America Needs a Fiber-Based National Broadband Policy Now, If Not Sooner

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In his latest album, *Modern Times,* Bob Dylan paints a troubling picture of what may lie ahead for the United States. In a track called "Workingman's Blues #2," Dylan sings of the diminishing buying power of American workers; of low wages becoming a reality in the face of brutal competition from abroad; of our inability to give away, let alone to sell, what we have to offer; of hunger creeping into our bellies; and of our fear of sinking into lives of continual crime.

"The place I love best is a sweet memory," Dylan laments, "It's a nude path, that we trod." Dylan urges each of us to choose: "You can hang back or fight your best on the front lines, singin' a little bit of these workingman blues."

Are Dylan's concerns overstated? Are they premature? We think not. Whether one agrees or disagrees with the details of President Bush's broadband policies, most of us would surely agree with his observation in his most recent State of the Union address that America's ability to remain competitive in the "dynamic world economy" is at risk. Noting the rapid emergence of competition from India, China, and other countries, he challenged America to take the dramatic steps necessary to ensure that we will continue to occupy the position of global leadership to which we have become accustomed.

In this paper, we discuss the critical importance of an aggressive national broadband policy that emphasizes the development of high-bandwidth communications systems, particularly FTTH systems. The stakes for America are huge. It is a fight from which we cannot hang back but must give our best on the front lines.

The Stakes For America

The United States gave birth to the Internet and in the 1990s it was the unchallenged world leader in broadband deployment. By 2001, however, it had fallen to fourth place among nations in the world in *per capita* broadband deployment. Since then, it has plunged to as low as 19th place in some surveys 2 The United States has also fallen far behind the leading nations in access to high-capacity broadband connectivity, cost per unit of bandwidth,

1 http://www whitehouse gov/stateoftheunion/2006/Mdex html

2 http://www websiteoptimization comfhw/0601

and growth of broadband subscribers.[3] For example, in Japan, ordinary households can now obtain 100 Mbps of connectivity for less than $40 a month.[4] That level of bandwidth is unavailable at any price to the vast majority of residents and small-to-medium-sized businesses in the United States. While the United States is still first in absolute number of broadband lines, its lead will soon be overtaken by China.[5]

Furthermore, if the 25 nations in the European Union are viewed in the aggregate—as many analysts suggest[6]—the "EU25" already have more broadband lines than the United States today, and they will have a huge lead by 2010.[7] By one recent estimate, the EU has almost 53 million broadband users, with an increase of almost 20 million during 2005.8 In comparison, U.S. residential broadband uptake has largely "stalled." [9]

How important is this? It is immeasurably important because broadband will increasingly provide the platform for virtually everything that we do at work, at home, and at play. As a result, in the emerging global economy, the countries that have the most robust, ubiquitous, and affordable broadband infrastructure will be the ones that are most successful, and those that fall behind may not recover for years, if ever. The Brookings Institution estimated that America's broadband decline could lead to a potential loss of $1 trillion in economic productivity over the next decade, as well as more than 1.2 million jobs that could be created by better broadband.[10]

Comparing the United States and Japan, Thomas Bleha expressed these concerns forcefully in his trenchant article, "Down to the Wire," published in *Foreign Affairs*:[11]

> *It is now clear that Japan and its neighbors will lead the charge in high-speed broadband over the next several years. South Korea already has the world's greatest percentage of broadband users, and last year the absolute number of broadband users in urban China surpassed that in the United States. These countries' progress will have serious economic implications. By dislodging the United States from the lead it commanded not so long ago, Japan and its neighbors have positioned themselves to be the first states to reap the benefits of the broadband era: economic growth, increased productivity, technological innovation, and an improved quality of life.*

3 Free Press, Consumers Union and Consumers Federation of America, *Broadband Reality Check II* (October 2006), http://www.freepress.net/docs/bbrc2-final.pdf.

4 http://www.broadbandreports.com/shownews/77192.

5 http://www.redherring.com/Article.aspx?a=18334&hed=China+Broadband+to+Surpass+US.

6 See, e.g., T.R. Reid, *The United States of Europe* (2005).

7 http://www.internetworldstats.com/europa4.htm; http://www.ispreview.co.uk/cgi-in/news/viewnews.cgi?id=EEpykEuVyEhvVssPqv.

