Final Minutes of the
President's Information Technology Advisory Committee
May 10, 2001

The thirteenth meeting of the President's Information Technology Advisory Committee (PITAC) was called to order by Co-Chairs Raj Reddy and Irving Wladawsky-Berger at 3:03 p.m., May 10, 2001, in Room II-555 of the National Science Foundation (NSF) building, 4201 Wilson Boulevard, Arlington, Virginia. 19 Committee members, 39 Federal employees and 21 private citizens were in attendance at the two-day PITAC meeting.

Software Challenges

Update on Federal investments in software research and development

S. Graham reported on software challenges and reviewed the software recommendations made in the 1999 PITAC report. The major recommendation was to "Make fundamental software research an absolute priority." This was accomplished through actions supporting the four secondary software recommendations:

- "Make software research a substantive component of every major IT research initiative." Graham cited several examples, including the renaming of the High Confidence Systems (HCS) Program Component Area (PCA) to High Confidence Software and Systems (HCSS) and expanding its coverage to include assurance and safety as well as security; the creation of a new Software Design and Productivity (SDP) PCA to coordinate research leading toward productive software development methods and higher quality software with predictable characteristics that is cost-effective; the restructuring of the Human Centered Systems (HuCS) PCA as the Human Computer Interaction and Information Management (HCI&IM) PCA with an expanded agenda; and significant software efforts in the other PCAs.

- "Fund more fundamental research in software development methods and component technologies." Graham cited several initiatives such as component-based software design; a library of certified domain-specific software components; model-based design for embedded software; technologies for automated analysis, simulation, and testing of components and systems; "predictable, reliable, and secure components and systems," and technologies for interoperable distributed applications.

- "Support fundamental research in human-computer interfaces and interactions." Graham cited efforts in virtual reality, virtual environments and universal access. These efforts focus on faster computations and hardware to enhance visualizations, and also to "provide easy access for all people, regardless of economic circumstances, physical impairment or intellectual limitations" [February 1999 PITAC Report].

- "Fund more fundamental research in information management technologies." Graham cited the multi-agency Digital Libraries initiative begun in 1994 and the Biomedical Information Systems Technology Initiative (BISTI) at NIH.

On the PITAC budget recommendation to "increase funding for software research," Graham noted NSF's Information Technology Research (ITR) initiative supporting more and larger grants and support to thematic programs such as Quantum and Biologically Inspired Computing (QuBIC). The total funding recommendations in software research rose by $145.8 million in FY 2000 and by $318.3 million in FY 2001.

Report on the Software Design and Productivity planning workshop

Frank Anger, Computer and Information Science and Engineering Directorate, National Science Foundation, gave a report on the SDP Planning Workshop held April 18-19, 2001, by the SDP Coordinating Group (CG). Fourteen universities and non-profits, eleven government agencies and eight commercial enterprises were in attendance at the two-day SDP Planning Workshop. The goal was to involve Federal agencies and the research community in forming an SDP research agenda.

The participants were divided into four panels: the future of software and software research, new software development paradigms, software for the real world, and software for network-centric and distributed systems. The panels identified goals and emphasized the need for a formal, repeatable Software Engineering discipline. In addition, the panels identified a number of different aspects of the problem. They addressed the expanding challenges for design, identifying the need for software to become more human-centric, network-centric, and mobile-global as it continues to become more complex, pervasive, and multi-faceted. A second workshop is now being planned to formulate these results into a full SDP research agenda.

Report on High Confidence Software and Systems

Shankar Sastry, University of California at Berkeley, gave a presentation on the activities of the HCSS CG. The CG has held five interagency workshops: critical aviation systems, public-key infrastructure for advanced network technologies, high-confidence aviation systems, future directions in hybrid and embedded systems, and medical device software safety. The CG has produced an HCSS research agenda that details the needed research in the areas of foundations; technology and tools; engineering and experimentation; and pilot applications. Sastry also gave a presentation on "new plans for HCSS's Information Assurance and Survivability programs."

