President's Council of Advisors on Science and Technology

Building Out Broadband

Findings and Recommendations

September 30, 2002

Executive Summary
Building Out Broadband: Findings and Recommendations
From The President's Council of Advisors on Science and Technology
Approved unanimously September 30, 2002

The President asked PCAST to review the current status of broadband demand and suggest policies that will stimulate economic recovery in high technology and keep America competitive. In response, this report reviews the central role of broadband technologies in American economic growth and technical leadership and sets forth a series of concrete steps that this Administration should consider to support and sustain the rapid deployment of next-generation, high-speed Internet access at reasonable cost to all Americans. They include:

- Build on the No Child Left Behind Initiative to connect research and development in distance education and classroom technologies and join with the efforts of the private sector to exploit broadband technologies.
- Support a Broadband Telework Initiative with special attention to how broadband can enable and expand the scope and flexibility of telework opportunities.
- Support a Telemedicine Initiative to expand interagency coordination and explore impediments to improving the quality and reducing the cost of healthcare to all Americans through broadband enabled telemedicine, including a review of provider reimbursement practices, patient privacy, licensure, and credentialing for telemedicine services.
- Ensure that the E-Government Initiative recognizes the full potential of broadband applications. Sound investments in Federal broadband applications for service and information provision may also bring down unit costs for broadband facilities economy-wide.
- Develop broadband connectivity to enhance homeland security through sharing of critical information among federal and local agencies and first responders.
- Facilitate wireless broadband applications including wireless home networks and innovative approaches to spectrum sharing.
- Encourage public rights of way policies that support the benefits of broadband and fair compensation to federal entities and local communities.

The President's Council of Advisors on Science and Technology was established by Executive Order 13226. The purpose of PCAST is to advise the President on matters of science and technology policy, and to assist the President's National Science and Technology Council in securing private sector participation in its activities.

21st Infrastructure Panel Members

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Building Out Broadband:
Recommendations to the President

The President's Council of Advisors on Science and Technology
September 30, 2002

On August 13, 2002 at the Waco Economic Forum, President Bush stated:

> *In order to make sure the economy grows, we must bring the promise of broadband technology to millions of Americans. My Administration is promoting investment in broadband. We will continue to work to prevent new access taxes on broadband technology. If you want something to be used more, you don't tax it. And broadband technology is going to be incredibly important for us to stay on the cutting edge of innovation here in America. The Federal Communications Commission is focusing on policies to encourage high-speed Internet service for every home and every business in America. The private sector will deploy broadband. But government at all levels should remove hurdles that slow the pace of deployment.*

As members of the 21st Century Infrastructure Panel of PCAST, it is our intention to respond to the President's priorities in this important area. Our task is to report on the current status of broadband demand and suggest policies that will keep America competitive. His assignment to us was to address concrete steps that this Administration should consider to support and sustain the rapid deployment of next-generation, high-speed Internet access at reasonable cost to all Americans. A number of industry, scientific and citizens groups have offered a variety of ideas to promote broadband deployment and demand. We have drawn significantly on these whitepapers and research reports in our deliberations (see attached appendix).

This PCAST report *will not* call for federal intervention in the marketplace. We *will not* call for federal funding of last-mile infrastructure, although, of course, federally supported R&D will continue to contribute to technical innovations. On the contrary, we look for creative interaction among public and private sector scientists and executives to address the roadblocks with fresh approaches to technological design, public policy and industry cooperation that have been characteristic of the public advisory committee process.

