Archived Material

Historical Purposes Only

Archive - NGI Material

October 1996 introduction

Background material - the initiative's economic benefits, three goals, funding, and implementation (October 1996).

Introduction

The Internet is the biggest change in human communications since the printing press. Every day, this rapidly growing global network touches the lives of millions of Americans. Students log in to the Library of Congress or take virtual field trips to the Mayan ruins. Entrepreneurs get the information they need to start a new business and sell their products in overseas markets. Caregivers for people with Alzheimer's Disease participate in an "extended family" on the Cleveland FreeNet. Citizens keep tabs on the voting records and accomplishments of their elected representatives.

We must invest today to create the foundation for the networks of the 21st Century. Today's Internet is an outgrowth of decades of federal investment in research networks such as the ARPANET and the NSFNET. A small amount of federal seed money stimulated much greater investment by industry and academia, and helped create a large and rapidly growing market. Similarly, creative investments today will set the stage for the networks of tomorrow that are even more powerful and versatile than the current Internet. This initiative will foster partnerships among academia, industry and government that will keep the U.S. at the cutting-edge of information and communications technologies. It will also accelerate the introduction of new multimedia services available in our homes, schools, and businesses.

Economic benefits

The potential economic benefits of this initiative are enormous. Because the Internet developed in the United States first, American companies have a substantial lead in a variety of information and communications markets. The explosion of the Internet has generated economic growth, high-wage jobs, and a dramatic increase in the number of high-tech start-ups. The Next Generation Internet initiative will strengthen America's technological leadership, and create new jobs and new market opportunities.

Goals

The Administration's "Next Generation Internet" initiative has three goals:

1. Connect universities and national labs with high-speed networks that are 100 - 1000 times faster than today's Internet: These networks will connect at least 100 universities and national labs at speeds that are 100 times faster than today's Internet, and a smaller number of institutions at speeds that are 1,000 times faster. These networks will eventually be able to transmit the contents of the entire Encyclopedia Britannica in under a second.

2. Promote experimentation with the next generation of networking technologies: For example, technologies are emerging that could dramatically increase the capabilities of the Internet to handle real-time services such as high quality video-conferencing. There are a variety of research challenges associated with increasing the number of Internet users by a factor of 100 that this initiative will help address. By serving as "testbeds", research networks can help accelerate the introduction of new commercial services.

3. Demonstrate new applications that meet important national goals and missions: Higher-speed, more advanced networks will enable a new generation of applications that support scientific research, national security, distance education, environmental monitoring, and health care. Below are just a few of the potential applications:

Applications

Health care: Doctors at university medical centers will use large archives of radiology images to identify the patterns and features associated with particular diseases. With remote access to supercomputers, they will also be able to improve the accuracy of mammographies by detecting subtle changes in three-dimensional images.

National Security: A top priority for the Defense Department is "dominant battlefield awareness," which will give the United States military a significant advantage in any armed conflict. This requires an ability to collect information from large numbers of high-resolution sensors, automatic processing of the data to support terrain and target recognition, and real-time distribution of that data to the warfighter. This will require orders of magnitude more bandwidth than is currently commercially available.

Distance Education: Universities are now experimenting with technologies such as two-way video to remote sites, VCR-like replay of past classes, modeling and simulation, collaborative environments, and online access to instructional software. Distance education will improve the ability of universities to serve working Americans who want new skills, but who cannot attend a class at a fixed time during the week.

Energy Research: Scientists and engineers across the country will be able to work with each other and access remote scientific facilities, as if they were in the same building. "Collaboratories" that combine video-conferencing, shared virtual work spaces, networked scientific facilities, and databases will increase the efficiency and effectiveness of our national research enterprise.

Biomedical Research: Researchers will be able to solve problems in large-scale DNA sequencing and gene identification that were previously impossible, opening the door to breakthroughs in curing human genetic diseases.

Environmental Monitoring: Researchers are constructing a "virtual world" to model the Chesapeake Bay ecosystem, which serves as a nursery area for many commercially important species.

Manufacturing engineering: Virtual reality and modeling and simulation can dramatically reduce the time required to develop new products.

Funding

The Administration will fund this initiative by allocating $100 million for R&D and research networks to develop the Next Generation Internet. This increase in FY98 funding will be offset by a reallocation of defense and domestic technology funds. As with previous networking initiatives, the Administration will work to ensure that this federal investment will serve as a catalyst for additional investment by universities and the private sector.

Implementation

The principal agencies involved in this initiative are the National Science Foundation, the Defense Advanced Research Projects Agency, the Department of Energy, NASA, and the National Institutes of Health. Other agencies may be involved in promoting specific applications related to their missions.

Questions and Answers - on the initiative (October 1996)

Question 1
Why does the government need to do this, given that the commercial Internet industry is growing so explosively?

The U.S. research community and government agencies have requirements that can not be met on today's public Internet or with today's technology. For example, the Department of Defense needs the ability to transmit large amounts of real-time imagery data to military decision-makers to maintain "information dominance." Scientists and engineers at universities and national labs need reliable and secure access to remote supercomputers, scientific facilities, and other researchers interacting in virtual environments. The productivity of the U.S. research community will be increased if they have access to high-speed networks with advanced capabilities. These new technologies will also help meet important national missions in defense, energy, health and space.

