



“We must be aggressive about the deployment of broadband.”
- President George W. Bush, June 13, 2002

UNDERSTANDING BROADBAND DEMAND *A Review of Critical Issues*

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The following analysis examines the state of broadband demand and usage in the United States, identifying successes, challenges and actions to promote more aggressive uptake. Our goal is to identify trends, issues and opportunities for policy makers and business leaders.

Over the past year the Technology Administration (TA) at the U.S. Department of Commerce has focused its attention on demand side issues impacting broadband roll-out and adoption. In addition to hundreds of meetings with stakeholders in industry, education, consumer groups, and state and federal policy-makers, TA held (or will hold) expert roundtables to better understand demand-side challenges and opportunities including:

- [Digital Content & Rights Management](#)
- [Broadband Demand and Business Productivity](#)
- [Innovation, Demand and Investment in Telehealth](#)
- Summit on the Use of Advanced Technologies in Education and Training (9/27/02)
- [How Information Technology Is] Transforming Enterprise (1/27-28/03)

Based upon our investigations and analyses to-date, we believe demand side factors – ready availability of easily understood, value-adding business and consumer applications at reasonable prices – are critical determinants of the pace with which broadband is adopted and merit greater attention. Wildly popular services and applications drove adoption of earlier technologies, and they will be the key to accelerating broadband deployment as well.

Of course this is not to suggest that there are not significant supply-side questions that need to be considered carefully. Regulatory considerations have impacted investment, competition and innovation in the telecommunications industry for most of the 20th century and there are very important questions that need to be resolved across all platforms to promote ubiquitous broadband availability, needed infrastructure upgrades and a competitive broadband market. However, these supply-side questions are currently before the FCC, NTIA or other bodies and are not the subject of this analysis or the work in the TA.

Text is underlined and in blue where providing a hyperlink to source material or further resources. At all times we encourage and welcome feedback and suggestions.

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EXECUTIVE SUMMARY

Broadband – high-speed, always-on Internet connectivity – represents the next phase in the evolution of the Internet. Most experts predict broadband will enable applications and services that transform our economy, education, health-care, R&D, homeland security, military effectiveness, entertainment, government and the quality of life for citizens around the world. The deployment and usage of broadband will significantly impact the global competitiveness of nations and businesses in the future.

Not surprisingly, many nations, states, cities and communities are trying to accelerate the deployment and usage of broadband networks. To date, these efforts have predominantly focused on the supply side – promoting infrastructure build-out and determining appropriate competition and regulatory policies. Since the primary role of government economic policy is to set an environment that encourages capital formation, rewards risk and encourages competition, investment and innovation, supply side inquiries remain vitally important. Supply side decisions are also critical because we'll need significant upgrades of existing network infrastructure to supply the last mile bandwidth required for advanced applications – today's broadband will be tomorrow's traffic jam, and the need for speed will persist as new applications and services gobble up existing bandwidth.

It is also important and appropriate to consider the demand side – factors impacting business and consumer uptake. President Bush has instructed his Administration to be aggressive about the deployment of broadband, and while the FCC, NTIA and others have aggressively focused on supply side issues, the President's Council of Advisers on Science & Technology (PCAST) and the Technology Administration (TA) have turned our attention to the demand side. TA's efforts have included multiple expert roundtables, independent research and hundreds of stakeholder discussions to assess the factors impacting the pace of broadband uptake and usage by consumers.

We have found that demand for broadband is robust, although as with most new technologies, broadband supply currently exceeds demand (in all but the most rural markets). There are several factors that impact the robustness of demand. For consumers these include concerns over cost; disappointment with the quality and types of content available, especially lack of movies, music and local information; inadequate customer support and lack of plug-and-play consumer premises equipment; and lack of confidence in the Internet due to security and privacy concerns. For businesses, barriers to greater broadband demand stem from price concerns (exacerbated by economic uncertainty); lack of access to DSL or cable; failure to perceive the returns on investment in broadband; lack of understanding about how to implement broadband business solutions that make sense for company strategy; and concerns over security and other legal uncertainties.

The factor most likely to accelerate broadband demand is the creation and deployment of easily understood, value-adding business and consumer applications at prices that meet the needs of the market. New applications and services that consumers want and businesses need will provide the tipping point for broadband demand and usage. At the same time federal, state and local leaders can take steps to accelerate broadband demand, and we highlight many such steps in the final section of this report. We conclude that, for broadband, the sky is the limit and it is not falling yet. Nevertheless, actions to accelerate demand are justified and valuable.

WHERE DO WE STAND?:

The State of Broadband Demand

The [wealth of nations is changing](#). While prior centuries were dominated by nations with superior industrial or agricultural capabilities, the innovation age rewards new competencies and strengths. Knowledge – ideas and the people who generate them – is the new coin of the realm. Innovative capacity is the key driver of future economic prosperity. Cross-cutting emerging technologies such as genomics, bioinformatics, quantum computing and [nanotechnology](#) promise even faster change and deeper disruption in the future. It is no exaggeration to predict that there will be more change in the next 30 years than we witnessed in all of the 20th century.

While America enters this new age of innovation following 60 years of global technology preeminence, our future innovation leadership is anything but assured. In fact, it's very much at stake. Our ability to remain a global technology (and thereby economic) leader will depend upon a variety of factors including:

- our ability to attract, retain, and educate the best and brightest scientists and technologists;
- our support for world-class R&D and innovation in the public and private sectors;
- our success in fostering a business environment that rewards risk and encourages entrepreneurship; and
- our ability to maintain a world-class information infrastructure.

With respect to this last point – maintaining a world-class information infrastructure – there may be no element more critical today than ubiquitous and affordable high-speed Internet – broadband. The deployment and usage of broadband networks will significantly impact the global competitiveness of nations and businesses in the 21st Century.

INTERNATIONAL COMPARISONS

The importance of broadband has not been lost on leaders around the world. In August 2002, President Bush proclaimed that “we must bring the promise of broadband technology to millions of Americans... [i]n order to make sure the economy grows... [and] to stay on the cutting edge of innovation here in America.” ([Bush Remarks at the Waco Economic Forum, Aug. 13 2002](#)). Writing in the *London Times* in March 2002, UK Prime Minister Tony Blair and Swedish Premier Goeran Persson observed that “broadband communication is a key element of Europe's future competitiveness.” For years PM Blair has been calling on Britain to be “the most competitive and extensive broadband market” among the G7 countries by 2005, while [Canada](#), [Japan](#), [Korea](#), [Australia](#), [Italy](#), China and other leading nations offer aggressive plans to boost broadband penetration. Worldwide broadband subscriber growth is predicted by In-Stat/MDR to grow 53% in 2002, from 30 million to 46 million. ([In-Stat MDR, July 22, 2002](#)).

While the United States has the largest total number of Internet users, broadband users, businesses online, and e-commerce transactions (both B2B and B2C, both by volume and value), other nations are gaining ground fast. ([Nielsen Net Ratings, Aug. 15, 2002](#)). South Korea is significantly ahead of the rest of the world in percentage of total population using broadband and percentage of Internet users with high-speed access. The following chart highlights relative positions at the end of 2001 among the broadband leaders and is based on data provided by eMarketer analyst Ben Macklin in his comprehensive August 2002 report “[Broadband & Dial-Up Access](#).”

International Broadband Penetration as of Dec. 2001

COUNTRY	BROADBAND HOUSEHOLDS (in thousands)	BROADBAND AS % OF TOTAL HOUSEHOLDS	INTERNET HOUSEHOLDS (in thousands)	INTERNET AS % OF TOTAL HOUSEHOLDS
United States	11,200	10.4%	56,379	52.3%
South Korea	7,500	51.7%	8,265	57.0%
Japan	2,570	5.8%	21,497	48.2%
Canada	2,300	19.7%	6,505	55.6%
Germany	2,090	5.4%	14,858	39.1%
Taiwan	1,125	18.2%	2,604	42.0%
France	605	2.5%	7,448	30.4%
Netherlands	550	8.1%	4,196	61.7%
Hong Kong	545	26.0%	1,241	59.1%
Sweden	542	13.4%	2,546	62.1%

Source: eMarketer, "[Broadband & Dial-Up Access](#)," Aug. 2002.

