OPPORTUNITY 08
Independent Ideas For Our Next President

Strengthening U.S. Information Technology
Keep America #1 on the Net

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Summary

Leadership in information technology is the foundation for America's competitiveness and future economic well-being. The Internet is and will be the central medium of information technology today and for the next decade. It underpins large software, hardware, and Internet application market opportunities, and it enables a far broader set of industries to achieve greater transaction profitability, increase productivity, and create new markets—this is how the Internet and IT sparks growth.

America must stay #1 on the Net. The next President should endorse policies that enable American companies to remain the primary inventors and purveyors of Internet technology, stimulate American entrepreneurs to continue to develop the best new Internet businesses, and help American workers continue to receive the benefits of increased productivity and economic growth.

Retaining U.S. leadership is by no means assured. It will require the next President to follow a well documented path—investing in basic research and development, welcoming talented immigrants, making science and engineering education a priority, and encouraging expanded Internet availability.

Specifically, the next President should pursue the following objectives. Starting now, the nation should:

- recruit and retain 10,000 new mathematics and science teachers per year
- double our annual number of engineering graduates
- each year convince 1,000 more of the nation's top engineering students to pursue doctoral studies
- at least double the number of H1-B visas for highly-skilled foreign workers to meet market demand

By the end of the next two Presidential terms,

- regulators should "free the airwaves," so that 90 percent of Americans have broadband access, and 50 percent have wireless broadband access
- the United States should double current federal funding for fundamental natural and physical sciences research to $40 billion annually.

These are not easy steps, but they are straightforward. America has all the ingredients for future Net leadership—stellar research universities, a deep pool of financial risk capital, the largest domestic market in which to launch new technologies, and the greatest number of large technology companies that spawn new firms and new ideas. The policies of the next President will be a central catalyst to this leadership recipe.

Context

Why Technology Matters—A Lot

Technology leadership brings unique benefits to the U.S. economy. Information and telecommunications technology ("IT") are fundamentally important drivers of economic growth.[1] They are substantial industries in their own right—for example, the U.S. semiconductor industry employs more than 250,000 skilled workers and accounts for 7

[1] This paper uses the term "technology" in two senses: fundamental technology advances the basic capabilities of computing and communications (such as by increasing the storage capacity of a hard drive or the amount of data that can be sent over a fiber optic connection); applied technology advances the use of those capabilities for a specific purpose (such as a new retail Web site or network-linked manufacturing control program).

percent of GDP. A large proportion of the Fortune 500 includes IT companies, and 12 of the world's top 100 most valuable brands belong to U.S. IT companies, more than to any other industry.

However, IT has a broader and more powerful economic impact, because it enhances all aspects of the growth equation (capital input, labor input, and total productivity). It makes both capital and labor more efficient. But most important, IT more rapidly and completely enables the creation and distribution of new knowledge and creative ideas at little to no marginal cost. Knowledge creation is very powerful.

