 2012 Budget Request

In February 2011, NITRD released its Supplement to the President’s Budget request. The Supplement is a summary of the NITRD research activities planned and coordinated for Fiscal Year 2012 (FY12) for each of the participating agencies. The NITRD request totals \$3.9 billion for FY 2012, a 1.9 percent increase from FY10 expenditures, and reflects many spending priorities recommended in the PCAST report.

The NITRD Supplement breaks down budget requests for each of the 14 federal agencies involved in NITRD according to the PCAs.¹² (See Appendix B for details.)

For agencies within the jurisdiction of the Committee on Science, Space and Technology, the budget request totals are reflected in Table 3:

Agency	FY10 Actual	FY12 Request
NSF	1105.6	1257.7
DOE*	418.4	529.9
NIST	81.0	133.9
NASA	85.3	94.7
NOAA	26.3	26.3
DOE/NNSA	29.6	25.9
EPA	6.3	5.9

*Includes Office of Science and Office of Electricity Delivery and Energy Efficiency

Major changes in investments for agencies within the Committee’s jurisdiction include a \$152 million (14 percent) increase for the National Science Foundation (NSF). This amount includes \$35 million for High End Computing R&D for nanotechnology research and the Science, Engineering, and Education for Sustainability (SEES) effort and investment in Cyberinfrastructure Framework for the 21st Century Science and Engineering (CIF21); \$22

¹¹ Ibid, p. 85.

¹² The Networking and Information Technology Research and Development Program Supplement to the President’s FY 2012 Budget, p. 30

¹³ The Networking and Information Technology Research and Development Program Supplement to the President’s FY 2012 Budget, p. 28

million for cybersecurity activities; \$60 million primarily to support a National Robotics Initiative; \$12 million for basic research in radio spectrum systems; and \$24 million in SDP for new software centers, CIF21, and increased SEES investment.

The Department of Energy request includes a \$112 million (27 percent) increase: \$66 million for research and new partnerships to address the challenges of emerging disruptive computing technologies from the private sector; \$30 million for cybersecurity research; and \$16 million for installation and operation of an Energy Sciences Network (ESnet) dedicated optical network.

The National Institute of Standards and Technology includes an increase of \$53 million (65 percent), \$25 million of which is to be used to support new cybersecurity initiatives. The remainder is spread across other PCAs for interoperability in emerging technologies activities.

Appendix A

H.R. 2020

The Networking and Information Technology Research and Development Act of 2009

SECTION-BY-SECTION ANALYSIS

SECTION 1. SHORT TITLE.

“Networking and Information Technology Research and Development Act of 2009.”

SEC. 2. PROGRAM PLANNING AND COORDINATION.

Requires the NITRD agencies to periodically assess the program contents and funding levels and to update the program accordingly.

Requires the NITRD agencies to develop and periodically update (at 3-year intervals) a strategic plan for the program. The characteristics and content of the strategic plan are described, and include strengthening NIT education, fostering technology transfer, and encouraging innovative, large-scale, and interdisciplinary research.

Encourages a more active role for OSTP in ensuring that the strategic plan is developed and executed effectively and that the objectives of the program are met.

Ensures that the existing advisory committee for NITRD is closely linked to the President’s Council of Advisors on Science and Technology while retaining the necessary breadth and depth of expertise in NIT fields.

Specifies that the annual report now required for the NITRD program explicitly describes how the program activities planned and underway relate to the objectives specified in the strategic plan.

Specifies that the annual report now required for the NITRD program include a description of research areas supported in accordance with section 3, including the same budget information as is required for the Program Component Areas.

SEC. 3. LARGE-SCALE RESEARCH IN AREAS OF NATIONAL IMPORTANCE.

Authorizes NITRD agencies to support large-scale, long-term, interdisciplinary research with

the potential to make significant contributions to society and U.S. economic competitiveness and to encourage collaboration between at least two agencies as well as cost-sharing from non-federal sources.

Characteristics of the projects supported include: collaborations among researchers in institutions of higher education and industry, and may involve nonprofit research institutions and federal laboratories; leveraging of federal investments through collaboration with related State initiatives, when possible; and plans for fostering technology transfer.

Authorizes support of activities under this section through interdisciplinary research centers that are organized to investigate basic research questions and carry out technology demonstration activities.

SEC. 4. CYBER-PHYSICAL SYSTEMS AND INFORMATION MANAGEMENT.

Requires the program to support research and development in cyber-physical systems; human-computer interactions, visualization, and information management.