8 *Telecom Paper*, Feb. 20, 2006, citing report by European Commission, http://www.telecom.paper.nl/news/article.aspx?id=118059. The report also found that the production and use of information and communication technology accounts for around 40 percent of productivity growth and one quarter of overall growth in Europe.

9 Daniel Terdiman, "Study: Americans' Home Net Adoption Slowing,"*CNET News.com*, Feb. 23, 2006, http://news.com.com/Study+Americans+home+Net+adoption+slowing/2100-1034_3-042670.html?tag=nefd.top.

10 John Reinan, "Broadband Gap Looms as Net Loss for U.S.," *Minneapolis Star Tribune,* Feb. 22, 2006, http://www.startribune.com/535/v-rint/story/257956.html.

11 http://www.foreignaffairs.org/20050501faessay84311/thomas-bleha/down-to-the-wire.html?mode=print.

Similarly, in his book **The World is Flat**,[12] which emphasized developments in India, Thomas Friedman shed further light on the world that is emerging and America's role in it.

> *The dynamic force in [the current stage of globalization]—the thing that gives it its unique character—is the newfound power for individuals to collaborate and compete globally. And the lever that is enabling individuals and groups to go global so easily and so seamlessly is not horsepower, and not hardware, but software—and all sorts of new applications—in conjunction with the creation of a global fiber optic network that has made us all next-door neighbors. Individuals must, and can now ask, "Where do I fit into the global competition and opportunities of the day, and how can I, on my own, collaborate with others globally."*
> ……
> *[W]e are entering into a phase where we are going to see the digitization, virtualization, and automation of almost everything. The gains in productivity will be staggering for those countries, companies, and individuals who can absorb the new technological tools. And we are entering a phase where more people than ever before in the history of the world are going to have access to these tools—as innovators, as collaborators, and, alas, even as terrorists. You say you want a revolution? Well, the real information revolution is about to begin. ...*

Friedman also explored at length the trend of companies worldwide to break down manufacturing, production, service, and other processes and to farm out pieces to the places in the world in which they can be done the most cost-effectively. For example, many American firms—from computer companies to accounting firms—have begun to "outsource" tasks to English-speaking India, the Philippines, and other countries in which bright, well-educated, and highly motivated young people will gladly perform these tasks for a small fraction of what it would cost the firms to have the work done in the United States.

China's surging economy is particularly threatening to America's traditional way of life. In his book **China, Inc.: How the Rise of the Next Superpower Challenges America and the World**,[13] Ted Fishman noted that China expects some three hundred million people to move from the countryside to major cities over the next 15 years. To accommodate this massive population shift, China will have to build the equivalent of Houston, Texas, *every month*, and its government will have to expand and accelerate its aggressive twenty-year-old program of encouraging importation of as many businesses and jobs from around the world as possible. The following passage from *China, Inc*. captures well the high stakes involved for the United States and the rest of the world:

> *The most daunting thing about China is not that it is doing so well at the low-end manufacturing industries. Americans will be okay losing the furniture business to China. In the grand scheme of things, tables and chairs are small potatoes in the U.S. economy. The Japanese, for their part, have lost the television business. The Italians are losing the fine-silk*

12 T. Friedman, *The World is Flat: A Brief History of the Twenty-first Century* at 10-11, 45-46 (Farrer, Strauss and Giroux—New York—2005).

13 T. Fishman, *China, Inc.: How the Rise of the Next Superpower Challenges America and the World* at 14-15 (Scribner—New York, *et al*.—2005).

> *business. Germans cannot compete in Christmas ornaments. Everyone but the Chinese will lose their textile and clothing factories. More worrisome for America and other countries is the contour of the future, where manufacturing shifts overwhelmingly to China from all directions, including the United States. Consumer goods trade on the surface of the world's economy and their movement is easy for consumers to see. The far bigger shift, just now picking up steam, is occurring among the products that manufacturers and marketers trade with each other: the infinite number and variety of components that make up everything else that is made, whether it is the hundreds of parts in a washing machine or computer or the hundreds of thousands of parts in an airplane. And then there are the big products themselves: cars, trucks, planes, ships, switching networks for national phone systems, factories, submarines, satellites, and rockets. China is taking on those industries too.*

Similarly, the Institute of Electronic and Electrical Engineers (IEEE), a highly respected impartial professional organization, has observed:[14]