U.S. SUPPLY OF CURRENT GENERATION BROADBAND (CABLE & DSL)

This chart does not show the *availability* of broadband to citizens in each country, nor are we aware of such an international comparison. Yet no analysis of broadband demand can proceed without an initial look at supply – availability – of current generation high-speed connections.¹ In the U.S., deployment of the current generation of broadband appears by most estimates to be proceeding rapidly:

- The National Cable & Telecommunications Association reports that over 75 million U.S. households can now get cable modem broadband access if they want it. ([NCTA](#), Sep. 2, 2002).
- In recent statements, the regional Bell operating companies reported relatively wide and growing broadband availability:
 - Bell South reported that it had increased its broadband coverage to 72% of the households it serves (*July 22, 2002*).
 - SBC reported broadband availability to 26 million customer locations, roughly 64% of its wireline customer locations (*SBC DSL Update, Aug. 2002*).
 - Verizon said it had “deployed DSL to central offices serving 79% of the company's access lines” as of the end of 2001 (*Verizon Investor Quarterly, Jan. 31, 2002*).
 - Qwest has stated an intention to increase from 45% broadband availability at 2001 year-end to 70% by the end of 2002 (*Dec. 31, 2001*).
- In 2001 Morgan Stanley Dean Witter estimated that 90% of Americans will be able to sign up for either DSL or cable by the end of 2002, although other data has suggested that only 31% will have a competitive choice between these transmission platforms.

¹ It is important to observe that there are few consistent definitions of what constitutes “broadband.” International definitions vary, and companies are marketing “broadband” services at speeds ranging from 40kbps to 100mbps.

- The Federal Communications Commission (FCC) recently concluded that “advanced telecommunications capability is being deployed in a reasonable and timely manner,” with 97% of Americans living in zip codes where cable or DSL service is available (although not necessarily directly available to them). ([FCC, “Third Report on the Availability of High Speed and Advanced Telecommunications Capacity,” Feb. 7, 2002](#)).
- The most current study of broadband availability to U.S. businesses that we could find was from April 2001. It found 56% of small businesses, 85% of medium size businesses, and 87% of large businesses had access to broadband services if they wanted them. (*eMarketer “Benefits of Broadband” report citing Cahners In-Stat Group, Apr. 1, 2001*).
- Broadband availability has been more concentrated in urban areas with greater linear population density, with smaller and rural communities seeing deployment less rapidly. Satellite and fixed-wireless broadband solutions continue to emerge.

It is important to note here that the current generation of broadband technologies (cable and DSL) may prove woefully insufficient to carry many of the advanced applications driving future demand. Today’s broadband will be tomorrow’s traffic jam, and the need for speed will persist as new applications and services gobble up existing bandwidth. While long-haul data transport capacity exploded in the 1990s,² last-mile capacity upgrades have proceeded much more slowly. Estimates for new investments needed to build out a significantly more robust and capable national broadband Internet range from \$100 billion conservatively estimated by the [National Research Council](#) to \$200 billion according to Bear Stearns, to more. Regulatory certainty, reasonable returns on investment and long-term competitive markets are all going to be necessary if the private sector is going to make these investments and deploy the next generation networks.

U.S. UPTAKE / DEMAND

Broadband uptake among U.S. households has also been growing very rapidly, fueled by robust demand.

- Nationwide, new broadband subscriptions increased by 400% between June 2000 and June 2002 to 24 million *users* (not households), according to the Pew Internet & American Life Project ([Pew, June 25, 2002](#)). Pew reports user growth of 33% in the first 5 months of 2002, while the [FCC](#) reported growth of 33% in the second half of 2001.
- Consistent with these findings, [NCTA](#) reported 67% cable broadband user growth between August 2001 and August 2002. For Q2’01 to Q2’02, [Verizon](#) reported 79% DSL user growth, [SBC](#) 67%, [Qwest](#) 37% (with 81% DSL *revenue* growth), [Bell South](#) 111%, and [Earthlink](#) 74.6%.
- Nielsen NetRatings reported strong broadband demand and subscriber growth in some of the biggest U.S. cities between April 2001 and May 2002 – up 71% in New York City, 88% in Los Angeles, 48% in Boston, 153% in Washington, DC and 21% in San Francisco. ([Nielsen NetRatings, May 2002](#)).

² [Andrew Odlyzko](#), a researcher at the University of Minnesota, noted that fiber transmission capacity grew over 25,000% between 1998 and 2001 (due to new fiber deployments and new DWDM technologies), while network usage (demand) only grew 400%.

- At this pace, consumers are adopting current broadband technologies at a faster pace than CD players, cell phones, color TVs and VCRs. (*R. Pepper, FCC*).
- As with the deployment of almost all new technologies, higher income households are showing greater demand for broadband than lower income households.³ This likely reflects greater purchasing power, higher dial-up Internet penetration, higher PC ownership and higher education levels. [Leichtman Research Group](#) reported on online demand by income on September 17, 2002, finding:

INCOME	HAVE BROADBAND	WANT BROADBAND	NOT ONLINE
< \$35,000	4%	12%	70%
\$35k-\$50k	11%	20%	51%
\$50k-\$75k	14%	24%	40%
\$75k-\$100k	17%	30%	29%
Over \$100k	28%	37%	15%
Mean	\$69,200	\$62,700	\$41,700

(*"Broadband Internet Adoption Driven by Higher Income Groups," Leichtman Research Group, Sept. 17, 2002*).

Broadband uptake among U.S. businesses also appears to be robust.

- A survey commissioned by the [Technology Policy Group](#) and released in September 2002 by eCom Ohio found 48.3% of U.S. businesses using some broadband service, up 27% from the prior year. (*TPG / eCom Ohio, "Ohio and National Business Online Survey 2002," Sept. 2002*).
- Nielsen NetRatings estimated faster at-work broadband growth in 2001 – 42% -- to 25.5 million office workers. (*Nielsen NetRatings, Mar. 5, 2002*).

Overall, broadband Internet usage accounted for more than half of all time spent online in January 2002, outpacing dial-up Internet access for the first time, according to Nielsen/NetRatings. (*Nielsen NetRatings, Mar. 5, 2002*). And projections for future U.S. broadband demand remain bullish, with [Solomon-Wolff Associates](#) predicting around half of the Internet users in the U.S. will access via current generation broadband by 2004. (Of course, similar bullish predictions were hallmarks of the Internet bubble of 1999-2000).

As encouraging as the access and subscription statistics are, we have a long road ahead. To realize the true benefits of broadband, nations will want to encourage ubiquitous access and widespread usage of higher-speed networks – to close the demand gap. Right now only 20% to 30% of the U.S. Internet population uses broadband, and only 60% of the overall population has any Internet service at all. Similarly, in South Korea, over 80% of households are expected to have access to broadband by the end of 2002, but some observers suggest no more than 60% of households will subscribe despite government subsidies. (*Korea Times citing the Korean Ministry of Communications and Information, Jul. 19, 2002 / Point Topic, Sep. 3, 2002*).

³ More rapid deployment of new technologies in higher income / more urban areas is neither surprising nor symptomatic of a serious problem or market failure – yet. It is particularly encouraging to observe recent Education Department statistics showing 90% of the lowest income schools with access to broadband (as compared to 84% of the wealthiest). Lowest income schools had the fastest adoption rates as well (21% gain in one year). (*Internet Access in U.S. Public Schools and Classrooms: 1994-2001, Sept. 2002*).

Before turning to policies and actions that impact the pace of broadband demand, it is useful to consider why we should care. What makes broadband so valuable and important? What are some of the most promising future broadband applications and how might they impact us?

WHERE ARE WE GOING?:

Some Future Broadband Applications And Their Potential Impact

The following section highlights the myriad ways in which broadband can, or is predicted to, transform the economy, education, health-care, R&D, homeland security, the military, and the quality of life for seniors and those with disabilities, among others. These possibilities make clear that there is no shortage of “killer” applications in the pipeline, and their impacts are likely to be very significant.