Why Broadband Policy is Important

Broadband deployment promises to stimulate the U.S. economy, and increase U.S. competitiveness.[1] Robert Crandall and Charles Jackson recently completed a study that estimates that the universal adoption of broadband Internet access could provide U.S. consumers with economic benefits ranging from $200 billion to $400 billion per year – the faster the deployment, the greater the estimated benefits.[2] Benefits are expected to accrue across broad sectors of the economy. An August 2002 Gartner Group study estimates that implementation of

a "true" broadband infrastructure would increase U.S. Gross Domestic Product (GDP) by up to $500 billion annually for the next ten years.[3]

Expanded broadband availability and demand would strongly boost information technology ("IT") investment. Despite recent slowdowns, the IT sector has been responsible for significant growth in the U.S. economy – and the world economy – in recent years. According to the Department of Commerce, information technology generated 28% of growth in U.S. Gross Domestic Product (GDP) over the past five years, although it constituted just 7% of the U.S. economy – IT's low inflation rate also lowered the national inflation rate, and IT has helped to almost double productivity growth rates from 1.4% to 2.4% a year for the past five years.[4] Greater broadband deployment will stimulate investment in IT so that this sector can again serve as an engine for economic growth. In addition, greater availability of and demand for broadband could benefit manufacturers of networking equipment, personal computers, ancillary network equipment and software, and producers and distributors of entertainment products by as much as $100 billion annually.[5]

Increasing labor productivity growth is one of the most important economic benefits that should result from the expanded availability of broadband. IT use and production have been credited with generating between one-half and three-quarters of the growth in U.S. labor productivity growth since 1995.[6]

Information technology will not be the only industry sector to benefit from the expansion of broadband. A 2001 report by the Yankee Group predicts that companies in 26 industry segments can "save an estimated $223 billion using [collaborative] commerce solutions through 2005."[7] Use of broadband should allow for more accurate inventory management systems – lack of visibility into the supply chain and lack of complete information on inventories contributed to the recent downturn in several IT sectors. Allowing businesses to better manage inventory, production, and demand could reduce the length and severity of recessions by minimizing the lag time between a drop in demand and a corresponding drop in production.

Finally, expanded broadband deployment and usage will stimulate demand for high wage, high skill employees. A recently released study predicted that building and using a nationwide broadband network would create an estimated 1.2 million new and permanent high-skilled jobs.[8] The report also estimated that such a network of networks would generate about $35 billion annually in investment.[9] Michigan Governor John Engler has stated that jumpstarting high-speed broadband Internet access service throughout his state would help create an estimated 500,000 jobs in Michigan alone.[10]

The importance of broadband does not in itself necessitate a broad and unfocused federal intervention in the marketplace. Careful attention needs to be devoted to delineating appropriate federal engagement in this critical issue.

What Should Government Do?
A Five Point Plan for Federal Pilot Programs: Promoting Experiments, Addressing Impediments

1) Educational Applications

Although there has been a great deal of discussion of movies on demand, interactive entertainment and eCommerce, one recent study projected that the largest economic impact of ubiquitous broadband would be distance learning and web-based professional training. Broadband enabled classrooms will enhance the schoolroom educational experience, and high-capacity distance education may have even more transformative effects on the quality and availability of educational resources. We need to better understand the psychological, motivational, cognitive and economic ramifications of eLearning for both traditional and life-long learning opportunities. More than a few households have reported that their children's increasing use of the Internet for schoolwork and research convinced them to take the plunge for broadband service. Enhanced content and higher capacity applications including telepresence and three-dimensional visualization are likely to reinforce that trend.

PCAST recognizes that education and educational technologies are central to the President's policy agenda and the bipartisan No Child Left Behind Act the President signed into law on January 8, 2002. The new law targets $700 million for technical applications and shifts support for educational technologies to a consolidated block grant program to help schools use technology to support student achievement.

PCAST encourages the President to build on this initiative to connect research and development in distance education and classroom technologies with the efforts of the private sector to expand deployment and usage of broadband.

2) Telework

The President has expressed his strong conviction that telework is good for families, persons with disabilities, and the environment, because it gives workers the flexibility to meet everyday demands while working at home. The evidence is impressive:

More than two-thirds of teleworkers surveyed express greater job satisfaction than when working away from home. Almost three-quarters of at-home teleworkers reported a major increase in productivity and work quality. Telework increases opportunities for persons with disabilities who otherwise may not have the option to work. In areas where commuter congestion is a serious problem, telework reduces the numbers of cars on the road and effectively decreases toxic emissions, resulting in cleaner air in many of our most congested cities.