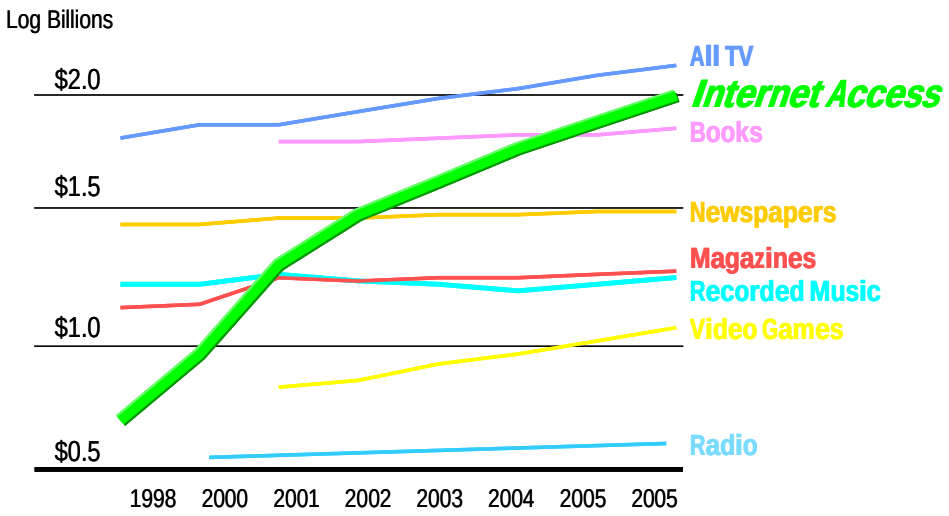
Technology investment has propelled U.S. economic growth for the last decade. In fact, IT investment contributed 20 percent of total U.S. economic growth over the last five years, *not even counting* its impact on productivity outside the IT sector.[2] During that time frame, the United States generated more growth out of IT than did any other G7 economy. If the United States had *not* invested in IT and telecommunications capital in the 10 years from 1995-2004, the U.S. GDP would be roughly 9 percent smaller—that is, more than $1 trillion. The well-publicized 2000-2002 technology industry "bust" has proved to be a blip in a long upward trend of IT investment driving strong returns.

The Rise of the Internet

The massive uplift from IT investment since 1995 parallels the establishment of the global Internet and its accessibility via the World Wide Web. The long-term accumulated asset of distributed global computing was unlocked by the ability to connect it all together. Since the 1994 introduction of the Mosaic browser, which made the scattered data on the Internet accessible to the masses, the Internet and the web have grown very quickly. The number of Internet users worldwide has increased 18-fold since 1997 to over one billion. On a typical day, the average working American spends more time on the Internet than watching television (See Chart 1).

[2] Jorgenson, Dale, and Vu, Khuong. *Information Technology and the World Growth Resurgence*. Available at http://post.economics.harvard.edu/faculty/jorgenson/papers/handbook.worldgrowthresurgence.palgrave.pdf

Chart 1. The Internet Moves Up: Global Consumer Spending On Media



Source: *Price Waterhouse Coopers Global Entertainment and Media Outlook: 2006–2010.*

The rise of the Internet has been coincident with the rise of the great American corporations of the last two decades. Nearly all of the major players of the supporting industries of the Internet reside in the United States. Google and Yahoo! were created to make the vast information on the Internet usable. Cisco Systems provides more than half of all Internet routers. Dell and Hewlett-Packard are the world's largest vendors of personal computers. Intel and AMD microprocessors power over 95 percent of the PCs and servers on the Internet—and most of those computers run Microsoft's operating system.

The Internet is changing the world economy far beyond new IT equipment and software industries. Across numerous industries, physical transactions and physical deliverables are being abstracted to virtual transactions—that are then executed across the Internet. The Internet enables the one-to-one, one-to-many, and many-to-many mass-processing of transactions between customers and businesses, maximizing marginal revenues and minimizing marginal costs for almost all types of commercial interactions. Companies large and small (and often brand new) compete by knowing,

what, when, and how to best sell both digital and physical items while making the best tradeoffs among production, inventory, and delivery costs. Large financial services companies are investing dramatically in connected computing power, because faster trades let them profit from fleeting market opportunities. Oil companies are analyzing massive amounts of underwater seismic data to increase the chances of hitting oil. Tiny "eBay entrepreneurs" by the hundreds of thousands run home-based retail businesses not possible before.

The Internet is rapidly changing the knowledge industries—news and entertainment. "Personalized" (versus "mass") media now use the web to deliver customized information and news to millions, through real-time subscription services or blogs. This demand trend marries the supply trend of user-generated content. Millions of individuals now create and share as much information over the Internet as they receive, with no printing costs, no editors, no producers, and no need for special equipment. More than 100 million video clips—the most popular of which are amateur videos—are downloaded each day. By the end of 2007, the installed base of digital cameras, camera phones, and camcorders that can create this homegrown content will reach one billion globally. Consumers now purchase their entertainment via highly-personalized micro-transactions—entertainment in 30-second up to two hour blocks, customizable by device, by song, by artist, by time, and by place.