As these services and applications become available, they will drive broadband and justify the investment for citizens, businesses and governments. At the outset, however, it is worth observing that broadband alone has minimal impact. Businesses simply switching to high-speed access will not suddenly save millions of dollars or begin producing more competitive goods or services. Likewise, consumers should not expect instantly better lives or more fulfilling relationships just because they signed up for broadband.

Broadband is an incredible *enabling* technology. It allows businesses that are willing to embrace Internet business solutions to transform business processes and realize significant returns on investment. It offers consumers new opportunities to work or learn more productively (at their desks or from home), publish multimedia, switch from viewers of entertainment to participants, and – most importantly – dramatically expand their communication possibilities.⁴ But these transformations are not always plug-and-play solutions – they often take work and effort. That said, the following broadband-enabled applications should ensure widespread deployment and justify efforts to stimulate growth.

ECONOMIC BENEFITS OF BROADBAND: *Promoting Jobs, Productivity and Sustained Growth*

Economists are already predicting significant macroeconomic benefits from the proliferation of broadband networks. It is believed that widespread broadband usage can extend the IT revolution and further improve national and regional productivity, helping to promote robust economic growth and increase our standard of living.

- In the most extensive economic study of broadband to-date, economists at the [Brookings Institution](#) estimate widespread, high-speed broadband access will increase our national GDP by \$500 billion annually by 2006. (*Crandall and Jackson, “The \$500 Billion Opportunity: The Potential Economic Benefits of Widespread Diffusion of Broadband Internet Access,” July 2001*).

⁴ **Communication remains the single biggest reason for going online.** Email is the most popular activity among dial-up, broadband and mobile Internet users. IP telephony, video conferencing, digital photo exchanging, unified messaging, and e-learning all represent broadband-enabled enhancements to a basic need – communication. One can get caught up in technologies and applications but when one gets down to it, communicating with others is the primary driver of Internet use.

- In a [New Millennium Research Council study](#), TeleNomic Research predicts that building and using a robust, nationwide network will expand U.S. employment by an estimated 1.2 million new and permanent jobs. (*Pociask, "Building a Nationwide Broadband Network: Speeding Job Growth," Feb. 25, 2002*). These jobs include direct labor associated with deploying and maintaining broadband investment, direct labor associated with manufacturing the infrastructure components and consumer premises equipment, and indirect labor associated with creating services and applications that would ride on advanced networks.
- A separate [Brookings study](#) from May 2002 suggests that "failure to improve broadband performance could *reduce* U.S. productivity growth by 1% per year or more." (*Ferguson, "The United States Broadband Problem: Analysis and Recommendations," May 31, 2002*).
- Experts convened by the Technology Administration at a roundtable discussion of broadband and business productivity identified broadband as *the* critical element enabling applications that transform business processes, such as supply chain management, customer relations management, telework, collaboration, virtual manufacturing, e-learning, and video conferencing. (*TA Roundtable on [Broadband and Business Productivity](#), Mar. 25, 2002*).
- 372 U.S. IT professionals responding to a July 2002 InfoWorld survey reported the top five broadband benefits as:
 - Improved productivity (78%)
 - Faster desktop access (76%)
 - Ability to handle data-intensive applications (57%)
 - Ability to handle more users (53%)
 - Ability to handle multimedia (51%)
- In the "Net Impact Study" conducted by the University of California-Berkley, the Brookings Institution and Momentum Resources Group credited e-business solutions with cumulative cost savings of \$155 billion to U.S. organizations through 2001. Internet business process solutions are expected to produce \$373 billion in cost savings by 2005 and more than \$500 billion by 2010, based heavily on high-speed applications. (*Varian, "The Net Impact Study," Jan. 2002*).
- National Association of Manufacturing President Jerry Jasinowski predicts accelerated broadband deployment "represents a major priority for continued increases in productivity for [US manufacturers]... particularly for smaller, independent manufacturers, who are less able to afford expensive upgrades." (*NAM, Apr. 2002*).

Because broadband technologies are so new (and continue to evolve), there are no definitive studies of their actual impact on regional economic growth and tech-led economic development. Of course that never prevents economists and technologists from speculating or estimating. [Gartner Consulting](#) predicted that faster broadband deployment in Michigan will help create nearly 500,000 new jobs and \$440 billion of additional economic output over the next 20 years in a 2001 research report prepared for the [Michigan Broadband Development Authority](#).

Specific regional economic development benefits anticipated as a result of greater broadband deployment and usage include:

- Job creation and retention. Broadband availability allows local businesses to remain competitive, operate more efficiently, and access more consumers more quickly and thus grow faster. Smaller manufacturers need access to high-speed networks to remain part of the supply chain of larger players.
- Reduced traffic congestion and automotive pollution through increased telecommuting. (*Macklin, "The Benefits of Broadband," eMarketer, May 2002*).
- More successful industrial growth, recruitment and retention. Information businesses can start and locate anywhere they want, and they tend to look for areas with educated workforces, advanced infrastructures and high quality of life. Knowledge workers expect and require advanced telecommunications infrastructure.
- Improved K-12 education systems. We have just begun to scratch the surface of technology-based improvements to education and have miles to go. Today's children are often immersed in digital technologies their entire lives *except* when they're at school, where technology is inadequately used.⁵ Integrated into learning by trained teachers, broadband connections can improve education for students.
- More productive research and development. A July 2002 Technology Administration roundtable on "BioCenters of Excellence" heard from several biotech and economic development leaders that high bandwidth connectivity is critical to advanced biotechnology research and database access. (That transcript will be online in the Fall).
- Increased start-up and entrepreneurial activities. The Internet enables entrepreneurship, facilitates networking critical to funding start-ups and encourages rapid tech-led economic growth, with broadband empowering smaller players to compete against larger and more established companies. (*See, e.g., National Commission on Entrepreneurship Testimony before the House Small Business Committee, Apr. 3, 2001*).
- Urban core revitalization. In cities around the nation, broadband-enabled cyber districts are transforming large blocks of formerly empty warehousing and manufacturing space into highly sought-after post-industrial hubs. For example, Pittsburgh has turned former steel plants into Digital Greenhouses and research centers incubating new companies and technologies. (*See, e.g., "Knowledge Value Cities," Milken Institute*).
- Improved government efficiencies and service delivery through e-government.

⁵ Education Secretary Rodney Paige recently observed: "[W]e still educate our students based on an agricultural timetable, in an industrial setting, yet tell students they live in a digital age. The problem is not that we have expected too much from technology in education – it is that we have settled for too little. Many schools have simply applied technology on top of traditional teaching practices rather than reinventing themselves around the possibilities technology allows. The result is marginal – if any – improvement." (*See Sec. Paige Preface to 2020 Visions: Transforming Education and Learning Through Advanced Technologies, Sept. 17, 2002*).

Certainly the deployment of broadband will be critical to establishing markets for the next generation of high tech equipment. Increasing the speed and capacity of data networks will enable innovations in semiconductors, applications, computers, communications equipment and devices, driving the next wave of technology investment.⁶ In his exhaustive April 2002 report on “[The Benefits of Broadband](#),” eMarketer analyst Ben Macklin details projections on the growth and economic value of services and broadband-enabled applications such as home networking, interactive TV, streaming media, telemedicine, online music, and e-business, among others.

In addition, greater usage of advanced Internet should help the economy more quickly absorb the extraordinary [excess capacity](#) that resulted from the technology spending boom of the late 1990’s. The great hope of the distressed telecom⁷ and telecom equipment sectors is that increased capacity in last-mile networks will allow greater usage of untapped long-haul capacity and generate revenue opportunities through new services.

BROADBAND AND EDUCATION: *Enabling Anywhere, Any Time, Student-Appropriate Learning*

New technologies are bringing hope and opportunity to those who need them most. We have just begun to scratch the surface of possibilities for using the Internet to improve learning and education, as 14 visionaries convened by the Technology Administration recently predicted. (See [2020 Visions: The Use of Advanced Technologies to Transform Education and Learning](#), Sept. 17, 2002). The more-than 200 Universities connected to [Internet2](#) are experimenting with unprecedented collaborations among researchers and multinational, cross-continent classrooms. [Congress’ Web-Based Education Commission](#) reported in December 2000 that broadband connectivity is a critical element of using information technology to transform and improve education. And online education/training in the workplace is also growing extremely quickly and becoming increasingly sophisticated with widespread broadband in the business sector.