Given such benefits, it is not surprising that the number of teleworkers has grown to more than 25 million employees in 2001, expanding at a rate of about 20 percent a year over the past ten

years. Several agencies in the federal government have begun to address the remaining barriers to wider and more rapid acceptance of telework. PCAST strongly supports these efforts and urges the President to support a Broadband Telework Initiative with special attention to how broadband can enable and expand the scope and flexibility of telework opportunities. The federal government can play an important role in leading by example and facilitating enabling technologies through telework for federal employees.

3) Telemedicine

One of the live technical demonstrations PCAST received at its June 12, 2002, meeting was a live, full-broadband connection between our Washington, D.C. meeting location and an Intensive Care Unit (ICU) at Sentara Hospital in Virginia Beach, Virginia. If high-functionality can be provided, this technology could greatly benefit medical monitoring and diagnostics in rural applications. It has already been demonstrated that the increased specialized medical knowledge made available through these technologies can result in a 15-20% reduction in mortality rates in ICU's.[11]

Telecommunications technologies have been used to exchange medical information among distant sites via video in the United States since the late 1950s. The early projects began with much promise and then faded away, largely due to their high costs and limitations in the technologies available. Since the late 1980s, however, advances in telecommunications and information technologies have overcome or minimized many of the technical problems encountered in earlier projects, expanding the capabilities and lowering the costs of the technologies deployed.[12]

Since the late 1980s, several federal agencies have actively supported telemedicine projects throughout the United States. The Joint Working Group on Telemedicine (JWGT) is a voluntary group of federal agency staff from all federal agencies involved in telemedicine that has worked together to coordinate telemedicine activities within the federal government since the mid-1990s.

PCAST urges the President to support and expand this interagency coordination on telemedicine policy. This should include exploring impediments to improving the quality and reducing the cost of healthcare to all Americans through broadband enabled telemedicine including a review of data standards for health infomatics, provider reimbursement practices, patient privacy, licensure, and credentialing for telemedicine services. Work is also needed to help develop appropriate standards and security measures needed to ensure compliance with the Health Insurance Portability and Accountability Act.

4) E-Government

The President has made it clear that an E-Government Action Plan is a central element of his Management Agenda. PCAST applauds and endorses the E-Government Strategy announced by the Office of Management and Budget in February 2002.

The focus of the President's strategy is clear:

Make it easy for citizens to obtain service and interact with the federal government;
Improve government efficiency and effectiveness; and
Improve government's responsiveness to citizens.

More than 60 percent of all Internet users interact directly with government websites.   E-Government is poised to save taxpayers significant tax dollars, while adding value to citizens' experience with government and better serving their needs. Federal information technology spending will exceed $52 billion in 2003. That level of IT spending provides enormous opportunities for transforming government into a citizen-centered E-Government.   A good portion of current federal IT spending is already devoted to Internet initiatives, yielding over 35 million web pages at over 22,000 web sites.

PCAST recommends that the E-Government Initiative recognize the full potential of broadband applications. Sound investments in Federal broadband applications for service and information provision may also bring down unit costs for broadband facilities economy-wide. Several elements of the E-Government Strategy offer special promise for broadband applications including the Recreation One-Stop, International Trade Process Streamlining, Geospatial Information Services, One-Stop Business Compliance, Project SAFECOM, Integrated Human Resources and Recruitment and E-Travel.

5) Homeland Security

Broadband connectivity has the potential to enhance homeland security. It could provide officials at all levels of government with more sophisticated data in more useable forms – such as geospatial data – and make it available directly to service providers and first responders wherever and whenever they need it. Broadband also brings a quantum leap in the capacity to share vast quantities of data across government agencies and all levels of government. Moreover, the expanded capacity of public officials to convey important security and safety information directly to citizens will drive demand for broadband in the home, as families recognize its life-saving potential.

Virtually every aspect of homeland defense involves information sharing among local, state and federal government officials, including border security, emergency response capacity, biological threat assessment and monitoring, and physical infrastructure management. True broadband capacity will be essential as this homeland-defense IT architecture is developed.