An initiative of this nature would not be undertaken by the private sector alone because the benefits can not be captured by any one firm. The Administration believes that this initiative will generate

enormous benefits for the Nation as a whole. It will accelerate the wide-spread availability of networked multimedia services to our homes, schools and businesses, with applications in areas such as community networking, life-long learning, telecommuting, electronic commerce, and health care.

Question 2
What are some of the capabilities that the "Next Generation Internet" will have that today's Internet does not?

Below are just of the few of the possibilities. Many new applications will be developed by those using the Next Generation Internet.

- An increased ability to handle real-time, multimedia applications such as video-conferencing and "streams" of audio and video -- very important for telemedicine and distance education. Currently, the Internet can't make any guarantees about the rate at which it will deliver data to a given destination, making many real-time applications difficult or impossible.
- Sufficient bandwidth to transfer and manipulate huge volumes of data. Satellites and scientific instruments will soon generate a terabyte (a trillion bytes) of information in a single day. [The printed collection of the Library of Congress is equivalent to 10 terabytes.]
- The ability to access remote supercomputers, construct a "virtual" supercomputer from multiple networked workstations, and interact in real-time with simulations of tornadoes, ecosystems, new drugs, etc.
- The ability to collaborate with other scientists and engineers in shared, virtual environments, including reliable and secure remote use of scientific facilities.

Question 3
Is it still Administration policy that the "information superhighway" will be built, owned, and operated by the private sector?

Absolutely. The Administration does believe that it is appropriate for the government to help fund R&D and research networks, however.

Partnerships with industry and academia will ensure that the results of government-funded research are widely available.

Question 4
Will this benefit all Americans, or just the research community?

By being a smart and demanding customer, the federal government and leading research universities will accelerate the commercial availability of new products, services, and technologies. New technologies have transitioned very rapidly from the research community to private sector companies. For example, Mosaic, the first graphical Web browser, was released by the National center for Supercomputing Applications in 1993. By 1994, Netscape and other companies had formed to develop commercial Web browsers. Today, millions of Americans use the Web.

The public will also benefit from the economic growth and job creation that will be generated from these new technologies, the new opportunities for life-long learning, and research breakthroughs in areas such as health.

Question 5
What, if anything, will it do about "traffic jams" on the Internet, or the ability of the Internet to continue its phenomenal rate of growth?

The lion's share of the responsibility for dealing with this problem lies with the private sector. Internet Service Providers will have to invest in higher capacity, more reliable networks to keep up with demand from their customers.

However, this initiative will help by investing in R&D, creating testbeds, and serving as a first customer for many of the technologies that will help the Internet grow and flourish. One of the goals of the initiative is to identify and deploy technologies that will help the Internet continue its exponential rate of growth. Examples include:

- Ultra-fast, all-optical networks
- Faster switches and routers
- The ability to "reserve" bandwidth for real-time applications
- A new version of the Internet Protocol that will prevent a shortage of Internet addresses
- "Multicast" technology that conserves bandwidth by disseminating data to multiple recipients at the same time
- Software for replicating information throughout the Internet, thereby reducing bottlenecks
- Software for measuring network performance
- Software to assure reliability and security of information transmitted over the Internet

Question 6
How does this initiative relate to existing government programs, such as the High Performance Computing and Communications Initiative? Will this be a totally new network?

The initiative represents an increase in the HPCC budget. The initiative will include both: (1) an expansion and augmentation of existing research networks supported by NSF, the Department of Defense, the Department of Energy, and NASA; (2) new networks; and (3) development of applications by agencies such as the National Institutes of Health.

Question 7
Are more technical details on the initiative available?

The Administration intends to consult broadly with the research community, the private sector, and other stakeholders before developing the final technical details for this initiative.

Internet Timeline

1969 Defense Department commissions ARPANET to promote networking research.

1974 Bob Kahn and Vint Cerf publish paper which specifies protocol for data networks.

1981 NSF provides seed money for CSNET (Computer Science NETwork) to connect U.S. computer science departments.

1982 Defense Department establishes TCP/IP (Transmission Control Protocol/Internet Protocol) as standard.

1984 Number of hosts (computers) connected to the Internet breaks 1,000.

1986 NSFNET and 5 NSF-funded supercomputer centers created. NSFNET backbone is 56 kilobits/second.

1989 Number of hosts breaks 100,000.

1991 NSF lifts restrictions on commercial use of the Internet.

High Performance Computing Act, authored by then-Senator Gore, is signed into law.

World Wide Web software released by CERN, the European Laboratory for Particle Physics.

1993 President Clinton and Vice President Gore get e-mail addresses.

Mosaic, a graphical "Web browser" developed at the NSF-funded National center for Supercomputing Applications, is released. Traffic on the World Wide Web explodes.

1994 White House goes on-line with "Welcome to the White House."

1995 U.S. Internet traffic now carried by commercial Internet service providers.

1996 Number of Internet hosts reaches 12.8 million.

President Clinton and Vice President Gore announce "Next Generation Internet" initiative.

[Source: Hobbes' Internet Timeline, v. 2.5]