The NITRD Program Today

One of the few formal multiagency enterprises in the Federal government, the Networking and Information Technology Research and Development (NITRD) Program was chartered by Congress under the High-Performance Computing Act of 1991 (P.L. 102-194) and the Next Generation Internet Act of 1998 (P.L. 105-305) to improve coordination and cooperation among agencies engaged in IT R&D.

Over the past 13 years, the scope of the agencies' collaborative activities has evolved and expanded to encompass emerging technological fields – such as wireless and optical networking, cybersecurity, high-assurance software and systems, and embedded systems – that did not yet exist when the program began. The successful NITRD collaboration has come to be viewed as a model Federal research effort that leverages agency strengths, avoids duplication, and fosters interoperable systems that maximize the benefits of Federal IT R&D investments to both agency missions and private-sector innovation.

Today, the NITRD Program remains the Nation's primary source of not only fundamental technological breakthroughs but also highly skilled human resources in the advanced computing, networking, software, and information management technologies that underpin our 21st century infrastructure and quality of life. NITRD's broad impact derives in part from its highly diversified and multidisciplinary research strategy, which funds fundamental scientific investigations across Federal laboratories and centers, research universities, nonprofit organizations, and partnerships with industry.

Goals of the NITRD Program

The NITRD Program provides agencies that perform IT R&D with a framework to plan, budget, coordinate, implement, and assess their research agendas. The program is an R&D priority of the Administration that is a distinct feature in the President's annual budget. NITRD's signal role in supporting the national interest is reflected in the program's goals, which are to:

- Assure continued U.S. leadership in computing, networking, and information technologies to meet Federal goals and to support U.S. 21st century academic, industrial, and government interests
- Accelerate deployment of advanced and experimental information technologies to maintain world leadership in science, engineering, and mathematics; improve the quality of life; promote long-term economic growth; increase lifelong learning; protect the environment; harness IT; and enhance national security
- Advance U.S. productivity and industrial competitiveness through long-term scientific and engineering research in computing, networking, and related information technologies

Management and Structure

The NITRD Program functions under the aegis of the National Science and Technology Council (NSTC). Overall program coordination at the operational level is provided by the Interagency Working Group on IT R&D (IWG/IT R&D), made up of senior managers from each of the NITRD agencies and representatives of the Office of Science and Technology Policy (OSTP) and the Office of Management and Budget (OMB). (See roster on page 81.) The IWG, which is co-chaired by an agency representative (currently, NSF's Assistant Director for the Computer and Information Science and Engineering Directorate) and the Director of the National Coordination Office (NCO) for IT R&D, meets quarterly to coordinate NITRD policies, programs, and budget planning.

Program Component Areas (PCAs)

At the core of the NITRD enterprise are seven research domains called Program Component Areas (PCAs). The PCAs, which have evolved over time as the ambit of information technology has expanded, encompass

the principal areas of mission-related IT research engaged in by the NITRD agencies. The PCAs are:

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

In each PCA, program managers from NITRD agencies with R&D in that area and from other agencies interested in the topic participate in a Coordinating Group (CG). The CGs meet monthly to share information, develop collaborative activities, and coordinate their PCA's overall research agenda. The CGs report to the IWG, serving as the link between the coordinating body and research activities at the agency program level. CG chairs are listed on page 81.

NATIONAL COORDINATION OFFICE FOR IT R&D

The NCO provides technical and administrative support for the interagency NITRD Program, including extensive activities on behalf of the IWG and planning, budget, and assessment tasks for the program as a whole. The NCO also supports the President's Information Technology Advisory Committee (PITAC), an external, non-government panel appointed by the President to provide independent reviews and guidance on IT R&D-related topics (story on page 7). The NCO supported the work of the High End Computing Revitalization Task Force and is helping coordinate implementation of the HECRTF plan (details on pages 14-16). The NSF serves as the NCO's host agency. Information about NITRD and PITAC, and copies of NITRD documents, are posted on the NCO web site: *www.nitrd.gov*.

IWG: COORDINATION AND ACTIVITIES

IWG HIGHLIGHTS

In FY 2004, the IWG is leading several major coordination initiatives in addition to its regular program oversight activities. As part of its ongoing responsibility to review the NITRD structure periodically and evaluate the need for program updating, the working group:

- Charged the NITRD agencies to report on their FY 2004 program activities, highlighting interagency collaborations and plans, and to present their views on research gaps and/or issues in the NITRD structure at Special Meetings of all the CGs
- Charged each CG to review the results of its Special Meeting and, using those results, to develop a definition of the PCA that reflects participating agencies' current research investments and interests
- Established a PCA/CG Task Group to coordinate review of the new PCA definitions, evaluate the need for changes in the PCA/CG structure based on agency comments, and make recommendations to the IWG
- In coordination with OMB, authorized preparation of an Interagency Coordination Report (ICR) that would provide technical details of NITRD Program collaborative activities on an annual basis

Also in FY 2004, the IWG Issued "Grand Challenges: Science, Engineering, and Societal Advances Requiring Networking and Information Technology Research and Development," a report by a multiagency NITRD task force that spent a year on the effort (story on page 6).

RESEARCH LINKAGES

The PCA/CG Task Group, based on its review of agency perspectives, identified two areas – cybersecurity issues and interoperability standards – that cross PCA boundaries in the current coordination structure. The task group recommended, and the IWG approved, setting up "temporary linkage groups" enabling agencies across PCAs with an interest in these or future crosscutting subjects to meet and plan activities on an ad hoc basis.

PCA DEFINITIONS AND FY 2004 PROGRAMS

This Supplement to the President's Budget provides the new one-page PCA definitions developed by the CGs as well as FY 2004 program activities reported by each agency at the Special Meetings. The document also summarizes coordinated activities in each PCA reported by the CG and participating agencies. The IWG's full Interagency Coordination Report is available on the NCO web site, at *www.nitrd.gov/pubs/icr/*.