For example, public safety in the post-September 11th environment depends in part on the ability of government agencies and public officials to collect and assess information about potential threats, and to disseminate critical information quickly and reliably to federal, state and local authorities and, in certain cases, to the public at large. Additionally, if civil defense or other information needs to be communicated directly to the public, broadband connectivity to the home would enable individual citizens to receive information quickly and with appropriate graphical, media and other enhancements.

Ubiquitous broadband availability and adoption also will enable the Department of Homeland Security, once established, and other federal government entities to share information on existing homeland security projects, "best practices", and other useful information.

In emergencies, local authorities could benefit from a high-speed broadband network and the software tools that enable authorities to immediately access, combine, and visualize critical infrastructure and public safety data without needing to engage in time-consuming and risky data conversion exercises.

The software technologies exist today to deploy such systems, but they rely on broadband connectivity and wireless broadband to reach their potential. Fully realized, these systems can quickly draw on and visualize a wide variety of interrelated data, such as building floor plans and other architectural details, location of physical assets, demographic information, evacuation routes, hazardous material threats, and wind direction, among other information.

Thus, with a broadband network and sophisticated software deployed among government entities, public safety and homeland defense can be enhanced in a variety of ways that directly benefit citizens.

Other Issues: Wireless as a Driver of Demand

As detailed above, truly ubiquitous broadband is likely to prove its value as a critically important driving force in this country's economy and economic recovery. By combining the potential of fully functioning broadband applications with the "always on" convenience that truly ubiquitous wireless broadband will offer, wireless broadband can bring numerous benefits in the form of increased productivity and economic growth.

Wireless broadband applications already are having a significant impact on the way people live, work, and learn. As wireless technologies continue to evolve, wireless broadband applications will result in even greater changes in the way individuals, businesses and governments function. Wireless broadband services of the future promise significantly higher bandwidths and devices that are more sophisticated and user-friendly.

Impediments to wireless access technologies

There are potentially enormous economic and other advantages to be achieved through full deployment of advanced wireless broadband technologies. Before these benefits can be realized, however, PCAST believes that there are several challenges to be faced. These include (1) a shortage of suitable spectrum for both licensed and unlicensed wireless services; (2) the costs of deploying wireless networks; (3) legitimate concerns about the security of existing wireless networks; and (4) concerns about the future interoperability between new wireless technologies and applications. We discuss each of these issues in turn.

Spectrum

Wireless communications are transported through air and space on designated frequencies in a section of the electromagnetic spectrum known as the radio spectrum. Some wireless providers (such as PCS, cellular, terrestrial fixed wireless providers and other fixed and mobile providers) operate on licensed spectrum; others (such as wireless LAN providers that operate under the 802.11 standards) use spectrum that is unlicensed, and thus open to multiple users on a shared basis.

Despite significant technological advances that already have expanded those portions of the electromagnetic spectrum that can be used for mobile wireless communications, the amount of spectrum that can support such communications remains limited. In an effort to address this spectrum shortage, on July 23, 2002, the Administration issued an "Assessment of the Viability of Accommodating Advanced Mobile Wireless (3G) Systems in the 1710-1770 MHz and 2110-2170 MHz Bands," proposing to make available up to 90 MHz of valuable spectrum for 3G services.

PCAST applauds the Administration for taking this important first step in ensuring that sufficient spectrum is made available in the long term to support the continued development and roll-out of wireless broadband technologies. PCAST urges the Administration to expeditiously conclude the process that will bring this spectrum to the marketplace.

PCAST calls upon the Administration to continue to work to address the spectrum shortage by exploring other methods for freeing up additional spectrum to support advanced wireless broadband deployment. In particular, the Administration should consider: encouraging more efficient use of federal, state, and local and commercial spectrum that is already in use (through spectrum sharing and other mechanisms); reallocating spectrum that has been allocated to existing users but which is lying fallow; pursuing market-based approaches for meeting federal users spectrum needs; and facilitating the creation of secondary markets for spectrum to expedite and remove the transaction costs associated with the process of acquiring spectrum.