Recognition of awards

I. Wladawsky-Berger noted that Robert E. Kahn and Vint Cerf (along with Lennie Kleinburg and Larry Roberts) had received the 2001 Charles Stark Draper Prize from the National Academy of Engineering for their work on the Internet.

He also noted that Raj Reddy had received the prestigious Padma Bhushan Award for outstanding contributions in computer science and information technology from President K.R. Narayanan of India in an award ceremony in New Delhi. This is one of the highest awards given by that nation.

David Crandal, National Nuclear Security Administration (NNSA), acting on behalf of DOE Secretary Spencer Abraham and NNSA Administrator John Gordon, presented a Special Award to David Cooper, citing that his "Outstanding leadership in high-performance computing" in NNSA's program was "instrumental in securing the Nation's security and in advancing the frontiers of scientific computing."

Address by The Honorable Sherwood Boehlert, Chairman, House Science Committee

I. Wladawsky-Berger introduced *The Honorable Sherwood Boehlert (R-N.Y.), Chairman of the House Science Committee* and *David Goldston, Chief of Staff of the Committee*. Rep. Boehlert began by saying that he and his Committee had recommended to the President the extension of the PITAC. Rep. Boehlert said that he felt that the Administration's proposals for funding the science enterprise were inadequate. He also noted that certain key Administration positions remain unfilled, including the Science Advisor and several critical vacancies at the Office of Science and Technology Policy (OSTP).

Rep. Boehlert said that the House Science Committee would be very active. They have professional and knowledgeable staff who can make clear to both Congress and the Administration that investments in the science enterprise are central to economic growth, and that the Committee also has a large role to play in issues like K-12 education that have not been perceived in the past as depending on science investments. But the Committee needs advice from experts such as PITAC to help them identify the most crucial research areas.

The discussion period focused on how PITAC recommendations were received by Congress and how PITAC might present its views more effectively. Rep. Boehlert said that, first, IT experts such as the PITAC must do a much better job of lobbying, and must talk to Congress directly, to present a unified view of the multiple benefits of these large projects. Second, special effort must go to educating freshman legislators. Third, PITAC can help Congress prioritize science investments by identifying what is crucial versus what is of lesser priority.

Report of the Panel on Individual Security

J. Thompson, Chair of the Individual Security Panel (ISP), said that the ISP would plan to hold a workshop this summer, report the results at the September PITAC meeting, and then publish their report by the end of 2001.

Individual security is the combination of privacy and protection against identity theft. To combat identity theft, we need a new definition of identity, since the use of a Social Security Number as an identity authenticator has been hopelessly compromised by overuse. Industry can provide the technology to do this, but they may need some prompting to do so.

E. Benhamou described how he himself was the victim of identity theft earlier this year. All funds were recovered, but he did not have the use of the money for some weeks. He found that his credit reports were seriously inconsistent and out-of-date, and that the claims process was cumbersome, requiring multiple claims in different jurisdictions. Most importantly, he found the system biased against him, so that he felt he had to prove his own innocence.

In the discussion period, several other anecdotes were raised. The consensus was (1) financial industries were failing to follow rudimentary identification procedures, depending instead on business volume and consumer tolerance, (2) individuals could take certain protective action, but these will remain insufficient until industry

rises to the problem, (3) the problem is not just on the Internet, but the Internet does make the problem more immediate, and (4) policy decisions are needed to ensure that identification procedures do not collide with individual privacy.

Public Comments

There were no public comments.

Adjournment of session

Co-Chair I. Wladawsky-Berger adjourned the session at 5:15 p.m., noting that the PITAC would reconvene at 8:00 a.m., May 11, 2001.

The full transcript of the PITAC meeting is available from the National Coordination Office for Information Technology Research and Development, 4201 Wilson Boulevard, Suite II-405, Arlington, Virginia 22230, Tel, (703) 292-4873, E-mail: nco@itrd.gov

Draft Minutes of the
President's Information Technology Advisory Committee
May 11, 2001

The thirteenth meeting of the President's Information Technology Advisory Committee (PITAC) reconvened and was called to order by Co-Chairs Raj Reddy and Irving Wladawsky-Berger at 8:00 a.m., May 11, 2001, in Room II-555 of the National Science Foundation (NSF) building, 4201 Wilson Boulevard, Arlington, Virginia.