Grand Challenges: IT Goals in the National Interest

In FY 2003, the IWG established a Grand Challenges Task Force and charged it with identifying a set of science, engineering, and societal challenges that require innovations in IT R&D. The charge to formulate a new set of grand challenges was a direct response to update the list of grand challenges in IT called for in the HPC Act of 1991 and documented in the FY 1994 Blue Book. The Task Force comprised volunteers from ten NITRD agencies, FAA, the NCO, and OSTP. The group completed its work in FY 2004.

The Task Force began by revising the HPC Act's definition of "grand challenge," taking into account the impact of current technological advances. The new definition of a NITRD grand challenge is as follows:

> *A long-term science, engineering, or societal advance, whose realization requires innovative breakthroughs in information technology research and development and which will help address our country's priorities.*

Key criteria for defining the grand challenges included:

- Description of the multi-decade nature of the challenge
- Focus of the grand challenge in the next ten years
- Benefits of the grand challenge to the social, economic, political, scientific, and technological well-being of mankind
- Relationship of the grand challenge to vital national priorities. In consultation with OSTP, the Task Force identified six national priority areas that reflect the country's broad-based scientific, military, social, economic, and political values and goals. The national priorities identified are: Leadership in Science and Technology; Homeland and National Security; Health and Environment; Economic Prosperity; A Well-Educated Populace; and A Vibrant Civil Society.

The Task Force formulated 16 new illustrative grand challenges (below) mapped to these criteria and designed to stimulate multidisciplinary thinking. The goal was to create a set of visionary research attainments that would test the intellectual aspirations of the Nation's researchers, asking them to reach for possibilities beyond their understanding today or in the next decade.

The Task Force then considered what fundamental IT research will be required to enable realization of each of the 16 grand challenge goals. Out of this discussion came a list of 14 "IT hard problem areas" – broad topical categories of research in which solutions or advances are required to achieve progress toward the grand challenge goals. Each IT hard problem area was mapped to the relevant challenges. The resulting Task Force document is the first NITRD report of its kind. It is available on the NCO web site, at: *www.nitrd.gov/GCs/*.

16 Illustrative NITRD Grand Challenges

- **Knowledge Environments for Science and Engineering**
- **Clean Energy Production Through Improved Combustion**
- **High Confidence Infrastructure Control Systems**
- **Improved Patient Safety and Health Quality**
- **Informed Strategic Planning for Long-Term Regional Climate Change**
- **Nanoscale Science and Technology: Explore and Exploit the Behavior of Ensembles of Atoms and Molecules**
- **Predicting Pathways and Health Effects of Pollutants**
- **Real-Time Detection, Assessment, and Response to Natural or Man-Made Threats**
- **Safer, More Secure, More Efficient, Higher-Capacity, Multi-Modal Transportation System**
- **Anticipate Consequences of Universal Participation in a Digital Society**
- **Collaborative Intelligence: Integrating Humans with Intelligent Technologies**
- **Generating Insights From Information at Your Fingertips**
- **Managing Knowledge-Intensive Organizations in Dynamic Environments**
- **Rapidly Acquiring Proficiency in Natural Languages**
- **SimUniverse: Learning by Exploring**
- **Virtual Lifetime Tutor for All**

IT 'Hard Problem' Areas

- **Algorithms and Applications**
- **Complex Heterogeneous Systems**
- **Hardware Technologies**
- **High Confidence IT**
- **High-End Computing**
- **Human Augmentation IT**
- **Information Management**
- **Intelligent Systems**
- **IT System Design**
- **IT Usability**
- **IT Workforce**
- **Management of IT**
- **Networks**
- **Software Technologies**

President's Information Technology Advisory Committee

PITAC Highlights

The President's Information Technology Advisory Committee (PITAC) is appointed by the President to provide independent expert advice on maintaining America's preeminence in advanced information technology. PITAC members are IT leaders in industry and academe with expertise relevant to critical elements of the national information infrastructure such as high-performance computing, large-scale networking, and high-assurance software and systems design. The Committee's studies help guide the Administration's efforts to accelerate the development and adoption of information technologies vital for American prosperity.

Chartered by Congress under the High-Performance Computing Act of 1991 and the Next Generation Internet Act of 1998, the PITAC is a Federal Advisory Committee formally renewed through Presidential Executive Orders. The current Committee held its first meeting November 12, 2003.

In June 2004, the PITAC delivered its first report – "Revolutionizing Health Care Through Information Technology" – to the President, following eight months of study by its Subcommittee on Health and IT. The report concludes that although the potential of IT to improve the delivery of care while reducing costs is enormous, concerted national leadership is essential to achieving this objective. The PITAC study focuses on specific barriers to the nationwide implementation of health IT that can only be addressed by the Federal government.

The report offers 12 specific recommendations for Federal research and actions to enable development of 21st century electronic medical records systems. At the core of such systems is the concept of a secure, patient-centered electronic health record (EHR) that: 1) safeguards personal privacy; 2) uses standardized medical terminology that can be correctly read by any care provider and incorporated into computerized tools to support medical decision making; 3) eliminates today's dangers of illegible handwriting and missing patient information; and 4) can be transferred as a patient's care requires over a secure communications infrastructure for electronic information exchange.

Two other PITAC subcommittees – on Cyber Security and Computational Science – have been charged by OSTP to review and evaluate Federal R&D investments in these areas to assess whether they are appropriately balanced between long-term and short-term efforts and effectively focused to achieve maximum benefits. Reports on these topics are to be presented to the Administration in FY 2005.

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