Finally, PCAST calls upon the Administration to work to more fully align its spectrum allocations with spectrum allocations globally. By ensuring that domestic spectrum allocations, where appropriate, are more closely aligned with international spectrum allocations, the U.S. can help to ensure that as broad a market as possible exists for companies focusing their R&D efforts on developing the technologies and applications of tomorrow.

Cost

Although many of the costs associated with the wide-scale deployment of wireless broadband services and applications are declining, certain factors continue to threaten the widespread adoption of wireless as a viable alternative or adjunct to wireline broadband.

For example, "[customers'] perception regarding the return on investment in next-generation technologies remains shaky. According to a study commissioned by the Information Technology Association of America, 32 percent of respondents with dial-up Internet connections felt that it would be too expensive to upgrade to faster service."[13]

PCAST believes that the Government, like the private sector, can significantly increase its efficiency and productivity by incorporating wireless broadband technologies in its information technology and communication systems. While such uses increase demand for specturm, the demand generated by government adoption of wireless applications could help provide the "critical mass" necessary to make consumer and business investment in similar or complementary technologies or services economically rational.

As it considers future spectrum allocations, the Administration should continue to pursue flexible use and spectrum sharing policies for licensed spectrum as well as through the increased allocation of spectrum for unlicensed services to support further broadband applications.

Security

As noted above, wireless networks are bringing dramatic changes to the landscape of computer networking. Consumers, educational institutions and businesses around the world are relying increasingly on wireless networks as a means to increase productivity and allow users to access e-mail, schedule meetings, and access files and applications regardless of where they are in their home, campus or office. With increased reliance on wireless data networks, consumers and businesses are increasingly concerned about network security and privacy. Wireless security technologies are available. The Administration should promote their implementation and plug-and-play ease of use.

PCAST applauds the Administration for the recent Report on Wireless Network Security issued by the National Institute of Standards and Technology ("NIST") to develop policy recommendations to enhance wireless security. PCAST recommends that the Administration continue such efforts in the funding of research and development, in the evolution of voluntary standards in cooperation with industry and in pursing other appropriate policies that foster strong wireless security.

PCAST also calls upon the Administration to increase consumer awareness of ways to manage and protect the security and privacy of wireless networks, rather than discouraging the use of wireless technology as the industry continues to evolve.

Home Networks

One-third of U.S. households have two or more computers at home.[14] As more and more families rely on multiple computers and embrace broadband at home as a primary means of achieving connectivity, families are discovering that wireless technologies allow them to connect all of their home computers to each other and to a single high-speed connection. Simultaneous access to the Internet makes online tasks more accessible for the whole family, such as telecommuting, distance learning, and keeping in touch with long-distance relatives and friends. In the past few years, home networking also has become easier and less expensive to install.

As with wireless broadband generally, wireless home networking offers significant consumer benefits that wired connections do not. Today's wireless technologies — such as the WiFi, or 802.11 standard — can allow consumers to roam around the house completely unfettered, with

an adequate range to allow family members to maintain a continual high-speed Internet connection.[15] Wireless home networking products are also an option for homes and apartment buildings with wiring challenges or for home users who want the freedom to use laptops brought home from school or the office.

Home networking's rise in popularity makes it a clear area of focus for wireless service providers and manufacturers seeking to increase broadband penetration rates. But increased consumer uptake of home network devices depends on resolution of the impediments discussed above. Through greater consumer confidence and awareness of available security protections, additional funding for research and development of security measures, and lowered cost of technology for consumers as a result of lower costs to the industry, consumer investment in wireless broadband can continue to serve as a key driver of our country's economy.

Interoperability/Interference Issues

In order for consumers and businesses to willingly embrace wireless broadband as a viable means of achieving connectivity, the industry must provide some degree of assurance that such technologies will both be compatible with other existing and future applications and operate free from harmful interference. Wireless broadband products and services must be based on open, global standards, protocols and interfaces, with appropriate protections for the investments in proprietary technologies and standards. Applications and platforms should be as interoperable as possible, providing seamless geographic and inter-generational roaming. Only by overcoming these forward and backward compatibility and interference concerns will wireless broadband providers be able to make a strong contribution to the broadband applications market.