Advertising is following viewers. Online advertising is growing 30 percent annually at the expense of television and print. Craigslist.org is the new alternative to local newspapers' traditional moneymaker: the classified ad. Search engines capture every click of a user's mouse, optimize the advertisements the user sees; they then sell that optimization to the highest bidder (advertisers).

What's next for the Internet?

The Internet will advance as fast as the underlying technology allows. Rapid improvement in telecommunications and IT capability continues unabated—if anything, it is accelerating. Within the next two Presidential terms, computer-based radios will

have 250 times today's transmission capability, and semiconductor transistors will have 250 times today's number-crunching capability.[3]

Technology advancement at such a pace forces rapid industry evolution and destabilizes the structure of the technology industry (and of industries highly dependent on technology). The Internet, unlike any previous medium, is an open platform—anyone with an IP address and a terminal can build a new Internet application, and, at this moment, the next Google, Intel, or Cisco is most likely a scribble in some graduate student's notebook.

The Integration of Communications, Computing and Sensing Capability

It will become difficult to characterize the Internet as the traditional model of a user, a PC, and a fixed broadband connection. Wireless Internet communications and computing capability will be embedded in an increasing array of phones, mobile computers, cameras, game consoles, home appliances, automobiles, clothing, and industrial equipment. These varied devices also will have sensing capabilities that let them interact with the physical world. Phones will have global positioning system capability and provide different services in different locations; UPS packages will have radio frequency identification transponders that enable companies to optimize their supply chain based on constant tracking of packages' status; home PCs will sense physical characteristics (blood sugar levels, heart rate, weight) to provide health and wellness data to both users and remote doctors. There are many more coming. These applications are possible today with customized technology—but the real impact will be when advancement lowers the cost and moves them to the mainstream.

[3] *Moore's Law.* In 1965, Gordon Moore, who later founded Intel, predicted that the number of transistors that would be built on an integrated circuit would double every two years—*an observation has held true ever since*—while the cost of computing falls at the same rate. In ten-twelve years, this will give a basic personal computer the capability of today's supercomputer. *Cooper's Law.* Wireless networking technologies advance at a similar cadence, with carrying capacity doubling every two-and-a-half years for the past century, an observation made by Martin Cooper, an inventor of the portable phone..

Globalization

In the 1990s, there were hundreds of news stories describing how different countries were attempting to recreate "Silicon Valley." These efforts are bringing results. Europe is home to global leaders in mobile telephony and telecommunications infrastructure; Korea and Japan have far higher broadband penetration than does the United States; China is investing heavily in local semiconductor companies, and its personal computer brand Lenovo recently bought IBM's PC division; Taiwan designs and manufactures nearly all PCs today. Nearly all industrialized nations are doubling their investment in higher education in science and engineering and are promoting competitiveness in technology industries through tax credits and subsidies. And these countries are aiming at the crown jewels of the technology industry; the prime minister of India has commented often how advanced semiconductor manufacturing and process technology development (the hardest of the hard stuff) are central to India's future growth.

The Future Internet: Deeper, Broader—and More Important

The Internet will remain the single most important "big thing" in the telecommunications and information technology industries for the next decade. Metcalfe's Law, which states that the value of a network rises at the square of the number of participants, indicates the massive value inherent in this singular network—and that the value increases exponentially each year as more users go online.

The demographics of usage indicate very high growth. For many young people, the Internet has become central to their social and cultural lives. At the same time, the emerging markets globally are getting online. Before the end of the next two Presidential terms, over two billion people will have instantaneous and permanent access to the collective knowledge of humankind via the Internet.