> *A new generation of broadband, or "gigabit networks," can mean significant benefits to the United States, but our nation must act promptly to ensure that such an infrastructure is ubiquitous and available to all. If we do not act, the consequence will be to relegate the U.S. telecommunications infrastructure to an inferior competitive position, thus undermining the future of our country's economy. This issue demands the attention of policymakers as well as the public at large*
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> *...*
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> *The U.S. economy is based on knowledge — its creation, dissemination and application. A knowledge economy uniquely creates new wealth through invention and innovation. Development depends on research that depends on access to the entire body of existing knowledge and the rapid exchange of new knowledge throughout the economy and the society. Modern research typically retrieves, creates and exchanges massive information files at gigabit rates. After the research, many follow-on functions will benefit from gigabit networks, including computer-aided design; integration of design, manufacturing, sales, and distribution; and collaboration among all through high quality video conferencing.*
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> *...*
>
> *U.S. broadband networks badly lag behind those of many other countries. By one measure, 19 countries have broadband service superior to that of the United States. U.S. maximum public broadband capabilities by DSL and cable modem are in the range of 1 to 5 Mb/s downstream to the user, but generally 500 kb/s or less upstream. By contrast, most South Korean residents have access to 50 to 100 Mb/s, which in many cases is symmetric. South Korea achieved this infrastructure through a government policy supporting deregulation, competition and investment.*

14 IEEE-USA, *Providing Ubiquitous Gigabit Networks in the United States*, http://www.ieeeusa.org/volunteers/committees/ccip/docs/Gigabit-WP.pdf.

Among IEEE-USA's specific suggestions of ways for America to stay abreast of the other leading nations are eliminating the incumbents' ability to use anticompetitive legal and regulatory challenges to the deployment of end-user-owned networks and giving municipalities that deploy gigabit networks broader access to such programs as the Rural Utility Service and the Universal Service Fund.

Is Big Broadband Really Necessary?

Not so long ago, when virtually all Internet users were restricted to dial-up connections of 14.4 kbps, 28 kbps, or 56 kbps, the notion of a "broadband" service enabling an always-on Internet connection of 1 Mbps, 3 Mbps, or even 5 Mbps was viewed as revolutionary. The reality, unfortunately, is that those broadband speeds, while certainly providing a more pleasant and efficient Internet browsing experience, have not fundamentally changed what most people do on the Internet.

While it is true that users may now download short video clips and music, the Internet's true potential is hamstrung by such a limited capacity. The Internet provides the means to instantaneously deliver *and transmit*[15] all manner of communications to and from anywhere in the world. High-definition and on-demand video, real-time multiplayer gaming, the transmission of enormous data files among businesses, and the deployment of innovative applications which do not yet exist, will *not* exist for consumers and businesses whose choice (if they are fortunate enough to have a choice) is limited to a service offering only a few megabits of capacity.[16]

In fact, to rely on a future involving anything less than a 100 Mbps broadband capacity is to be truly shortsighted.[17] The math is simple:

15 [I]it takes only one session with *iMovie* or Windows Movie Maker and a DV camcorder to realize that sharing large image-sized video with family members around the country is still not an application that's truly supported by any domestic broadband services. Uploading such a file is bad enough. Don't even try to stream video from your own PC in real time with today's networks—it's just not possible. Whether 256K bit/sec, 384K bit/sec, even 512K bit/sec or a 1M bit/sec upstream—none of these will really cut it for many bandwidth-needy users these days. Daniel Briere and Patrick Hurley, *ADSL, VDSL, Plus, 2: What Do Consumers Really Need?* NetworkWorld.com, June 21, 2005, http://www.networkworld.com/edge/columnists/2005/0620bleed.html.

16 In August of 2001, USA Today Science Correspondent April Holladay wrote an article about the differences in capacity for dial-up, wireless and fiber optics cable: "Think of the speed. Suppose you were to download the entire Library of Congress onto your PC using a dial-up modem transferring data at a rate of 56 thousand bps. It would take about 82 years. A wireless connection going at 2 Mbps would move the library in a little over two years. How long would a 3-trillion-bps fiber-optics connection take? 48 seconds." Quoted at http://www.iprovo.net/modules/xoopsfaq/index.php?cat_id=1.

17 *See* T. Mastrangelo, *How Much Bandwidth is Enough?,* Converge Network Digest, Oct. 14, 2005, http://www.convergedigest.com/bp-ttp/bp1.asp?ID=263&ctgy=Market.