PCAST recognizes the contributions made by the IEEE, the Wireless Ethernet Compatibility Alliance (WECA), the Open Mobile Alliance and other industry organizations to ensure that as additional wireless broadband devices are introduced into the marketplace they can communicate efficiently with and do not interfere with devices already in use. However, PCAST calls upon the Administration to promote the benefits of interoperability and pursue policies designed to expand the market for the entire mobile industry by removing barriers to global user adoption and ensuring seamless communication between applications.

Other Issues: Rights of Way for Broadband Infrastructure Build Out – Wireless & Wireline

Access to public rights-of-way (ROW) – streets, roads and other public lands -- is essential to the deployment of broadband networks, whether wireline or wireless.

If ROW access is unfairly denied, delayed, or burdened with unjustified costs, broadband deployment is slowed, and our citizens are deprived of access to vital communications facilities.

A variety of Federal, State, and local government authorities manage ROW in the U.S. It should be a priority of this Administration to ensure that ROW issues are dealt with in a balanced manner that facilitates prompt ROW access for broadband networks while preserving legitimate government interests to protect public health, safety and welfare and ensuring that government

entities are fairly compensated for the costs of managing their rights-of-way and that disruption of rights of way is minimal.

The National Telecommunications & Information Administration (NTIA) and other officials in the Department of Commerce have consistently highlighted ROW access as a key barrier to broadband deployment that must be addressed. Nancy J. Victory, Assistant Secretary of Commerce for Communications and Information, and NTIA Administrator, has succinctly outlined four broad categories of issues that arise in the ROW context:

1. *Information Collection:* Broadband providers operating across multiple jurisdictions are often required to supply the same information in applications to numerous permitting authorities. To the extent possible, ROW managers should work to streamline and standardize their applications to save time and reduce costs.

2. *Timeliness of Processes:* Broadband providers need to obtain rights-of-way permits on a timely basis. Otherwise, undue delay can increase the costs of deployment and can sometimes prevent deployment altogether. ROW managers should adopt rules or procedures, where feasible, to ensure timely and appropriate action on ROW applications and appeals.

3. *Fees:* The nature and amount of fees charged to broadband providers vary widely across different jurisdictions. Where possible, ROW managers should ensure that ROW fees are appropriate and reasonable and do not unfairly impede the deployment of broadband networks.

4. *Remediation and Maintenance:* ROW managers have a legitimate interest in ensuring that broadband providers take appropriate action to remediate and maintain the ROW that they use. At the same time, ROW managers should ensure that remediation and maintenance requirements are reasonable and do not place undue burdens on broadband providers.

PCAST lauds the Administration's leadership on this issue through NTIA's interagency Federal Rights-of-Way Working Group and NTIA's work with State and local ROW managers. PCAST also commends the FCC for focusing on ROW in its upcoming Public Forum on Rights-of-Way Issues. But PCAST asks the President to make this a special priority in urging state and local officials to make elimination of ROW barriers to broadband deployment job one.

A Concluding Note

The design of broadband systems and the decisions to deploy them are appropriately the work of the private sector. But the public sector can and should play a reliable supporting role. PCAST looks to the high tech industries to continue to lead American innovation in broadband development. We urge the Administration to support those efforts as we have noted above to help enhance investment in and demand for broadband and to make the benefits of these technologies available to all Americans.

Appendix A -- A Review of Policy Options

The matrix presented here identifies six policy 'whitepapers' recently put forward by a diverse sample of industry, scientific and community groups who have explored the broadband issue. Each has a unique point of view and emphasis. But arrayed here in matrix format to compare the policy recommendations of each group we find a striking coherence and complementarity. In our own recommendations we have built upon this work, however, we do not endorse every proposal presented below; in particular, some of these proposals would run counter to our general recommendation of avoiding unwarranted Federal intervention in the marketplace. For our present purposes, the chart sets aside a large number of supply-side regulatory issues addressed in these studies that more appropriately represent the domain of the FCC, an independent regulatory agency. Given the partial summaries provided here, we encourage interested readers to consult the full reports available at the websites listed at the bottom of the matrix, again noting that this is a reference rather than an endorsement.