The Internet will be an even greater economic leveler. An online video web site can be created for well less than $1 million. Amazon.com's recent effort to become an Internet utility that rents out its capabilities (bandwidth, server space, application

hosting) will take down costs even further. The barriers to entry for starting an Internet-based business become smaller all the time.

Computing will become even more distributed—with processing power in far more objects and in the hands of far more people. Very small biotechnology companies will be able to use servers to test chemical characteristics of drugs at a scale far greater than the major pharmaceutical companies can do today in physical labs; the amateur astronomer will be able to do more detailed analyses of cosmic data than what NASA does today; the very smartest future students will be able to simulate nuclear explosions in their basements.

The Internet will go completely mobile, and just as mobile telephony has changed voice communications, the mobile Internet will greatly magnify the value and importance of the Internet. An always-on, always-available broadband Internet connection will have much greater meaning to users because it is much more useful—people want to know and do different things at different times and in different places.

The Internet will have real cultural effects. The most viewed Internet site currently is MySpace, a social networking site that connects people who never would have met otherwise. A quarter of single Americans have used an online dating service. There is some fear that these sites will cause societies to atomize—that people will spend too much time in their basements online. Yet, the Internet is inherently a tool that expands, rather than contracts, social relationships.

Preparing for Tomorrow

The above review leads to two conclusions: *we are only at the beginning of the Internet era—the biggest impact and the most groundbreaking innovations are yet to come, and IT leadership is of utmost importance to our nation's present and future economic success.* By leading at the beginning, the United States molded an Internet conducive to American technologies, American companies, American workers, and American users.

But the United States does not have any special right to be the global leader on the Net. The United States is currently benefiting from 30, 50, or even 70 years of educational, infrastructure, and basic research investment combined with a pragmatic business and political culture that encouraged innovation and the practical application of fundamental research. However, America's recent investments have not matched this history. Ironically, the Internet's open nature makes it inherently easier for other countries to catch up—even if the United States were on the top of its game, other countries would be gaining.

Increases in foreign investment in and development of information technology are not bad for the American economy. The IT industry benefits from economies of scale. Intel sells essentially the same set of microprocessors in more than 150 countries. Foreign companies purchase more than $500 billion in American-designed and produced semiconductors, computers, servers, software, and fiber optics annually. This begs the question: can America benefit just as much from the Internet era even if it is not the leader in its fundamental technologies? Can it be a "fast follower" as many other countries are today? Can American companies simply use foreign-designed innovations? And, can American companies facing labor shortages simply find more skilled workers offshore? The nature of success in IT industries suggests that the answer to these questions is that we cannot.

In technology, the bulk of the profits and the prime market position are almost always held by those who first perfect or deploy a new technology solution—economies of scale and learning efficiencies make product leadership and being first-to-market of enormous benefit. This holds for Intel in the semiconductor market. *We believe this holds for countries as well.*

Product and time-to-market leadership are most likely to happen where one finds the best underlying technical infrastructure and the brightest technical workers. This fact is augmented by technology's powerful clustering effect and the dynamic IT industry structure. One successful company in one location prompts the creation of others.

Supporting industries (venture capitalists, and so on) then move in to drive greater investment, until an entire ecosystem is built around a certain geographic area—innovation "hot spots" where startups flourish. A country's policies must support the growth of these small companies so that the country can grow the next giant. There were dozens of Silicon Valley search-engine startups in the late 1990s—but only two have become major companies. The same math applied to personal computer companies in the 1980s.

A final argument for leadership in basic Internet technologies defies statistical analysis. The Internet is structured on an inherently American cultural model: open, egalitarian, participatory, dynamic, not kind to those who would hide or distort data—in short, a free marketplace of ideas, products, and services. Preserving this culture through continued American predominance is an exceedingly powerful mandate.