Bandwidth Requirements for IP-Based Services	
Service	**Bandwidth (downstream)**
Broadcast TV, per channel (MPEG-2)	2 to 6 Mbps
HDTV, per channel (MPEG-4)	8 to 12 Mbps,
Picture in Picture (MPEG-2)	Up to 12 Mbps
Personal Video Recorder	2 to 6 Mbps
Interactive TV	Up to 3 Mbps
High-speed Internet	20 - 50 Mbps
Video conferencing	300 to 750 Kbps
Voice/video telephony	64 to 750 Kbps

Assuming two set-top boxes per home and simultaneous recording or picture-in-picture capabilities, four HDTV channels compressed via MPEG-4 are likely to require a total of at least 50 Mbps capacity. If the provider allocates an additional 20 Mbps for data and Voice over IP (VoIP), then the total bandwidth requirement becomes at least 70 Mbps.[18]

A study by Jupiter Research in 2005 concluded that, by 2009, average households will need 57-72 Mbps of bandwidth and that "tech savvy" households will consume nearly 100 Mbps.19 A significant amount of this bandwidth will support in-home wireless applications, as well as high definition television and other bandwidth-rich applications. According to a leading industry journal, Jupiter's research "provides justification for such technologies as FTTx, which can deliver that bandwidth to the home…."[20]

A study in 2005 by Technology Futures is of particular interest because it was funded and supported by the Bells. The study concluded that "[i]n the 2006 time frame, a shift to much higher data rates in the range of 24 Mbps to 100 Mbps is likely to begin. So far, only a few places have access at these rates, notably Japan."[21]

That amount of bandwidth is clearly beyond the capability of current copper networks. Even the most advanced versions of DSL (ADSL2+, VDSL) require ideal copper conditioning, with the signal—and capacity—heavily degraded the further the end user is from the fiber node. Telcos such as AT&T that are relying on "fiber-to-the-node" and existing copper facilities for the last mile, rather than fiber to the user, are meeting skepticism from Wall Street analysts because of the inherent technological limitations of their strategy.[22]

18 Tim Doiron, *Got Provisions for Triple Play Provisioning?* OSP Magazine, March 2006, http://www.ospmag.com/issues/article/?articleid=00000397.

19 Jupiter Research, *Jupiter Research Predicts that Wireless Home Bandwidth Requirements Could Top 57 Mbps by 2009*, http://www.jupitermedia.com/corporate/releases/04.11.04-newjupresearch.html.

20 L. Vanston, R. Hodges, J. Savage, *Forecasts for Higher Broadband Bandwidth Needs*, http://www.tfi.com/pubs/r/r02004_broadband.html.

21 L. Vanston, R. Hodges, J. Savage, *Forecasts for Higher Broadband Bandwidth Needs*, http://www.tfi.com/pubs/r/r02004_broadband.html.

22 Ed Gubbins, *How Much Bandwidth is Enough?,* Telephony Online, June 5, 2006, http://telephonyonline.com/mag/telecom_bandwidth_enough/.

So, even limited to only the applications we know and expect at the present moment, relying on coaxial cable, DSL, or limited technologies as the infrastructure for the future is truly short-sighted. From a long-term perspective, it is critically important to acknowledge, and act on, the reality that more and more data-intensive network applications will emerge requiring bandwidth capacity exceeding even 100 Mbps.[23]

Furthermore, the difference between 5-10 Mbps and symmetric 100+ Mbps is not simply about the ability to receive more data faster. It is, rather, an economically crucial difference that causes a profound shift in how the medium is used. In Japan, for example, a recent academic study of the effects of widespread, near-symmetric 100 Mbps (as opposed to the passive, receiving-only model that dominates in the U.S. and elsewhere), found a dramatic increase in the use of peer-to-peer applications of various types, as well as in the number of "heavy hitter" users who take advantage of such applications.[24] In other words, affordable access to high-bandwidth capacity results in a surge of applications and of both content users and content creators that does not—and cannot—exist in an asymmetric, low-capacity environment.

There are two important lessons (at least) to be gleaned from the experience in Japan. The first lesson is that access to robust upstream connections is crucial, as it enables a broad range of users to produce and distribute their own content and applications. The second lesson is that affordable high-capacity broadband, as opposed to "baby broadband" of the kind that is available in the United States today, makes not only a quantitative difference, but also an economically significant qualitative difference in the way that users take advantage of the bigger bandwidth.