Groups / **Reports**	Computer Systems Policy Project	TechNet	Semiconductor Industry Association	National Research Council Computer Science and Telecommunications Board	Information Technology Industry Council	Alliance for Public Technology
	Building the Foundation of the Networked World (Jan 2002)	**A National Imperative: Universal Availability of Broadband by 2010 (Jan 2002)**	**Increased Broadband Deployment (Jan 2002)**	**Broadband: Bringing Home the Bits (Jan 2002)**	**Ten-Point Plan to Bring Broadband to More Americans (May 2002)**	**Advanced Services, Enhanced Lives (May 2002)**
Overall National Policy	Adopt a National Vision for Broadband	Make Broadband a National Priority	Establish National Goals for Broadband	Foster Widespread Deployment and Use of Broadband	Advance the Deployment of Widespread, High-speed, Affordable Broadband to all Americans	Create a National Broadband Policy that Accelerates Deployment
	Set clear goals: 100 million homes - 100 Mbps by 2010	Set clear goals: 100 million homes - 100 Mbps by 2010	Set clear goals: 100 million homes - 100 Mbps by 2010	Define dynamically to reflect today's applications and stimulate new ones		
State & Local Policy Initiatives	State & local review policy to reduce barriers to broadband	Streamline state and local regulation		Establish federal-state policy supporting local initiatives to foster competition	Minimize barriers to rights-of-way access	
	Review building & road codes to encourage new trenching techniques	Limit exorbitant local fees for rights of way				
	Federal initiative to identify best practices for local rights of way regulation	Encourage interstate consistency of regulation		Establish national clearinghouse to raise awareness, provide technical assistance, best practices		

Research & Development	Commit to Further R&D		Support R&D including nanotech for new broadband infrastructure	Support R&D on access techs, alternative content and services, and on economic, social, and regulatory factors		Support for federal demonstration projects
		Permanent R&D tax credit	Boost university research in IT	Gov't-funded university research complements industry activity.		
		Strong federal funding of basic research	Ensure reliable operation of critical systems			
			Develop scalable Internet	Research architectural options for fiber cost reduction, wireless access,quality of service, reliability, social and economic factors		
			Support telemedicine research			
Promote Industry Action						
	Promote ease of use					
	Promote interoperability					
	Promote network security					
	Promote richer content			Promote richer content—leverage R&D		
	Resolve copyright issues				Promote industry-led solution to digital rights management	
Targeted Tax Incentives	Congress should adopt tax incentives for broadband	Tax incentives should encourage broadband deployment		Provide financial incentives for underserved and high-cost areas	Enact broadband tax credit	Create investment incentives - tax credits for broadband deployment
	Broadband tax credit for rural areas	Tax incentives should be technology neutral	Accelerate tax depreciation for broadband infrastructure		Enact IT/broadband/wireless asset depreciation reform	
	broadband tax credit for small businesses					

Government Initiatives						
eGovernment		Promote e-Government	Expand e-Government	Support development of eGovernment		
Telework			Distributed work represents economic advantage; expand research on broadband telepresence	Expect, support telework as a demand driver	Support telework initiative	
Community Initiatives				Explore public-private partnerships, aggregation of demand		Facilitate community initiatives for aggregation of demand
Security	Public and private investment in network security	Broadband enables more effective homeland security	Broadband enables physical and economic national security through distributed processes	Support security improvements, as a demand driver		
Economic Growth		Promote broadband through procurement		Provide planning grants to localities to explore options for deployment	Promote government as broadband consumer and leader	
Public Health & Healthcare				Support development of new medical applications		Telemedicine: services to those who need them, where and when they need them
Education	Support e-learning		Support distance learning initiatives	Support new educational applications		
eCommerce	High-performance broadband will make eCommerce more appealing		eCommerce increases economic efficiency	Nurture eCommerce as demand driver	Target small business broadband deployment	

Computer Systems Policy Project www.cspp.org
TechNet www.technet.org
Semiconductor Industry Association   sia-online.org
National Research Council Computer Science and Telecommunications Board   www.cstb.org
Information Technology Industry Council   www.itic.org
Alliance for Public Technology www.apt.org

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[1] Robert W. Crandall and Charles L. Jackson, Criterion Economics LLC, The $500 Billion Opportunity: Benefits of Widespread Diffusion of Broadband Internet Access, July 2001. There have been several estimates of the economic benefits of broadband, not all of them, however, this high. The precise estimation of economic benefits is difficult and remains an area of controversy.