Secure an Internet Leadership Position for the United States

Our fundamental recommendation is that the next President take steps to assure that America stays #1 on the Internet. This is a multi-faceted goal that means:

- America leads in developing new fundamental and application technologies, in both the academic and commercial spheres
- America is the best place to start new fundamental and applied technology companies
- American companies are the first to utilize and build upon new Internet technologies, and
- America leads in extending Internet access to its people.

The next President can best achieve these goals by:

- increasing U.S. investments in science and math education
- developing an immigration policy that encourages the world's best and brightest to study, work, and live in the United States

- substantially increasing the federal investment in basic research and development, and
- investing more in, and encouraging the development of, our basic technology infrastructure, specifically broadband wireless technologies.

Strategies to assure our continued IT leadership should involve public-private partnerships in education, research, and technology support. For example, the government can catalyze innovation, and government policies can assure a level playing field for investment, but the private sector can deliver the product.[4]

Restore U.S. Educational Leadership in Math, Science, & Engineering

Human brainpower is the raw material of technology advancement. Math and science are the foundational skills of technological success. American companies were successful as the Internet took off because they tapped a diverse pool of talented, highly skilled workers built up over decades. This precious asset is seriously threatened, and, although this paper will not address all of the reforms needed in the U.S. educational system, many specific shortcomings directly imperil American leadership in technical education.

U.S. primary and secondary school students are falling increasingly behind their peers in other leading countries in math and science—at best we rank middle-of-the-pack. Our students' test scores are lower, and they are far less likely to have teachers with science and math backgrounds. Although U.S. students' scores on standardized tests have stabilized, we are standing still while other countries are advancing. Nearly all of the countries that are our primary competitors have defined, funded programs focused on improving math and science skills. Students who excel in these subjects are most likely to specialize in them in college; but, as important, IT fluency and a grasp of the underlying technical concepts will be "table stakes" for nearly all the career opportunities we will want our children to pursue.

[4] Note these recommendations do not explicitly propose sustaining America's market-leading risk capital industry, which is so central to new firm development, because this area currently is healthier than the others.

Second, talented college undergraduates increasingly avoid technical disciplines, and our universities do not graduate enough engineers and scientists. Meanwhile, other countries have picked up the pace (Chart 2).

Chart 2. Bachelors' Degrees Awarded in Engineering

Country	Degrees / Year (thousands)
China	220
EU-15	180
Japan	105
Russia	82
India	82
United States	**60**
South Korea	57
Taiwan	27
Mexico	24
Poland	22

Source: *U.S., National Science Foundation as referenced in "Losing the Competitive Advantage? The Challenge for Science and Technology in the United States,"* 2005. Available at http://www.aeanet.org/Publications/idjj_AeA_Competitiveness.asp.
Note: *The chart uses reported data for the most recent year.*

Engineers with advanced degrees have a disproportionate impact—they usually spark new ideas and breakthroughs. At the time of its initial public offering, Intel had only nine PhDs out of 342 employees. However, three of those nine were its two founders and its Director of Operations (Drs. Gordon Moore, Robert Noyce and Andrew S. Grove).

The United States still leads the world in the number of doctoral degrees per year in science and engineering. Our post-graduate programs appear strong, with degrees awarded hitting an all-time high in 2005. Yet, this total is up only 3 percent since 1996, while the IT industry has more than doubled. All of this growth is from foreign students—the absolute number of doctoral candidates with U.S. citizenship has actually *decreased* in the last five years.

The next President should advocate a decade-long strategy to improve math and science performance and increase capacity at every level of the U.S. educational system:

- The United States ***should aim to recruit and retain 100,000 new math and science teachers (10,000 per year)****, as the foundation of our technical education programs*. The first step is to provide financial incentives for trained graduates to pursue this career, using four-year scholarships or student loan forgiveness of $5,000 annually.
- Government should work with private industry to fund ***skills training for current teachers, with the goal of upgrading the skills of up to 500,000*** teachers by 2016.
- At the collegiate level, we must increase the number and quality of U.S. students who complete science and engineering degrees, ***doubling the annual number of U.S. engineering graduates over the next decade,*** by providing an additional 50,000 students per year with $15,000 annual scholarships for engineering and science study.
- At the graduate level, we should ***recruit an additional 1,000 of the top U.S. engineering graduates per year*** *to pursue doctoral work, using fellowships, scholarships, and federal research funds*.