Rapid advancements in the years ahead could enable new learning environments that employ simulations, visualizations, immersive environments, game playing, intelligent tutors and avatars, networks of learners, reusable building blocks of content, and more. The technologies that are coming could permit rich and compelling learning opportunities that meet all learners’ needs, and provide knowledge and training when and where it is needed, all the while boosting the productivity of learning and lowering its cost. The Technology Administration is convening a summit on the potential for

⁶ The Pew Internet & the American Life Project survey reports that broadband users spend more time online, do more things, and do them more often than dial up users. Broadband users create more multimedia content and are more likely to look for technologies such as digital cameras, CD burners, etc. ([Pew](#), Jul. 2002).

⁷ The telecommunications sector is particularly desperate to see accelerated broadband deployment. Telecom is mired in a serious downturn that some analysts blame for over 500,000 jobs lost and \$2 trillion in evaporated market capitalization, with broadband the only “bright spot” according to the *Wall Street Journal*. The sector suffers from extraordinary debt overhang – debts grew 165% while revenues grew just 50% from 1996-2000, according to the Precursor Group. Likewise, new wire less and data services are squeezing traditional carriers’ profit margins, while cautious VC and financial markets are virtually closed to telecom companies due to fears following the bubble and the WorldCom, Global Crossing, Tyco, Adelphia, and other scandals. And telecom and telecom equipment makers also suffer from extraordinary excess capacity, particularly following the boom and bubble of the late 1990s.

advanced technologies to transform education and learning later this month,⁸ and the experts clearly expect future innovations in learning technologies to ride and rely on high-speed networks.

BROADBAND AND THE LIFE SCIENCES: *Transforming Health Care*

Broadband networks present enormous opportunities for life sciences and health care. More than access to medical information and online pharmacies, the real promise of telemedicine envisions citizens getting home check-ups without long drives and long waits, and anytime, anywhere diagnoses. Blood analysis devices in the home could permit online assessments of cholesterol and enzyme levels, anticipating problems *before* they require an ambulance. High-speed wireless connections could allow 24-7 monitoring of patients without confining them to hospital beds, while rural and remote doctors might be able to obtain second opinions from the world's foremost experts. Broadband-based applications such as robotic surgery and remote diagnosis could allow American doctors to answer the President's call for volunteerism by helping others in need around the world *without leaving home*.

In July 2002, the Technology Administration at the Department of Commerce hosted an expert roundtable to explore issues of innovation, demand and investment in telemedicine. ([Innovation, Demand and Investment in Telemedicine Roundtable, June 2002](#)). Experts advised that broadband-enabled telehealth applications offer opportunities to better prevent diseases and provide health care, empower patients and doctors, reduce medical errors, reduce costs and prepare for disasters, *although significant policy, regulatory and coordination barriers must be overcome to achieve to more robust telemedicine usage*. We hope to issue a more thorough report on telemedicine in the coming months, but one thing is clear – the most promising telemedicine applications need serious bandwidth.

We are already seeing the value of high-speed connections for biotechnology research. SRI observed in a February 2001 report on Knowledge-Management Tools that over 1,000 Merck & Co. scientists at four worldwide research sites tap into a bioinformatic database that contains four terabytes of data (expected to grow to eight terabytes in nine months). Don't try this with dial-up. Likewise, high-speed access enables academic scientists to analyze genetic sequences for monthly fees under \$1,000. Before these applications were available online, the technology to analyze the sequences was only available to companies that could afford \$250,000 licensing fees, \$500,000 computer equipment and the staff to manage it. (*The Industry Standard, May 29, 2000*).

BROADBAND AND THE GLOBAL WAR ON TERROR: *Transforming the Military*

Broadband is also core critical to another of the President's top priorities – winning the global war on terrorism. Maj. Gen. Charles E. Croom, vice director for command, control, communications and computer systems with the Joint Chiefs of Staff, identified the need for more bandwidth as the No. 1 technology challenge facing our military in Afghanistan (although these data communications generally ride on wireless and satellite networks presently unavailable to average citizens). ([Government Computer News, Jan. 2002](#)). Broadband boosters should take hope from military efforts to develop and

⁸ On September 27, 2002, experts from industry, government and the education community will gather to discuss the investments, partnerships and technology developments needed to advance progress on innovations needed to advance education technologies. At the same time the Education Department is working on a National Educational Technology Plan – called for in the No Child Left Behind Act – to help plan how we'll integrate these new technologies into education.

improve information technology systems, since applications created originally for defense purposes regularly become commercialized and available for civilian use (as did the Internet itself).

There may be no better example of an organization undergoing IT-enabled business process transformation than the United States military. Post-Cold War, post-Gulf War forces are becoming more mobile and more accurate – light and lethal – increasing effectiveness while decreasing the likelihood of U.S. casualties or civilian collateral damage. The technological core underlying these new systems – from unmanned reconnaissance aircraft, to data links among soldiers on the battlefield, to more efficient procurement systems – is a broadband data network.

BROADBAND AND HOMELAND DEFENSE: *Securing the Home Front*

Broadband can also help enable homeland defense systems. Satellite-delivered broadband connections may permit [real-time cockpit monitoring](#) on aircraft, while high-speed access can provide local public safety workers with access to education and training videos created by FEMA and other expert organizations. Broadband-enabled video conferencing and business e-learning solutions could provide important productivity enhancements, allowing the same economic output despite reduced travel or more distributed organizational structures. Airport security officials will need fast connections to match passenger data against current [biometric](#) or national security databases. And broadband networks are the base upon which advanced knowledge management systems will rest, permitting greater coordination of health or intelligence information, so our experts can make use of real-time data to improve public safety.

BROADBAND AND NEW FREEDOM: *Bringing New Possibilities and New Hope*

The high-speed Internet promises to extend new possibilities to those facing traditional limitations. A recent [report for the National Association of the Deaf](#) observes that broadband-enabled remote interpreting and peer-to-peer signing offer radical opportunities for the deaf. (Bowe, “[Broadband and Americans With Disabilities](#),” 2002). Likewise, a paper published by SeniorNet this year suggests broadband may have greater impact and significance upon American seniors than any other demographic group. (Adler, “[The Age Wave Meets the Technology Wave: Broadband and Older Americans](#),” Jun. 2002). For seniors, broadband can enhance communications with family and friends, expand opportunities for lifelong learning, improve delivery of health care services, support independent living, and create new options for entertainment and interaction with the government. And as video email messages replace written text on a true broadband Internet, communications opportunities may greatly expand for the millions of illiterate Americans presently challenged by text-based Internet communications.

WHAT DETERMINES OUR PACE?: ***Understanding Broadband Demand***

With such extraordinary possibilities, robust broadband demand and usage seems inevitable. Yet many leaders understandably wish to accelerate broadband uptake to realize its benefits more rapidly. To determine the best ways to accelerate broadband usage, one must understand the current market trends in broadband demand. Here’s what we’re seeing among consumers and businesses.

BROADBAND DEMAND AMONG CONSUMERS:

Cost, Content, Convenience, and Confidence

COST.