[2] Ibid.

[3]   Gartner Dataquest applied the principle of correlation of teledensity and GDP per capita to create a broadband model – the model is based on the International Telecommunications Union (ITU) model tracking teledensity and GDP worldwide. Gartner defines "true broadband" as broadband to the home with aggregate downstream capabilities of at least 10 Mbps.

[4]   U.S. Department of Commerce, Economics and Statistics Administration, *Digital Economy 2002*, (Feb. 2002).

[5]   The $500 Billion Opportunity at 2.

[6]   Council of Economic Advisers, Economic Report of the President, p. 32, January 2001; Karl Whelan, Federal Reserve Board, "Computers, Obsolescence and Productivity," p. 25, February 2000; Stephen Oliner and Dan Sichel, Federal Reserve Board, "The Resurgence of Growth in the Late 1990's: Is Information Technology the Story?" *p. 2,* May 2000; Congressional Budget Office, "The Budget and Economic Outlook," Fiscal Years 2001-2010, Section 4 of 14 and Appendix A, January 2000; Dale W. Jorgensen and Kevin J. Stiroh, Federal Reserve Bank of New York, "Raising the Speed Limit: U.S. Economic Growth in the Information Age," pgs. 2-8, May 1, 2000.

[7]   "The Collaborative Commerce Value Statement: A $233 Billion Cost Savings Opportunity Over Six Years," Module B-to-B Commerce and Applications, Vol. 6.6, Yankee Group, June 14, 2001. The industry segments analyzed include food manufacturing, beverage and tobacco product manufacturing, textile mills, textile product mills, apparel manufacturing, leather and allied product manufacturing, wood product manufacturing, paper manufacturing, printing and related support activities, petroleum and coal products manufacturing, chemical manufacturing, plastics and rubber products manufacturing, nonmetallic mineral product manufacturing, primary metal manufacturing, fabricated metal product manufacturing, machinery manufacturing, computer and electronic product manufacturing, electrical equipment, appliance, and component manufacturing, transportation equipment manufacturing, furniture and related product manufacturing, miscellaneous manufacturing, mining, merchant wholesale durable, merchant wholesale non-durable, retail, and construction.

[8]   Stephen B. Pociask, *Building a Nationwide Broadband Network: Speeding Job Growth*, New Millennium Research Council, pg. 7, February 25, 2002, http://www.newmillenniumresearch.org/event-02-25-2002/jobspaper.pdf

[9]   *Ibid*.

[10]   *See Engler Proposes Broadband Jumpstart to Help Spur Michigan's* Economy, Press Release, The Office of the Governor, Nov. 2, 2001. http://www.michigan.gov/gov/1,1431,7-103-703-4779--M,00.html .

[11]   Executive Summary Cap Gemini Ernst & Young Analysis of the VISICU eVantage Program at Sentara Healthcare.

[12]   Puskin, D.S., "An Overview of Telemedicine: Through the Looking Glass," in Telecommunications for Nurses: Providing Successful Distance Learning and Telehealth, M.L. Armstrong and S.S. Frueh (eds.), Springer, N.Y., 2003.

[13]   *See* CSPP paper at 19.

[14]   *See* Bill Howard, Mark Saltzman, and Don Willmott, *The Well-Connected Home*, available at http://www.yil.com (Aug. 5, 2002).

[15]   *See* N'Gai Croal and Bruce R. Jaffe, *Technology: Networking Made Easy*, Newsweek, July 22, 2002, at 55.