A public relations campaign should support these initiatives, to counter the perception that math and science workers are "geeks" and "nerds" with the financial facts of life: having in-demand technical skills leads to the well paying jobs of the future.

Collectively, these programs would cost approximately $4 billion per year.[5] And, clearly, while they would greatly benefit growth and development in the IT sector, they would be of enormous benefit to many other high-tech industries in the biosciences, energy development, and others.

[5] Calculation: $5,000 x 10,000 students x 4 years = $200 million; for engineering recruitment: $15,000 x 50,000 students x 4 years = $3 billion; for teacher training and for PhD fellowships, including advertising, recruitment, and overhead, less than $1 billion.

Welcome Highly Trained Immigrants

In the past, the gap between U.S. demand for technical workers and domestic supply has been filled by foreign nationals. In the current vigorous debate about U.S. immigration policy, the contributions of these workers are sometimes lost, even though their impact has been unequivocally positive. One out of every five scientists and engineers working in the United States in 2004 was foreign-born. Yet this situation poses nearly zero threat to the native born workforce—unemployment in science and engineering has always been less than that of the general population and has *never* risen above 5 percent in the 22 years it has been tracked.

However, just as domestic demand for highly skilled foreign workers is rising, the federal government has increased barriers to entry. The number of visas for these workers dropped to 65,000 after 9/11, down two-thirds since the late 1990s. Foreigners increasingly sense they are unwanted in America, and these potential Andy Groves or Vinod Khoslas are voting with their feet: foreign applications to U.S. graduate programs have fallen every year since 2001. Meanwhile, other countries are working hard to attract them. Japan has increased its foreign high-skilled workers by 10 percent since 1999, while relaxing its employment and residency requirements.

Immigrants are not just stopgap solutions to workforce holes—they also develop many new businesses. The largest U.S. companies founded by immigrants are all in the information technology fields. In a 2006 survey, the National Venture Capital Association learned that 47 percent of today's venture-financed startups were founded or co-founded by immigrants; and, of all the U.S. publicly-traded companies that *ever* received venture financing, *one out of four were founded by immigrants*.

The next President should lead efforts to roll out the welcome mat to highly-skilled foreign workers and graduate students, in both public statements and in policy action. ***These policies should increase the number of H1-B visas for highly skilled workers, in order to meet market demand—to at least double the number today. At the same time, the student and H1-B visa approval process should***

be simplified and expedited, including rapidly minimizing the backlog of security background checks.

Increase Investments in Science and Engineering Research

During the last ten years, the federal government has reduced its financial support for fundamental research and development that underpins Internet technologies. Public sector support is critical, because the federal government is the nation's primary funding mechanism for basic research. This makes economic sense—basic research has the longest lead time from breakthrough to commercialization, carries the greatest risk, and is least likely to receive private sector funding. The Internet would not exist if the National Science Foundation and the Defense Advanced Research Projects Agency had not created the first "Internet" linking Department of Defense computers. The Web browser, fiber optics, routers, computer-aided design tools, and the computer mouse all started in federally funded labs.

The federal commitment to research and development funding is now at 0.75 percent of GDP—well below its pre-1990s peak of approximately 1.25 percent of GDP. The proportion of this funding applied to engineering, the physical sciences, math, and computer science has dropped considerably. Total government spending on space research, general technology, and the physical sciences will reach only $18 billion in 2006. *In stark terms, the United States is moving in the opposite direction of its global competitors.*

The new President should increase funding for fundamental natural, physical, and general sciences research to a total of $40 billion annually by the end of two Presidential terms (an average annual increase of 10 percent from the current $20 billion level).