I. Wladawsky-Berger introduced Floyd Kvamme, Co-Chair Designate of the President's Committee of Advisors on Science and Technology (PCAST), Richard Russell, Office of Science and Technology Policy (OSTP), John Ackerly, National Economic Council (NEC), Paul Domich (OSTOP) and David Trinkle, Office of Management and Budget (OMB).

Report of the Panel on National Security

R. Kahn, Co-Chair (with K. Kennedy) of the National Security Panel (NSP), noted that the charter of the NSP was to identify a long-range information technology research strategy and rationale to improve the national security of the United States. This would involve not just science and technology issues, but operational and procedural ones as well. NSP is preparing a report, to be issued later this year, that identifies six such categories: cyber-crisis management, autonomous systems, networked intelligence gathering and assessment, distributed decision-making and coordination, computer-based education and training, and managing legacy systems on a continuing basis.

In the discussion period, it was suggested that the next steps are (1) to get Administration feedback on whether there is a need for long-term study, (2) if so, to update the categories list and assign priorities, (3) determine how to attack the issues, and (4) decide how to organize the activity. Kahn noted that the stakeholder set is large and the activity must dovetail into a number of ongoing processes. Moreover, it must be managed by people inside the organizations, who have the substantive and continuing expertise on these processes.

The discussion turned to implementation of the NSP plan with the Department of Defense (DoD). ITR&D is still not high on the DoD priorities list, especially while key appointments in DoD (e.g., DDR&E, Director of DARPA) remain unfilled. Moreover, even if the NSP plan were fully implemented within DoD, that may not be enough. The civilian IT infrastructure is now so large and so important that it too must be protected from cyber attack; protecting only DoD systems, or even Government systems, is no longer sufficient. To do this, however, we need cooperation from the private sector. Kahn replied that that raises some difficult issues, such as the ownership of information. It can also impact the functioning of a system, not simply protect it from attack.

Infrastructure Challenges

L. Vadasz began the report on Infrastructure Challenges by noting that business-to-consumer Internet commerce rose in CY 2000 to over $45 billion and to more than $60 billion this year, so the predictions for huge Internet growth have been correct.

Report on scalable information infrastructure research and development

R. Kahn gave an overview of the progress toward the 1999 PITAC Report recommendations in Large Scale Networking. Funding was about one-half of what the Report had recommended. The recommendations called for instrumenting the existing network to collect and analyze performance data, for developing new technologies, and for developing a plan to scale the Internet for increased load. Three other recommendations were added: the need for middleware to enable large-scale systems, the need to develop large-scale applications and the need to create pilots and testbeds to explore new technologies.

Kahn said that the network was in fairly good shape. NSF has broadened the base of institutions with high-speed connections (now over one hundred sites with 100 Mbps), while DARPA has implemented approximately ten sites at 1 Gbps. The NSF effort also involved a number of procurements where people could use the network of their choice, funded for the first few years. For Government networking, a comprehensive national strategy was considered but not implemented. NSF's research budget has grown about 50 percent in the last few years, and ITR added $13 billion onto that. The main concerns continue to be scalability and security.

Dan Hitchcock, Office of Advanced Scientific Computing Research, Department of Energy, noted that networks were crucial to DOE's mission, with end-to-end throughput the vital concern, citing particularly the slow-start problem. Asked about the use of research and educational networks such as StarTap, he said that DOE does use them, but that these networks do have prior performance commitments.

Report on the large scale networking workshop

Mari Maeda, Information Technology Office, Defense Advanced Research Projects Agency, gave a presentation on the Next Generation Internet (NGI) program. The program had three goals, high performance networking, automatic network management, and testbed activities. The PITAC recommendation was for $120 million over the 1999 budget, but DARPA got an increase of about $58 million. The testbed is now operational, with a stable 2.5 Gbps backbone. DARPA established 50 workstation hosts spread across eight campuses, and solicited and funded relevant applications research. The program didn't originally target applications or wireless, but it does now.