The most obvious factor limiting broadband demand today is cost. An August 2002 survey by Yankee Group asking dial-up consumers why they were not upgrading to broadband networks found 72% of respondents complaining broadband was “too expensive.”⁹ (*“Revamping High-Speed Access Strategies: Tiered Services Hold the Key to Broadband Adoption,” Yankee Group, Aug. 2002*). Many consumers fail to see the value proposition for investing in broadband, considering it a luxury they cannot afford or not yet worth the \$45-\$55 per month investment.¹⁰ Some consumers believe that broadband is a workplace technology with little value outside the office (and little interest in bringing work home). Gartner Group predicted that only 10% of households in France, Germany, and the UK will have broadband access by 2005 unless prices fall. ([Gartner Group](#), Feb. 2002).¹¹

These sentiments appear to be exacerbated by concerns over price instability – 91% of all broadband providers (that did not go bankrupt in 2001) *increased* price since the beginning of 2001, by an average of 11.4% for DSL and 16% for cable ([ARS research](#), May 2002). Remember too that roughly 40% of Americans have not yet seen the value proposition for subscribing to any Internet service, while almost 75% of dial-up Internet users in the U.S. reported being content with the quality of the service they use in a 2001 Parks Associates Survey. ([Parks Associates](#), Nov. 11, 2001).¹²

CONTENT

Yet even if broadband were free, one should not expect to see 100% usage immediately, as is demonstrated by an experiment being conducted 65 miles southwest of downtown Atlanta. In LaGrange, Georgia, the city is partnering with Charter Communications to offer cable broadband access at almost zero cost for all interested consumers (including WebTV for those without PCs). ([Holsendolph](#), “A Georgia City Decided to Provide Its Residents With a Year of Free Internet Access. But Only Half Have Signed On: Why LaGrange Isn't More 'Wired',” *Atlanta Journal & Constitution*, Sept. 2, 2001). One year after first unveiling this offer, only 29% of citizens had subscribed (down from

⁹ Responses to a 2002 Yankee Group survey on why consumers were not signing up for broadband include:

- 72% said broadband was “too expensive”
- 26% said they “cannot get high-speed access”
- 20% “don’t need” high-speed
- 12% said “installation is too complicated”
- 6% said “installation takes too long”
- 17% offered “other” reasons

¹⁰ Some observers suggest that Korea’s world-leading success in getting consumers to sign-up for broadband is, in part, due to low rates fueled by competition. (See Izumi Aizu, [Asia Network Research](#)).

¹¹ The UK Office of National Statistics reported 387.1% growth in broadband use from July 2001 to July 2002, growth they attribute to falling prices. ([UK Office of National Statistics](#), Sept. 19, 2002).

¹² In fairness, one must note that it is possible many consumers *perceive* greater price barriers than actually exist. At \$45 per month (average estimate), broadband may seem expensive. Yet dial-up consumers with a second line might only need to spend \$10 per month more to subscribe to broadband if they could cancel their current dial-up ISP and second telephone line.

49% during the period of heavy promotion). ([Comments of Charter Communications to the NTIA, Dec. 2001](#)).¹³ City leaders suggest barriers to greater adoption include reluctance to embrace change (often generational), lack of relevant local content, lack of reading ability, and lack of appreciation for the possibilities made available by broadband access. (It is also likely that some percentage of LaGrange citizens worried they would owe monthly payments after the period of free access ended).

It is worth noting that reluctance to embrace new technology is hardly just an American, generational or rural phenomenon. According to research from *Computer Weekly* reported in February 2002, 72% of UK consumers expressed no interest in paying for broadband Internet access. ([NUA citing Computer Weekly, Feb. 2002](#)). A study commissioned by the UK Department of Trade and Industry and Digital Content Forum determined that higher speed and lower prices alone will not be enough to ensure ubiquitous broadband demand. ([DTI/DCF, Jul. 2001](#)).

Content (including communications applications¹⁴) is king. A majority of consumers will sign up for broadband when value-adding applications and services are readily available, easily understood, and offered at reasonable prices. Wildly popular services and applications (“killer apps”) drove adoption of earlier technologies – e.g., fax machine (legal fax signatures), the PC (spreadsheets), and the dial-up Internet (email, web browser) – and they will be the key to accelerating broadband deployment as well. The good news is that, for consumers, we already know some of these killer apps.

Right now the most significant driver for consumer broadband adoption has been telework – the ability for consumers to work from home more readily¹⁵. According to In-Stat/MDR, more than 60% of the US workforce is in remote locations, an enormous potential source for future broadband teleworkers. ([In-Stat/MDR, Jun. 5, 2002](#)). In a 2002 poll, the Winston Group found:

- 54% of Americans believe teleworking will improve the quality of their lives,
- 66% believe telecommuting would help them strike a better work/life balance, and
- A third of Americans would even forego a pay rise in order to work from home.

([The Winston Group \(under E-work/survey results\), Jul. 2002](#)).

Online game-playing likewise promises to drive demand for broadband. Analyst Datamonitor forecasts that the online gamer market will grow from \$670 million in 2002 to \$2.9 billion in 2005. ([Datamonitor, Aug 29 2002](#)). Online gaming sites attracted more than 28 million visitors in the U.S. in April 2002, according to Nielsen NetRatings, and new broadband-based gaming consoles such as the X-Box are

¹³ Similarly, U.S. Internet penetration failed to exceed 60% in the U.S. despite widespread “free ISPs” in the late 1990s and extremely low costs for PCs.

¹⁴ Communication applications have been the top driver for Internet demand – including such killer apps as e-mail and instant messaging – and communications applications (such as video-emails, file and photo sharing, and video conferencing) are likely to prove to be the top drivers for broadband demand. (See Odlyzko, “[Content is Not King](#),” Jan. 2001).

¹⁵ Many folks believe telework entails simply logging on from home and otherwise doing the same work in the same way. In fact, we have only begun exploring teleworking opportunities and arrangements. Today’s remote employees are teleworking in the same way the Wright Brothers were flying in 1903. Pervasive, high-bandwidth computing will transform work from home / remote location as thoroughly as it is transforming office-based business processes. Applications such as virtual collaboration and multi-party video conferencing promise significant productivity improvements that will further integrate home-based and rural employees and drive the demand for last-mile bandwidth.

certain to increase consumer demand for higher speeds. ([Nielsen NetRatings](#), May 22 2002). At least one analyst points to online gaming as one of the greatest contributors to Korea's broadband leadership. According to a fascinating study of broadband in Asia by Izumi Aizu, Principal at the Asia Network Research organization:

The first and real driver of the Korean Internet and its rapid transition to high-speed access is believed to be the proliferation of 'PC Bang,' an Internet café exclusively designed for Internet game services... The PC Bangs eventually became more than game centers. Office workers use them to check private e-mail or web sites during coffee breaks or after-work hours downtown, students use them for preparing homework on its high-speed services, or housewives buy stocks or other goods and services online. [The number of PC Bangs exploded from 100 in 1997 to 18,756 by the end of 2001.]

(Aizu, "Comparative Study of Broadband in Asia: Deployment and Policy," [Asia Network Research](#), Aug. 14, 2002).

Even more compelling for consumers would be movies, music and games delivered online – entertainment on demand or interactive media.¹⁶ With an estimated 30-70 million unique visitors, the now-bankrupt file sharing service Napster demonstrated the viability of the Internet as a music distribution medium (and the enormous appeal of free music), driving demand for high-speed connections, faster computer processors, larger computer hard drives and CD-RW drives. More than 40% of home Internet users in the U.S. have already downloaded MP3 files onto their home computers, according to a new study by Parks Associates, while an analysis funded by the Motion Picture Association of America suggests between 400,000 and 600,000 movies are illegally downloaded every day, up 20% over piracy levels in 2001. ([Parks Associates](#), Mar. 26, 2002 / [Viant](#), "[The Copyright Crusade II](#)," 2002). PriceWaterhouseCoopers forecasts that music and video-on-demand content will lead to greater adoption of broadband in the US. ([PriceWaterhouseCoopers](#), Jun. 2002). Unfortunately, sanctioned music and movie services have been slower to go and succeed online.

In December 2001 and again in July 2002, the Technology Administration convened leaders from the IT, content and public interest sectors to encourage faster progress on bridging the gaps that are keeping so many movies and music from going online. ([Digital Content & Rights Management Roundtables](#), Dec. 17, 2001 and Jul. 17, 2002). All panelists agreed that such digital entertainment would be major drivers of accelerated consumer adoption of high-speed connections if available online at reasonable costs and in formats consumers want (e.g. movies on TV instead of PCs). A majority of participants in December suggested that it would be a mistake for government to set mandatory technological standards for protecting digital content. Panelists mostly agreed that content creators can never expect a 100% piracy-free environment, and they cannot wait for an end to piracy before they venture forth.