Requires the NCO Director to convene a university/industry task force to explore mechanisms for carrying out collaborative research and development activities for cyber-physical systems with participants from universities, federal laboratories, and industry. The NCO is to report to Congress on any findings and recommendations from the task force on models for collaborative R&D.

SEC. 5. NATIONAL COORDINATION OFFICE.

Formally establishes the NCO; delineates the office's responsibilities; mandates annual operating budgets; specifies the source of funding for the office (consistent with current practice); and stresses the role of the NCO in developing the strategic plan and in public outreach and communication with outside communities of interest.

Appendix B*

Agency NITRD Budgets by Program Component Area
FY 2010 Budget Actuals, FY 2011 CR Levels, and FY 2012 Budget Requests
(Dollars in Millions) [Footnotes on next page]

Agency		High End Computing Infrastructure & Applications (HEC I&A)	High End Computing Research & Development (HEC R&D)	Cyber Security & Information Assurance (CSIA)	Human-Computer Interaction & Information Management (HCI &IM)	Large Scale Networking (LSN)	High Confidence Software & Systems (HCSS)	Software Design & Productivity (SDP)	Social, Economic, & Workforce Implications of IT (SEW)	Total ¹
NSF	2010 Actual	325.2	89.1	72.7	269.8	121.0	74.3	54.4	99.2	1,105.6
	2011 CR Level ²	310.9	98.5	71.4	280.7	107.2	73.1	57.6	91.2	1,090.5
	2012 Request	308.1	123.8	94.7	330.0	132.6	91.8	78.8	98.0	1,257.7
NIH ³		309.0	18.0	0.1	213.0	17.0	8.0	46.0	35.0	646.1
		309.0	18.0	0.1	213.0	17.0	8.0	46.0	35.0	646.1
		316.0	18.0	0.1	213.0	17.0	8.0	46.0	35.0	653.1
OSD and DoD Service research orgs. ⁴		257.6	19.4	89.5	99.5	105.8	34.3	19.6		625.8
		251.2	21.3	85.6	93.8	110.3	24.3	19.4		605.8
		189.9	9.4	72.3	103.4	95.4	23.8	17.7		511.8
DOE ⁵		276.7	87.8	3.5		44.4			6.0	418.4
		282.5	81.6	33.5		53.6			6.0	457.2
		332.6	98.2	33.5		59.6			6.0	529.9
DARPA			116.0	144.7	173.9	96.3				531.0
			121.2	119.1	150.8	75.1	5.0			471.3
			56.9	222.4	136.7	54.2	10.0			480.2
NIST		17.0	3.6	29.6	14.1	6.2	4.7	5.5	0.3	81.0
		17.0	3.6	29.6	14.1	6.2	4.7	5.5	0.3	81.0
		17.0	4.4	54.7	18.8	14.2	10.4	10.1	4.3	133.9
NASA		59.4	0.8		16.0	0.8	5.8	2.5		85.3
		61.4	0.5		12.5	0.8	4.8	2.4		82.3
		62.2	0.5		10.0	0.8	13.2	8.0		94.7
NSA			118.4	29.0		2.8	5.6			155.8
			31.0	30.0		3.5	7.6			72.1
			19.5	29.2		4.2	6.8			59.7
DHS				38.0	3.9	8.0				49.9
				37.0	4.2	9.0				50.2
				41.0	5.4	10.0		0.7		57.1
AHRQ					27.1	0.5				27.6
					27.1	0.5				27.6
					27.1	0.5				27.6
NOAA		23.4	0.2		0.5	1.5		0.7		26.3
		20.9	0.2		0.5	4.0		0.7		26.3
		20.9	0.2		0.5	4.0		0.7		26.3
DOE/NNSA		8.9	16.1			0.9			3.7	29.6
		10.3	14.7			1.2			4.1	30.3
		9.5	11.5			0.9			4.0	25.9
EPA		3.3			3.0					6.3
		3.3			3.0					6.3
		2.9			3.0					5.9
NARA					4.5					4.5
					4.5					4.5
					2.5					2.5
TOTAL (2010 Actual) ¹		1,280.5	469.4	407.1	825.4	405.2	132.7	128.7	144.2	3,793
TOTAL (2011 CR Level) ¹		1,266.4	390.6	406.3	804.2	388.3	127.5	131.6	136.6	3,652
TOTAL (2012 Request) ¹		1,259.1	342.3	547.9	850.4	393.4	163.9	161.9	147.3	3,866

*The Networking and Information Technology Research and Development Program Supplement to the President's FY 2012 Budget, p. 28