Maeda then gave a presentation on the LSN Workshop on New Visions for Networking Research and Applications held March 12-14, 2001. The workshop had approximately 160 participants, and DARPA had received about 80 white papers on potential uses of the Internet and the research needed to enable these uses. The workshop developed a 20-year vision and a 5-year research plan. Two threads emerged from the workshop. The first was that of high-speed networking that enables distributed real-time collaboration in scientific research. Maeda cited the example of Very Long Baseline Interferometry (VLBI) as an instance in which improvement of these networks is needed. The second thread was that of pervasive networking, in which many densely distributed sensors are connected via a fine-grain network. Conducting military operations in urban settings is an instance where such networks could be crucial.

Report on the NRC/CSTB Report, "The Internet's Coming of Age"

Jon Eisenberg, National Research Council, Computer Science and Telecommunications Board (CSTB), gave a presentation of the new CSTB Report, *The Internet's Coming of Age.* The Report is organized along four topics: the Internet's basic design and architecture; scalability, reliability, and robustness; interconnection, transparency, and openness; and key conclusions relating to research and government policy responses. The Committee made two sets of recommendations. In the technology base, we must (1) continue industrial and government support for research and development on scalability, reliability, and robustness; (2) find new opportunities for research in realistic operational settings; (3) experiment with new business models and technology interconnections; and (4) continue support to develop open standards. In the area of Government Policy Responses, the Report found that (1) the present policy of non-regulation should be accompanied by close monitoring, and (2) monitoring should be accompanied by broad-based efforts to understand what would be potential triggers for possible future intervention. Security is the single most important limiter of the dispersion of this technology into daily life.

In the discussion period, it was noted that one reason budget levels were inadequate is that follow-on programs have not been identified, and that deployment of broadband is far behind where it should be. Eisenberg noted that CSTB has a study underway on this topic, with a report due out in September. Another problem in deploying broadband is the lack of applications. The 1999 PITAC report discussed "scalable information infrastructure," which includes applications as well as large-scale networking. NSF has recently identified in their budget "major research equipment line items," including VLBI telescopes, ecological networks, and engineering earthquake networks.

There was also discussion of copyright and intellectual property issues and the CSTB's general principle of network regulation. Many content providers assume that networks must protect the content they carry from

infringement, and are waiting for the technologists to solve the problem. But the issue is beyond technology, and involves interplay between the rights of authors and freedom of speech. Views on these issues differ in governments around the world. The core of the solution was telling people what technology can and cannot do. Vadasz closed by noting that content ownership rights are part of the fundamental economic model that must exist if Internet commerce is to succeed.

Socio-Economic Challenges

Update on Socioeconomic, Educational, and Workforce Implications of IT and IT Workforce Development

J. Thompson cited the 1999 PITAC recommendations in this area: Policy Issues, Equity and Access, and Workforce Development. He noted that the Internet II and vBNS programs had played a role, but that, for many institutions, two-thirds of their connectivity budget was paid just to get network access. Overall, the funding levels had run about 70 percent of PITAC recommendations.

Thompson noted the creation of the Socioeconomic, Educational, and Workforce Implications of IT and IT Workforce Development (SEW) PCA, which is now developing a white paper on Research Needs. He also cited the new SEW component in NSF's ITR program, noting that NIH, NASA and DOE were also involved. He cited the NSF's new "Learning in the 21st Century" program, which includes some participation by the Department of Education. Finally, he noted that there had been committee discussion of including the National Endowment for the Humanities in the crosscut. The discussion periods focused on the need for fuller involvement with the Department of Education and for identifying more opportunities for Federal assistance to K-12 education.