Strengthen the Internet's Physical Infrastructure

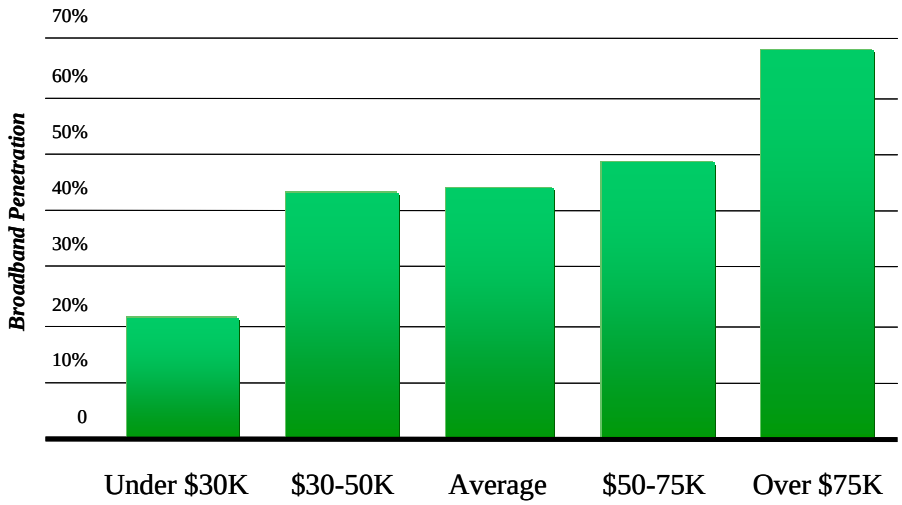
Leadership in Internet technologies depends on more than just a skilled workforce and research and development spending. The presence of a robust Internet

infrastructure—and its use—is central. The more people who have high-performance personal computers, high bandwidth mobile telephones, and high-speed broadband connections, the greater the network effect, and the greater the Internet's value. Companies in countries with the most advanced technology infrastructures can bring new, performance-hungry applications to market more quickly than others, reaping the valuable first-mover advantage.

Over the last five years, the United States has lagged behind other countries in technology infrastructure investment. The penetration of broadband Internet access—high-speed connections to the World Wide Web for homes and businesses—is a powerful indicator of infrastructure leadership. Sadly, we lag behind several countries in high quality, affordable broadband access. (Japanese broadband users pay a tenth of what American broadband subscribers pay and have far faster service.) With respect to mobile telephony, the United States has fallen behind other countries in advanced wireless technology over the last five years. While third-generation (3G) mobile telephony service has not delivered the performance and experience promised when it launched in 1999, it remains a solid step forward from existing 2G systems. First rolled out in East Asia, then Europe, 3G had no appreciable uptake in the United States until 2006.

Finally, the United States suffers from a substantial "digital divide"— high-income households are far more likely to have broadband Internet access than are the economically disadvantaged or rural residents (Chart 3). Increasingly, this divide reinforces economic inequalities, because access to technology leads to more and better opportunities.

Chart 3. Broadband Internet Penetration by Annual Family Income



Source: Horrigan, John B. Home Broadband Adoption: 2006. *Washington, D.C.: Pew Internet & American Life Project, May 2006, available at http://www.pewinternet.org/pdfs/PIP_Broadband_trends2006.pdf*

Encourage Broadband Wireless through Market-Driven Spectrum Regulation

Broadband wireless technologies are the most important of several solutions to digital access problems. Most broadband service customers today are connected to the Internet via wired connections, such as digital subscriber lines (DSL) or cable modem service. These technologies have been very successful in the United States, and growth was robust over the first decade of the Internet. However, geographic areas that do not have access to these technologies today most likely will never have it. Installing wired technologies in sparsely populated areas is simply too costly.