¹⁶ Consumers already have many secure, reliable and easy means for getting movies – from broadcast TV to cable to direct broadcast satellite to video rental stores. Movies will not drive broadband demand if they're just one more (and less perfected) method for getting the same content. However, movie availability will accelerate broadband usage if the Internet offers either a lower-cost substitute for current entertainment access or adds value through interactivity, new options (e.g. virtual theater where multiple viewers see the same movie at the same time from different locations while communicating with each other) or on-demand delivery.

There is considerable belief that creative, legal, for-profit sites can out-compete “free” alternatives. Industry will need to develop technologies that can protect digital content, ensure that *legal* services have the resources (breadth of content and range of devices) to out-compete illegal exchanges, educate consumers about the need to respect intellectual property on the Internet, cooperate across sectors and deliver content in ways and on platforms that consumers want (e.g. movies on big screens). Government will need to prosecute clear violations of the law, educate citizens about the importance of respecting intellectual property rights, facilitate and support market-determined solutions, and protect consumers’ interests (such as fair use rights). There remains great hope that, as with the VCR or DVD, business models can be found that leverage new technologies and prove highly beneficial to artists and content creators.¹⁷ (See “[Downloads Did Not Cause the Music Slump, But They Can Cure It](#),” *Forrester Research*, Aug. 15, 2002).

CONVENIENCE

In addition to concerns over price and (lack of sufficiently compelling) content, would-be broadband consumers express concern over deployment hassles and lack of plug-and-play equipment. Stories of dissatisfaction with service providers are legion, with some complaining that companies make you wait at home all day or require multiple trips to install the technology effectively. These inconveniences appear to influence narrowband consumers’ decisions to not adopt broadband, and broadband consumers’ spending decisions. In a 2002 study commissioned by [Motive Communications](#):

- 51% of respondents using broadband claimed that they had encountered problems with service and support, such as having to contact a provider multiple times to get a problem solved or unacceptable delays in support.
- 90% of US broadband users said they didn’t have enough confidence to purchase additional services from their current provider.

([NUA citing Harris Interactive](#), Jul. 2, 2002).

It is worth noting, however, that in the long-term, broadband access is likely to sell precisely because it offers greater conveniences for consumers. Home networking technologies, such as 802.11 wireless, offer blockbuster appeal for entertainment and teleworking. Parks Associates found that over 50% of American Internet households are interested in networking digital entertainment content among PCs, TVs, stereos and DVD players. ([Parks Associates](#), Aug. 2002). Of course the success of these technologies in driving broadband demand will depend upon their reliability, security, ease of installation, compatibility with legacy consumer electronics and consumers’ continuing ability to attach them to the network.

CONFIDENCE

The fourth area most clearly impacting demand for higher-speed Internet access is consumer confidence. Consumers are concerned about privacy, security, SPAM and unsavory online locations – the dark side of the Net. Despite the fact that 99% of the most heavily trafficked Web sites post privacy policies ([according to the Progress and Freedom Foundation](#)), a June 2002 study from Jupiter Media Metrix

¹⁷ And indeed, entertainment and news firms are venturing more aggressively online as the number of broadband users grows rapidly and technical ways to limit piracy appear to be effective. Multiple studios have initiatives underway with various business models and technologies being tried.

indicated that almost 70% of US consumers worry that their privacy is at risk online. ([Jupiter Research, Jun. 3, 2002](#)). Consumer fears over security – including identity theft, hackers, fraud-artists and viruses – are even more pronounced. A July 2002 Gartner Research study found that 30% of those currently using the Web to shop on a regular basis said they would stop using the Internet for purchases if they lost \$25 [to fraud], while 58% of non-regular Internet shoppers said that a loss of less than \$25 would keep them from purchasing anything else on the Web. ([eCommerce Times reporting Gartner, Aug. 2002](#)).

Consumers are likewise deterred from greater Internet use by difficulties escaping the unsavory side of the Internet, including pornographic materials. Unsolicited email from adult-oriented Web sites increased 450% from June 2001 to June 2002 according to Cyber Atlas, and the omnipresence of porn sites keeps some folks off the Internet entirely.¹⁸ ([Cyber Atlas, July 3, 2002](#)). The Radicati Group estimates SPAM now represents more than a third of all email sent. ([eCommerce Times, Sept. 11, 2002](#)).

BROADBAND DEMAND AMONG BUSINESSES:

As with consumers, businesses are steadily signing up for high-speed access and implementing broadband business solutions. Many businesses are using broadband to improve business processes or achieve efficiencies. Others are migrating to Internet-based systems to remain part of the supply chain of larger organizations that have moved their procurement systems online (such as automotive companies and retailer Wal-Mart). Telecommuting is driving significant business upgrades to broadband, according a September 2002 report to [In-Stat/MDR](#), as businesses look for secure solutions to link remote offices and increasingly mobile workers. Yet as with consumers, several factors limit the pace with which companies are upgrading to broadband.

Similar to consumers, businesses are motivated by concerns over cost,¹⁹ convenience / ease-of-use, and confidence in the security of online environments. With respect to content, there is arguably a richer array of business applications than consumer applications already out there. However, many businesses – especially small businesses – don't understand or appreciate what high-speed Internet access is or what broadband applications can do for them. A [National Federation of Independent Business \(NFIB\) report](#) in 2001 suggested that:

[B]roadband access is a necessary resource for small business to acquire soon even if they do not yet know this. But, small businesses are unlikely to recognize opportunities and threats posed by the Internet until they actually experience broadband service.

(NFIB, "[Broadband Internet Access for Rural Small Business](#)," Jan. 2001).

¹⁸ At the same time, one must acknowledge that pornographic sites draw many visitors and drive broadband / Internet use for a segment of the population. We are not aware of any studies estimating the net impact of Internet pornography on aggregate broadband demand, although understandable concerns over adult material online continue to impact national broadband strategies (e.g. Israeli efforts to pass telecom reform legislation were thrown into turmoil last year by parliamentary resistance from religious parties, fearful that cable would become a major porn medium).

¹⁹ For many businesses, DSL and cable represent *lower* cost alternatives to T1 lines or existing high speed alternatives. For these businesses, lack of availability may be the top barrier to broadband usage.

In a 2001 poll of small businesses taken by NFIB, small businesses “feeling that high-speed Internet provides no competitive advantage outnumbers those who believe it provides a significant competitive advantage by 6-to-1.” (NFIB, “[The Use and Value of Web Sites](#),” 2001). In a different survey released in September 2002, TPG / eCom Ohio asked a cross section of U.S. businesses using dial-up Internet why they did not use broadband. (TPG / eCom Ohio, “*Ohio and National Business Online Survey*,” 2002). The results:

- 29% reported no high speed service was available
- 23% said service was too expensive
- 21% suggested they were happy with their current access
- 13% reported they were not interested enough
- 8% said they never thought of it
- 3% said they had not gotten around to it
- 1% offered miscellaneous answers

This same TPG / eCom Ohio survey asked businesses about how they perceived the impact of Internet use on revenues and productivity:

- 64% of businesses predicted “no increase” in revenues
- 43% expected no increase in productivity.²⁰

These business awareness barriers were reiterated by experts at a March 25, 2002 roundtable held by the Technology Administration. (See “[Broadband and Business Productivity](#),” Mar. 25, 2002). Business leaders from NFIB, the U.S. Chamber of Commerce and the National Association of Manufacturers, among others, reported that companies often:

- Fail to see the return on investment (value proposition) for broadband upgrades, especially in a challenging business environment.²¹
- Fear they lack skilled experts at the firm to manage the networks and run the applications.
- Need more strategic advice from their suppliers.
- Lack management commitment to the Internet as a key part of the business strategy.
- Don't perceive demand among their consumer base.
- Are concerned about security,²² privacy and other legal considerations.²³

²⁰ Although one must acknowledge that in the TPG / eCom Ohio survey, fully 75% of businesses believe the Internet will transform their business in the next five years. This means that while many businesses don't yet see the tangible impact on revenues or productivity, they do see it as a profound, transforming agent for their businesses.