Report on the NRC/CSTB Report, "Building a Workforce for the Information Economy"

Marjory Blumenthal, National Research Council, Computer Science and Telecommunications Board, described the CSTB's new Report, *Building a Workforce for the Information Economy.* The Board recognized the highly politicized nature of the issue, but found no clear pattern of age discrimination, nor any clear connection with the use of foreign workers. The large number of foreign workers does depress wages somewhat, but any "ideal" number of H-1B visas is fundamentally a political question. The report discusses the need and ways to improve education, and contains recommendations to employers, workers, educational institutions and government policy makers.

High-Performance Computing Challenges

Update on high end computing research and development

S. Wallach began the discussion of High-Performance Computing (HPC) Challenges by re-visiting the HPC recommendations that PITAC had made in its 1999 report. He reported that:

- Funding for innovative computing technologies and architectures has gone up from $181.3 million to $254.9 million, mostly for evolutionary increments rather than revolutionary advances.

- Funding for software to improve HPC has also increased. But the biggest impact on software infrastructure would come from the open-source software efforts undertaken by federally funded projects.

- Achieving petaflops performance by 2010 will require advances and coordination at all levels. Most importantly, there is currently no active effort to actually build such a machine in total. Without this, the piecemeal research efforts will not produce the petaflops machine.

- Total HEC R&D funding had increased from $115 million to $316 million.

Update on the Partnership for Advanced Computational Infrastructure and the terascale programs

Robert Borchers, Advanced Computational Infrastructure and Research Division, National Science Foundation, gave an update of the Partnership for Advanced Computational Infrastructure (PACI) and the terascale programs. PACI is now in its fourth year with partnerships at UC San Diego (UCSD) and University of Illinois at Urbana-Champaign (UIUC), and other mid-level sites. With the recent award of the terascale machine to the Pittsburgh Supercomputer Center (PSC), users can access resources across partnerships and at PSC from a single PACI web site. The six-teraflops PSC machine has 64 nodes and 256 processors and is performing well so far; installation should be complete by Fall 2001. It is supported partly by PSC, but mostly by UCSD and UIUC. Borchers also gave brief updates on other HEC activities: the increased interest in open-source software for Linux clusters, the

increased interest in cluster-building using the Beowulf model, the Data-Intensive Computational Environment and the Storage Research Broker, and the Distributed Terascale Facility.

Update on the Advanced Simulation and Computing Initiative

Jose Muñoz, Office of Simulation and Computer Science, National Nuclear Security Administration, Department of Energy, reported on Advanced Simulation and Computing Initiative (ASCI), a major consumer of teraflops computing. ASCI aims to achieve 100 teraflops performance by 2005, but that assembling clusters of computers from commodity parts will not by itself achieve this goal. The PathForward program is an attempt to partner with industry to produce technologies that are consistent with the commodity purchasing models we have today. The Advanced Architectures Initiative lays out the acquisition plan. Muñoz said that the research pipeline is broken or empty; one area in the Advanced Architectures Initiative had no research proposals whatever. R. Borchers pointed out that open-source software programs in PACI are collaborating more with HEC academia, in both cluster and grid computing libraries. There are some emerging standards for middleware between open-source operating systems and applications, with the same mix of systems that existed before.

Public comments

There was a discussion of how PITAC might present itself more effectively and more often to Congress, especially to freshman legislators, as Rep. Boehlert had recommended. It was also suggested that PITAC begin an international effort, establishing contact with international bodies similar to itself, as part of the launch of the panel on international issues. However, this would have to await the appointment of the Science Advisor.

Larry Reeker, National Institute for Standards and Technology, asked PITAC to recommend more strongly increased funding for intelligent systems research, which, he said, had been lagging for several years. R. Khan and others agreed, noting the major contributions that intelligent systems work had made in recent years. They also noted that one possible reason was that these products were not clearly defined as having come from that discipline.

I. Wladawsky-Berger announced that the next meeting would be September 24-25, 2001.

Adjournment

Raj Reddy and Irving Wladawsky-Berger adjourned the meeting at 1:00 P.M.