In the future, broadband wireless, which can be both universal *and* mobile, will be the primary means for Internet communications. ***U.S. policy should be designed to enable 50 percent of the population to have access to high-speed broadband wireless, and 90 percent to have some form of high-speed broadband access, by the end of the next two Presidential terms***.

The United States has a significant opportunity to be the broadband wireless first mover—it can leapfrog other countries through emerging technologies. Wi-Fi uses

unlicensed radio spectrum to deliver high-speed broadband over short distances in the home and office, and operators are experimenting with using Wi-Fi city-wide. WiMAX delivers broadband access over a much wider area and can be used for both fixed-location *and* mobile access. WiMAX can utilize both licensed and unlicensed spectrum and is inherently more efficient than existing 3G technologies.

Profitable deployment of these new technologies will require access to large, adjacent, and efficient blocks of the radio frequency spectrum—blocks not available to private enterprise today. Service providers will need to make substantial (at minimum $5 billion) investments over the several years to achieve nationwide coverage. There must be a clear path to economic returns or operators won't make this investment.

Federal agencies can accelerate deployment of broadband wireless by a) allowing private entities to use the spectrum bands best suited for broadband, b) giving providers the flexibility to deploy the most efficient technologies, and c) encouraging innovation and entrepreneurship by permitting more unlicensed operation in portions of the spectrum.

The United States has advantages already—it is one of the first countries to set a hard date for the transition from analog to digital television (scheduled for February 2009), which will free up 60 megahertz of spectrum that is ideal for broadband. Government should continue to make more spectrum available. ***The National Telecommunications and Information Administration and the Federal Communications Commission should conduct a band-by-band analysis of the spectrum they regulate, identify any bands that are not being used efficiently, then allow market-based mechanisms to encourage more efficient use.*** [6]

[6] See, for example, Technology CEO Council. *Freeing Our Unused Spectrum*: *Toward a 21st Century Telecom Policy*. Washington, D.C.: TCC, February 2006. Available at http://www.techceocouncil.org/documents/TCC-radiospectrumfinal3.pdf

Finally, America should continue to move away from "command and control" spectrum management, which locks in inefficient uses and technologies. ***In particular, the new President should encourage the relevant agencies to provide operators with exclusive licenses that enable the technical and economic flexibility that will best promote market-driven competition and create largely unregulated, license-exempt, technology-neutral frequency bands to enable continued experimentation.***

Concluding Observations

The United States has the great advantage of incumbent leadership on the Net—but that position is in peril. Yet our country's technology destiny can still be altered with the right policies, and there's reason to be optimistic. The Internet's future will benefit the innovative scientist, the risk-taking entrepreneur, and the pragmatic businessman. Americans thrive in these roles. America can become more competitive by becoming more American—more willing to welcome talent from abroad, more willing to invest in the future, more willing to promote engineering as "sexy," and more willing to encourage scientific exploration.

The programs we advocate would require approximately $25 billion in new government spending annually (after eight years). The direct return from this funding is clear from past experience. Dozens of U.S. technology companies have market capitalizations exceeding $50 billion. Intel alone—one of many companies that benefits from government policy—employs approximately 50,000 U.S. workers, who receive compensation much higher than the national average and has paid nearly $30 billion in taxes over the last decade.

This is about more than simple economics. The Internet is an inherently decentralizing and democratizing medium that empowers the individual citizen, businessperson and student. It allows and encourages the socialization and interaction of people across physical, demographic, and socioeconomic boundaries, encouraging an equality that resonates with the core American character. The Internet reinforces who we are and

whom we aspire to be. Finally, because it showcases core American ideals, it is an incredible tool of cultural "soft power" that is being embraced and embedded in economies around the world. For this reason as well, U.S. IT leadership is essential to our national interests. Our next President must commit strongly to keeping America #1 on the Net.

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