²¹ Broadband demand among business is significantly impacted by changing attitudes towards capX / technology spending in the post-bubble, post-9/11, post-WorldCom world. After growth-centric years in which technology spending was seen as providing a competitive advantage enabling faster growth (in addition to greater productivity), businesses are now more likely to consider tech investments as costs impacting the bottom line. (Precursor Group). While the long-term winners will continue to invest aggressively in research and strategic technology upgrades, most businesses right now are looking for predictable investments with clear returns.

²² Internet attacks against public and private organizations around the world leapt 28% in the first six months of 2002, with most targeting technology, financial services and power companies, according to Internet security firm [Riptech, Inc.](#)

²³ Reuters recently reported a survey from a UK law firm that found more disciplinary cases have been brought against employees for violating email and Internet policies than for acts of dishonesty or violence. ([Reuters](#), Sep. 3, 2002).

(March 25, 2002 [roundtable discussion](#) on broadband and business productivity).

More than 20% of companies surveyed by In-Stat/MDR indicated they would not chose any type of broadband for their main office location, while 70% of respondents said “security” and “hosted applications” were key influencers for their firm’s main office bandwidth requirements. ([In-Stat/MDR](#), Sept. 11, 2002).

HOW CAN WE GET THERE FASTER?:

Steps to Accelerate Broadband Demand

With such extraordinary possibilities, you would think that governments would look to remove barriers to broadband deployment and accelerate usage. And indeed, most developed nations (and many U.S. states) have plans, strategies or concerted policies to promote broadband. Yet at least one observer suggests broadband strategies will fail when they look to governments for technology or market leadership and risk making things worse. Izumi Aizu, Principal at the Asia Network Research organization, suggests in his August 14, 2002 report on broadband in Asia:

[T]he important lesson taken from the Asian broadband experiences is that government policy to dictate market direction will lead nowhere. To find new markets with innovation, minimal intervention by government is required.

(Aizu, “A Comparative Study of Broadband in Asia: Deployment and Policy,” [Asia Network Research](#), Aug. 14, 2002). For example, Aizu suggests that Korean government direct investments and government subsidies in building a nation-wide fiber trunk (1995-1998) contributed to over-capacity and an unintended price war when the Asian financial crisis reduced demand and traffic. Thus Korea’s broadband success resulted in large part from the accidental failure of its policies and programs – a very difficult formula for other governments to replicate.

Certainly it is reasonable to look to new applications in a free market, more than any government-defined policy solutions, to define the uptake of high-speed networks. Yet governments can take actions that help create an environment that supports innovation and demand in broadband markets. The Bush Administration has already taken multiple measures to promote aggressive broadband roll-out and usage, as have other nations around the world, and the President’s Council of Advisers on Science & Technology is formulating still further recommendations for progress.

ACTIONS BY NATIONAL GOVERNMENTS

At the national level, we have seen several steps governments can take to encourage broadband demand.

- **Supporting Business Investment in Broadband Equipment.** For example, in March 2002 the Bush Administration accelerated depreciation schedules for business investment in capital equipment, such as broadband equipment, to improve the business case for investing in new systems.
- **Supporting Research & Development into New Applications and Technologies.** In [Australia](#), the government is providing grants to broadband content providers. In the U.S., the Bush Administration continues to urge Congress to make the R&E tax credit permanent to incent further

investments in cutting-edge technologies, such as broadband enabling technologies. At the same time we increased federal R&D investments to unprecedented highs. One historical example of the value of such investments can be found in the High Performance Computing Act, signed by President George H.W. Bush in 1990, which included funding for demand-side application development (including Marc Andreessen's creation of the Mosaic web browser).

- Creating Compelling Content and Leading By Example in Broadband Use. For example, the President has made e-government a top management priority for his Administration, and we're trying to lead by example in the use of broadband e-government applications to leverage our resources and better serve our constituents via high-speed applications.
- Protecting Intellectual Property and Supporting Digital Content. As market players work to develop technologies, standards and business models that enable digital content and rights management, governments can take several steps to strengthen the intellectual property rights framework. By prosecuting clear violations of law, educating citizens and students to respect IPR in the digital medium, protecting consumers' interests (such as fair use rights), and encouraging market players to cooperate and coordinate, the federal government hopes to increase the pace with which movies and music venture online.
- Opposing Taxation of New Content and Online Services. Taxation reduces demand by increasing consumer prices and reducing innovators' return. The Bush Administration pushed to extend the Internet tax moratorium to support development and adoption of e-commerce applications before Congress, and we successfully urged the WTO to extend the moratorium on customs duties on e-commerce transactions at Doha.
- Promoting Consumer Confidence and Cyber Security. To increase Internet penetration (let alone broadband) beyond 60%, consumers will need confidence in the online environment. The Bush Administration is working with the IT and telecom industries to better protect critical infrastructures such as the high speed Internet. The FTC and Department of Justice are aggressively prosecuting Internet fraud, protecting privacy and deterring online crime. The Office of Homeland Security released a white paper for comment proposing measures to improve networks' security on September 18, 2002.
- Ensuring Free Flow of Goods, Services and Ideas Online. Izumi Aizu suggests that "Freedom of speech can be regarded as one of the key factors behind the expansion of broadband [in Korea as contrasted with Singapore]." (Aizu, "[Comparative Study of Broadband in Asia: Deployment and Policy](#)," *Asia Network Research*, Aug. 14, 2002). From political participation to personal websites, citizens in free societies are more likely to find reason to go online. Nations that censor content, restrict access and punish speech will find weaker demand for new communications services, such as broadband Internet. Likewise, nations imposing value added taxes on online goods and services (as proposed by the EU) may retard growth in those areas.
- Promoting Efficient and Broadband-Friendly Management of Radio Spectrum. National governments seeking to promote broadband demand are also working to manage the radio spectrum in ways that extend opportunities for new technologies to deliver broadband and compete with other platforms. Wireless broadband solutions offer a mobility and convenience that can significantly increase demand. Just as mobility has expanded the number of minutes people use for voice, we can reasonably expect the same stimulative effect from mobile high-speed data.

ACTIONS BY STATE AND LOCAL GOVERNMENTS

States and localities around the U.S. are also taking steps to promote broadband demand. Some of these initiatives include:

- Considering Bandwidth when addressing issues such as rights of way,²⁴ taxes and application fees, tower siting, zoning, building and construction codes, building access,²⁵ franchise agreements, historic preservation and environmental protections. For example, the state of Michigan recently enacted legislation to establish a level regulatory playing field for all telecommunications and information carriers, enacting one-stop right-of-way permitting system to create common rules for all carriers and establishing a single tax and fee system to replace differing systems around the state. (See [LinkMichigan Initiative](#), May 2001).
- Aggregating Demand²⁶ to incent carrier deployment, as is being done by entities such as Berkshire Connect in New England. (See “[Berkshire Connect: A Case Study in Demand Aggregation](#),” MIT Program on Internet and Telecom Convergence, Nov. 2001). The Technology Administration is partnering with the Appalachian Regional Commission on a series of events to promote understanding of successful demand aggregation strategies.
- Educating Citizens and Businesses. Case studies also demonstrate that improvements in telecommunications access and use have been strongly driven by effective local leadership. [Ecom Ohio](#) offered just such an example, helping Ohio businesses online increase broadband use 59% (2001-2002) while broadband adoption among U.S. businesses overall grew 27%. (*eCom Ohio, “Ohio and National Business Online 2002 Survey,”* 2002). A report to the Appalachian Regional Commission likewise noted: “Many information and telecommunications deficits can be addressed by improving the overall awareness of community and business leaders.” (*Report, “Links to the Future: The Role of Information and Telecommunications Technology in Appalachian Economic Development,* [Appalachian Regional Commission](#), July 2002).

²⁴ For states and localities, these issues are very complex. Revenues are needed to finance police, schools, fire departments, roads, etc. Every time a street is cut up to allow new fiber deployments, its lifespan is halved. NARUC offers an extensive guide for communities to streamline local regulations to lower the costs to deploy new fiber and telecom infrastructure locally, while maintaining revenue sources for local governments. (See “[Promoting Access Through Public Right-of-Way and Public Lands](#),” NARUC, July 31, 2002).