The full transcript of the PITAC meeting is available from the National Coordination Office for Information Technology Research and Development, 4201 Wilson Boulevard, Suite II-405, Arlington, Virginia 22230, Tel, (703) 292-4873, E-mail: nco@itrd.gov

Attendees

May 10-11, 2001

PITAC Members Attending

Raj Reddy, Co-Chair	Carnegie-Mellon University
Irving Wladawsky-Berger, Co-Chair	International Business Machines Corporation
Eric A. Benhamou	3Com Corporation
Vinton Cerf	WorldCom
Ching-chih Chen	Simmons College
David M. Cooper	Lawrence Livermore National Laboratories
Steven D. Dorfman	Hughes Electronics Corporation
Robert Ewald	EStamp
Sherrilynne S. Fuller	University of Washington Health Science Center
Hector Garcia-Molina	Stanford University
Susan L. Graham	University of California at Berkeley
W. Daniel Hillis	Applied Minds, Inc.
Robert E. Kahn	Corporation for National Research Initiatives
Ken Kennedy	Center for Research on Parallel Computation, Rice University
Edward H. Shortliffe	College of Physicians and Surgeons, Columbia University
Larry Smarr	California Institute for Telecommunications and Information Technology
Joe F. Thompson	Mississippi State University
Leslie Vadasz	Intel Corporation
Steven J. Wallach	CenterPoint Ventures

Government Attendees

Kamal Abdali, NSF
Julia Abrahams, NSF
John Ackerly, NEC
Frank Anger, NSF
David Bernholz, NCO/ITRD
Representative Sherwood Boehlert, U.S. Congress
Robert Borchers, NSF
Aubrey Bush, NSF
Laureen Daly, DOC
Frederica Darema, NSF
Paul Domich, OSTP
Michael Foster, DARPA
Cita Furlani, NCO/ITRD
Doug Gatchell, NSF
Helen Gigley, NCO/ITRD
Helen Gill, NSF
David Goldston, House Science Committee
Tom Green, NSF
Richard Hildebrandt, NSF
Rich Hirsh, NSF

Dan Hitchcock, DOE
Charles Holland, OSD
Sally Howe, NCO/ITRD
Terry Kelly, OSTP
Steven King, OSD/DDR&E
Charles Koelbel, NSF
Gary Koob, DARPA
Norman Kreisman, DOE
Stephen Mahaney, NSF
Bill Mehuron, NIST
José Muñoz, DOE/NNSA
Marshall Potter, FAA
Larry Reeker, NIST
Richard Russell, OSTP
Robert Sloan, NSF
Sylvia Spangler, NSF
Gary Strong, NSF
Mark Swinson, DARPA
David Trinkle, OMB

NCO Contractors

Ed Garcia
Vicki Harris
Larry Janicki
Martha Matzke
Virginia Moore
Betty McDonough
Grant Miller
Ann Rutherford
Lori Shapiro
Frank Sledge
Alan Tellington
Carolyn Van Damme
Diane Vellines
Robert Winner

Private Citizens

Fred Adler, Adler & Assoc.
Y. T. Chien, ITRI, Inc.
Marge Cooper
Laurent de Mercey, Embassy of France
Andrea Foster, The Chronicle
Susan Fratkin, Coalition for Academic Scientific Computation
Jeff Grove, Association for Computing Machinery
Robert F. Henderson, Noesis, Inc.
Michãel Hervé, Embassy of France
Tom Kalil
Taffy Kingscott, IBM
Floyd Kvamme, Kleiner Perkins Caufield and Byers
Neil MacDonald, Federal Technology Report
Scott Nance, New Technology Week
Hironori Nakanishi, NEDO
Jane Peach, Ace Federal
Debbie Rudolph, Institute of Electrical and Electronics Engineers
Shankar Sastry, University of California at Berkeley
Maureen Sirh, Tech Daily

Tony Stanco, Free Developers
Carmen Whitson, GWU

Minutes prepared by Frank Sledge

September 14, 2001

Cita Furlani

Director, National Coordination Office for Information Technology Research and Development

Approved:

September 18, 2001

Raj Reddy

Co-Chair, President's Information Technology Advisory Committee

September 19, 2001

Irving Wladawsky-Berger

Co-Chair, President's Information Technology Advisory Committee