A high-capacity network means that the last-mile bottleneck issue is solved. Network architects can focus on other bottlenecks throughout the network, addressing backbone issues and caching more efficiently. Applications developers will be assured that, for a commercially meaningful set of users, the network will cease to be a limitation. Of course, it is impossible to predict what exactly will occur over the next ten years or so as a result, but whatever occurs—even it is limited to the applications we know now—it promises to be economically significant. In the long term, areas without the network infrastructure to take advantage of it, whether a small town, a rural area, a less-affluent urban district, or an entire nation, will be on the short end of a competitive and cultural reorganization.[25]

When the unpredictable does occur—such as a new, unexpected family of applications and/or economic breakthroughs by virtue of plentiful upstream capacity—it is a fair bet that

23 This article focuses on fiber-to-the-user technology, which is clearly capable of delivering symmetric speeds of 100 mbps and much higher. Such technology is not currently feasible in some communities, particularly in low-density rural settings. For such communities, the greatest opportunity lies in wireless technologies, which will grow increasingly robust in the years ahead.

24 K. Cho, K. Fukuda, H. Esaki, A. Kato, *The Impact and Implications of the Growth in Residential User-to-User Traffic*, February 11, 2006, http://www.iijlab.net/~kjc/tmp/rbb-20060211.pdf.

25 *See,* Thomas Freidman, *The World is Flat,*

citizens of Europe[26] and Asia[27] will beat the U.S. in taking advantage of it on a widespread basis.

America Needs a National Broadband Policy Now

If given an opportunity, most Americans would probably throw their giant communications providers out and replace them with smaller, more responsive alternatives. After all, the incumbents have not only consistently ranked at or near the bottom in consumer satisfaction surveys, but, on their watch, America has also lost its huge lead in broadband deployment and become an international laughing stock for its backwardness and arrogance.

Realistically, however, no proposed national solution can succeed in the foreseeable future without the enthusiastic participation of all major stakeholders, including the incumbents. That can happen only if all concerned perceive substantial benefits from participating, significant harm from not participating, or a combination of the two.

Unfortunately, neither Congress nor the Federal Communications Commission has had much success in forging widespread consensus on a national broadband policy. Congress has been unable to pass new federal telecommunications laws, much less with the vast majorities in both houses that passed the Telecommunications Act of 1996. The Commission has, if anything, exacerbated America's declining world standing by adopting inadequate definitions of broadband and utilizing misleading data gathering approaches that have retarded our recognition of the urgency of the challenge.[28]

The best solution, we submit, is for the President, with the advice and consent of Congress, to appoint an independent, non-partisan, blue-ribbon commission to study, report on, and build consensus on a national broadband policy. The commission should include representatives of the Federal Communications Commission, the states, local governments, the incumbents, other industry groups (particularly the high-tech sector), the educational community, consumer groups, and all other major stakeholders.

Time is short. We cannot afford to delay. The alternatives, as Bob Dylan has reminded us, are not pretty ones.

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26 If the twenty-five nations in the European Union are viewed in the aggregate —as many analysts suggest — they already have more broadband lines than the United States today and will have a huge lead by 2010. By one recent estimate, the EU has almost 53 million broadband users, with an increase of almost 20 million during 2005. *See*, *e.g.*, T. R. Reid, *The United States of Europe* (2005); Telecom Paper, Feb. 20, 2006, citing report by European Commission, http://www.telecom.paper.nl/news/article.aspx?id=118059.

The report also found that the production and use of information and communication technology accounts for around 40 percent of productivity growth and one quarter of overall growth in Europe.

27 Most South Korean residents have access to 50 to 100 Mb/s, which in many cases is symmetric. South Korea achieved this infrastructure through a government policy supporting deregulation, competition, and investment. That policy jump-started its economy, especially in the information technology sector. Japan, likewise, adopted competitive policies leading currently to widespread 50- to 100-Mb/s symmetric capability and low prices. There is movement already to symmetric optical fiber networks connected to (as opposed to just passing) two million homes, with expanded gigabit availability to homes in 2005.

IEEE-USA, Providing Ubiquitous Gigabit Networks in the United States, http://www.ieeeusa.org/volunteers/committees/ccip/docs/Gigabit-WP.pdf.

28 Free Press, Consumers Union and Consumers Federation of America, *Broadband Reality Check II* (October 2006), (http://www.freepress.net/docs/bbrc2-final.pdf.