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PITAC Year 2000 Report to Congress Reviewing the Next Generation Internet Program and Related Issues

(Updated December 2002)

The Next Generation Internet Research Act of 1998, requires the President's Information Technology (IT) Advisory Committee (PITAC) to review the implementation of the Next Generation Internet (NGI) initiative and report annually on:

- Advanced Networking Research: Progress in NGI-funded advanced networking research, NGI Testbeds: Progress in implementing high-performance network testbeds,
- NGI Applications: Progress in developing high-performance network applications,
- Geographic Reach: Addressing geographic penalties faced by rural institutions,
- Minority- and Small-College Reach: Addressing access by historically black and Hispanic-serving institutions, colleges and universities with fewer than 5,000 students,
- Technology Transfer: Flow of NGI ideas to industry, Agency Coordination: Effectiveness of coordination among the NGI agencies, and
- IT Leadership: The extent to which Federal research support will maintain U.S. IT leadership .

The Committee reviewed the NGI initiative with DARPA, DOE, NASA, NIH, NIST, and NSF.

The NGI agencies have made excellent progress over the last year. We are gratified that they have responded to advice from Congress and from the PITAC. We recommend Congress extend funding of the NGI program for two more years at the proposed level of \$104 million.

Advanced networking research: The NGI program has initiated a broad networking research plan that addresses the need for critical technology. NGI research activities, especially the DARPA and NSF programs, are producing exciting results that are likely to be cornerstones of the new communications infrastructure. For example, DARPA's SuperNet program will provide guaranteed ultra high-bandwidth on demand for national, regional, metropolitan, and local networks. They are pioneering work on dynamically controlled optical networks.

NGI Testbeds: NSF and DARPA are deploying two NGI Testbeds. In FY 2000, NSF, DOE, and NASA have connected more than 150 sites to a testbed providing a 100-fold increase in network performance, and DARPA is deploying a testbed with 1000-fold increased performance at more than 15 sites to support networking research and applications development. Currently, the maximum desktop-to-desktop performance has been measured at about 900 million bits per second more than a ten-fold increase over the 80 Mbps reported to us last year. There is still much more to do, but the agencies have an excellent plan and they are executing it very well. The agencies have also cooperated in setting up the Qbone network to experiment with applications that need Quality of Service guarantees.

NGI Applications: The NGI agencies are exploring network applications that require NGI services and performance. NIH's National Library of Medicine, for example, has funded many promising application pre-proposals. Many agencies (NASA, DARPA, USGS, NOAA, NEMA, and ACE) are cooperating on the Digital Earth framework to make all US geo-referenced data available via a point-and-click user interface via a high-speed network. Today, there are few applications that will use the low latency, quality of service, or high bandwidth that NGI will offer. Only 20 percent of NGI's FY 2000 funding is for applications, hence

progress has been disappointing. We again recommend increased emphasis on and investments in new applications that use NGI-level capabilities. It is necessary to fund such applications explicitly. Congress might consider doing this as part of other agency funding bills.

Reach: The NGI initiative cannot directly address reach to rural, inner-city, minority, or small institutions. NGI is a research and development program to provide the technologies and applications required as foundations for the next generations of the Internet. It is a relatively small initiative that funds peer-reviewed research proposals. The announced NGI awards cover 177 of the nation's 2,200 four-year, college-level educational institutions. It cannot fund institutions where research is not emphasized and where there is little experience developing advanced networking or applications. The end of this report makes a specific recommendation to address this issue.

Geographic Reach: While the NGI initiative was not planned or directed to address reach in general, access for otherwise qualified universities with fundable research proposals must not be disadvantaged merely because of their location. NSF expanded the High Performance Connections program to cover all 50 states and has made 40 grants in 18 EPSCoR states. Eventually, NGI research on wireless, hybrid, and satellite technologies may reduce the cost and improve the services available to all users including those in geographically remote areas.

Minority- and Small-College Reach: The NGI was not funded to address Internet access for historically black, Hispanic-serving, Native American, or small colleges and universities. Based on its standard peer review process, NSF has awarded High Performance Connection grants to two historically black and five Hispanic-serving institutions. In addition, unrelated to the NGI effort, NSF has granted 6 million dollars to Educause to work with disadvantaged minority colleges to develop their IT infrastructure.

Technology Transfer: Industry, universities, and Federal agencies collaborate on NGI research, testbeds, teams, and workshops. This creates substantial technology transfer opportunities. Indeed, a quick survey found about a dozen startups capitalized at nearly \$30 billion that have sprung up from the NGI program.

Agency Coordination: NGI agencies coordinate their activities through the Large Scale Networking Coordinating Group and its specialized teams that focus on the NGI goals. The agencies seem to be cooperating effectively in implementing the NGI goals.

IT Leadership: The Committee's Report to the President, February 1999, concluded that Federal support for research in information technology is seriously inadequate. The PITAC recommended the Federal government increase IT research funding by \$1.4B per year by FY2004. The President's FY 2000 Budget includes an Information Technology for the 21st Century (IT2) initiative that begins to address this recommendation.

Recommendations

The Committee recommends that the NGI program be extended through FY 2002 at the proposed funding levels. Planning for follow-on activities should begin now. In particular, more applications should be funded that demonstrate the utility of the NGI's gigabit bandwidth to end-users, its increased security, and its expanded quality of service.

The Committee shares Congress' concern that no Federal program addresses the reach issue. We recommend Congress consider additional funding for a program where the NGI research institutions act as aggregators and mentors for nearby smaller or disadvantaged institutions. This is primarily infrastructure, not networking research and, hence, not part of the current NGI program.

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