²⁵ Izumi Aizu suggests one of the seminal factors enabling Korea to lead the world with over 50% broadband penetration was the ability of competitive providers to access residential communities, especially the 40% of the Korean population living in high-rise apartments. (Aizu, “*A Comparative Study of Broadband in Asia: Deployment and Policy*,” [Asia Network Research](#), Aug. 14, 2002).

²⁶ States such as Pennsylvania and Michigan have sought to aggregate the collective purchasing demands of state government, higher education users, K-12 users, local government users, and other public and private partners and asked private-sector firms interested in serving the state to provide advanced telecommunication services to each. Providers were required to build and maintain a high-speed backbone infrastructure that extends to most regions of the state to serve these customers, reselling excess network capacity on a non-discriminatory wholesale basis to increase competition and encourage investment in regions that might not otherwise attract new service providers.

- Deploying eGovernment. As in LaGrange, citizens want content relevant to their lives, such as community information and local government services. For example, [Franklin County \(OH\) auditor Joseph Testa](#) allows citizens to renew dog licenses or access geographic information about property lines / water lines / etc. on his web site – value-adding information addressing local concerns. The [North Dakota State University Extension Service](#) in Fargo, North Dakota, uses broadband videoconferencing to train farmers at remote sites on how to manage risk in everything from production and marketing to financial and legal aspects of managing their farms.
- Removing Non-Telecom Barriers to Killer Apps. Advanced applications, such as telemedicine, could drive broadband demand and deployment (in addition to improving health care delivery and cost efficiencies). Yet telemedicine often faces complex, non-technical barriers, such as state licensure requirements that prevent medical experts from “seeing” citizens in other states over the Internet. States looking to promote broadband (and improve health care delivery) are looking for ways to remove such barriers. Likewise, efforts to offer distance learning often face difficulty in obtaining accreditation from educational oversight bodies unfamiliar with e-learning.
- Offering Regional Broadband Planning Assistance. For example, the state of Michigan provides regional planning grants for local communities, encourages regional initiatives to link or leverage their local strategies to the statewide backbone initiative, and encourages communities to identify and remove existing barriers to new telecommunications investment. Michigan established a [Broadband Development Authority](#) in part to help localities create viable broadband strategies.
- Encouraging Experiments (e.g. Fiber-To-The-Home New Builds). Planned communities are springing up around the nation, with fiber-to-the-home installations increasing by more than 200% in the past 12 months. ([FTTH Council](#), Aug. 2002). In-Stat/MDR suggests the percentage of connected greenfield homes will skyrocket from 11% in 2002 to 61% by 2006, ([In-Stat](#), Feb. 12, 2002). The [Technology Policy Group](#) has a (pre-publication) White Paper highlighting innovative local experiments around the country (expected for release in the Fall) such as [Blacksburg Electronic Village](#) and [Berkshire Connect](#). These experiments and others should encourage innovation in applications and services.

ACTIONS BY BUSINESS LEADERS

Industry trade associations and business leaders are also taking steps that appear to promote broadband demand. Such efforts include, among other things:

- Promoting Business and Consumer Understanding. The [Positively Broadband](#) campaign offers a good example of private sector leadership to promote awareness and understanding of the benefits of broadband. Likewise, [SeniorNet](#) is working to educate senior citizens about what broadband can mean for them.
- Forging Partnerships Between Broadband Creators and Business Users. The [Information Technology Industry Council](#) and NFIB have announced intentions to work together to promote broadband deployment and demand. Opportunities for technology creators to work with their customers on improving awareness of applications is likely to increase demand among companies. Also valuable are surveys of business users – hearing directly from the would-be customers about why they are or are not adopting broadband, and how subscribers are using high-speed access.

- Improving Security and Protecting Privacy. These are critical to build and maintain consumer confidence, but they also represent a great opportunity. The security imperative will provide a strong catalyst for companies to re-engineer and re-think their entire operations. Successful business leaders will embrace new architectures and business processes that strengthen their place in the market and generate even greater productivity and efficiency through the use of technology. The security *challenge* will prove an *opportunity* for business.²⁷ The [Internet Security Alliance](#) and [Partnership for Critical Infrastructure Protection](#) offer two good examples of industry-led efforts, although greater coordination is still needed.
- Expanding Partnerships Among Educators and Researchers. The [Internet2](#) is truly pioneering applications, services and models for online partnerships that will generate greater demand for higher-speed networks and ensure greater returns for those who use them.
- Encouraging and Supporting Telework. Organizations such as the [Telework Consortium](#) are developing pilot projects to address telecommuting issues, identify and remove barriers and pioneer best practices. Likewise, businesses seeking greater broadband deployment can lead by example and promote telecommuting among their own employees.

ACTIONS BY INNOVATORS & ENTREPRENEURS

In the end we believe that technology innovation will prove the greatest driver of broadband demand. New applications and services that consumers want and businesses need will provide the tipping point for broadband demand and usage. The developments that appear most likely to stimulate broadband demand include:

- Developing DRM Solutions. Finding technical solutions to copyright challenges will expand digital content willing to go online, especially entertainment, and increase the value proposition for subscribers.
- Improving Usability and Reliability of Broadband Equipment and Service. Making the broadband experience more plug-and-play – reducing deployment hassles and improving consumers' experience with service delivery – will increase demand for broadband and new broadband services.
- Developing New Delivery Platforms. Consumers and businesses may be more interested in broadband over platforms that compete with cable and wireline platforms – such as wireless, satellite, optical fiber and perhaps even [powerline](#). Such cross-platform competition would increase consumer offerings, keep prices low and encourage greater broadband adoption.

²⁷ For example, Y2K prompted many companies and governments to overhaul their IT systems and upgrade to new platforms. That both mitigated exposure to Y2K risk and expanded capacity and quality of internal systems and processes. While some merely plugged holes and backfilled solutions in response to Y2K challenges, aggressive players saw Y2K as an opportunity to take operations to the next level.

- Improving Compression and Capacity of Existing Platforms. New technologies that deliver more data, more quickly over existing copper and coaxial infrastructures, such as the new MPEG 4 standard, will give consumers the broadband experience over existing and deployed infrastructure. As the surveys show, broadband usage is “sticky,” and once consumers gain access to these applications they’ll want more bandwidth.
- Developing Alternative Deployment Techniques. New ways of deploying new lines, such as [sewer access robots](#) that deploy fiber without tearing up streets and at far less cost (as in Albuquerque, NM or Omaha, NB), or last mile wireless solutions, promise readier broadband availability and greater likelihood of adoption.
- Improving E-Commerce Quality of Service (Security, Authentication & Micropayments). Broadband demand will grow as we attack and solve many of the issues hindering quality of service in e-commerce – guaranteeing data rates, authenticating users quickly and securely, paying for goods and services without delay or burdensome forms, and transmitting reliable voice over IP over public networks, for example.
- Creating Compelling New Content. In the end there will be no substitute for rich and varied applications that ensure returns on broadband investment, even as we spread the word about existing applications and how they can improve American business productivity and quality of life. Broadband demand will be driven by business and consumer excitement about new “killer apps” from mass-market voice over IP, to speech recognition, to 802.11 networks, to unheard of new technologies under development in garages across Silicon Valley and across the country.

CONCLUSIONS

In summary we believe that, for broadband, the sky is the limit and it’s not falling yet. New applications and services that consumers want and businesses need will provide the tipping point for broadband demand and usage, especially continued improvements in communications applications. However, success in sustaining the Internet revolution as it moves from dial-up to mid-band to truly high-speed broadband will benefit from concerted effort and partnerships among federal, state, and local government as well as business leaders. We must ensure an environment that encourages capital formation and rewards risk – we need to let the innovators innovate, and the entrepreneurs create jobs, companies and growth.

As President Bush has made clear, it is in our nation’s economic, national security and societal interest to have robust broadband connections to all Americans who want them, as soon as possible. Working together, we should be able to reach this goal.