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COMMUNICATIONS, BROADBAND, AND COMPETITIVENESS: HOW DOES THE U.S. MEASURE UP?

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

APRIL 24, 2007

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

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COMMUNICATIONS, BROADBAND, AND COMPETITIVENESS: HOW DOES THE U.S. MEASURE UP?

TUESDAY, APRIL 24, 2007

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 10:03 a.m., in room SR–253, Russell Senate Office Building, Hon. Daniel K. Inouye, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. DANIEL K. INOUYE, U.S. SENATOR FROM HAWAII

The CHAIRMAN. This morning, the Committee will examine communications, broadband and competitiveness and we look forward to hearing from the witnesses on how the United States measures up.

On this front, the news is not all good. Just yesterday, the Organization for Economic Cooperation and Development reported that the United States had fallen to 15th in the world in broadband penetration. In some Asian and European countries, households have high-speed connections that are 20 times faster than ours for half the cost. While some will debate what in fact these rankings measure, one thing that cannot be debated is the fact we continue to fall further down the list.

In the year 2000, the United States ranked fourth. Last year, we dropped to 12 and just yesterday, we found out that we have slipped further to 15. The broadband bottom line is that too many of our international counterparts are passing us by and for this, we are paying a price. Some experts estimate that universal broadband adoption would add $500 billion to the U.S. economy and create more than a million new jobs.

Compounding the situation is the state of information and communication technology and research. Today, we see less of the visionary long term research that took place at Bell Labs and resulted in the breakthrough technologies that made our communications industry the envy of the world and instead, competition has forced companies to focus on research tied to short term returns. While this strategy may be good for the bottom line, it sacrifices any chance our Nation has to operate the test bed for new technologies and applications that will be developed in the new economy.

In a digital age, the world will not wait for us so it is imperative that we get our broadband house in order and our communications policy right. Part of the process of getting it right includes having a firm understanding of the scope of our challenge.

To help these goals, we plan to introduce two bills shortly. First is the Broadband Data Improvement Act to improve broadband data collection at both the Federal and state levels. Second, the Advanced Information and Communications Technology Research Act, which will promote innovation and will improve our commitment to basic research on information and communications technology here in the United States.

While there are many issues on telecommunications policy that divide us, it is my hope that attention to these discrete issues, stronger communications research and more useful data about broadband can receive bipartisan support. And on that note, I'd like to recognize our Vice Chairman, Senator Stevens.

STATEMENT OF HON. TED STEVENS,
U.S. SENATOR FROM ALASKA

Senator STEVENS. Thank you very much, Mr. Chairman. I'm pleased that you are emphasizing broadband deployment as we did in the last Congress. Very clearly, this is something we have to explore. I'm hopeful that we can concentrate not only on the areas that are on what we call the South 48 but also upon your state and mine where we have situations where some portions of our states can be reached only by satellite. I want to be sure that we include the discussion of satellite capabilities in these hearings, and universal service is an important component of the total discussion. I'm encouraged. We've had one hearing already on universal service reform.

Another subject that has to be discussed in conjunction with this discussion is the debate on the Internet Tax Moratorium, which will expire this fall. So I look forward to working with you in this area. It is a very difficult area, I think, for us to come to an agreement on but I will do everything I can to work with you to get that agreement. Thank you.

The CHAIRMAN. I thank you very much. Now I'll recognize Senator Dorgan.

STATEMENT OF HON. BYRON L. DORGAN,
U.S. SENATOR FROM NORTH DAKOTA

Senator DORGAN. Mr. Chairman, thank you very much. Let me echo the comments of my colleague from Alaska. This is a very important issue and I'm pleased at the focus on it. I went back to my hometown one day, a town of 300 people and knocked on the door of my little boyhood home. I hadn't been there for many, many decades and asked the woman who answered the door if I could walk in and see the house where I grew up. And on the porch where we used to butcher chickens every spring, instead of butchering chickens, she was actually running a business on the Internet. She had little bracelets hanging on a stanchion and a camera on an arm and she was taking a picture of the bracelet and I said, "what are you doing?" She said, "well, I sell jewelry on the Internet." From a little town of 300 people in my little home where I grew up, she

has a business to sell jewelry on the Internet and it describes, I think, what is made possible by all of this everywhere, anywhere if you have good bandwidth. From telemedicine to distance learning to e-Commerce, not to mention the unique availability of content and information and news and entertainment.

This is really important. But it's really important that we do well in this area and you know, we have a Federal Communications Commission that considers speeds of 200 kilobytes broadband speed. Well, of course, it is not and they consider areas where one person in an entire Zip Code having broadband means that whole area is being served and of course, it isn't. So we rank well behind other countries in penetration. We have a lot of challenges here and I think your focus by putting together this hearing and the focus that this Committee has previously put on this issue is really very important.

This will require, I think, an aggressive marketplace and also thoughtful assistance in public policy to get right. Mr. Chairman, thank you.

The CHAIRMAN. Thank you very much. We are pleased to have two panels. Our first panel consists of the President and Chief Executive Officer of ConnectKentucky and Connected Nation, Incorporated, Mr. Brian Mefford. Then the Policy Director of Free Press, Mr. Ben Scott; and the Chairman of Criterion Economics, LLC and Adjunct Professor of George Mason University School of Law, Dr. Jeffrey Eisenach. May I recognize Mr. Mefford.

STATEMENT OF BRIAN R. MEFFORD, PRESIDENT AND CEO, CONNECTED NATION, INC.

Mr. MEFFORD. Chairman Inouye, Vice Chairman Stevens, Senator Dorgan, thank you for the opportunity to be with you today. It is both an honor and a privilege. My name, as you said, Mr. Chairman, is Brian Mefford and I'm the President and CEO of Connected Nation, a national nonprofit that has been working across the country with states and private sector providers and technology companies to close the digital divide, of which you have just spoken.

Connected Nation is the parent company of ConnectKentucky, our Kentucky-based organization that has served as the demonstration project of sorts for Connected Nation. It is the Kentucky story specifically that I'm here to share with you today.

Three years ago, Kentucky faced a challenge that is common to all states in the country. The needs of the day called for applying technology to traditional and historic challenges such as healthcare and education and government service delivery. So we were talking and strategizing around the concepts of e-Government and telemedicine and virtual education, distance education. But we were struck by the reality of the situation at the time so we surveyed the landscape and realized that it was the basic building blocks, the foundation that was not in place in order for us to successfully execute all these types of policies and these types of applications.

We realized that not only did Kentucky not have those basic building blocks in place but relative to other states, the Commonwealth was literally at the bottom of the barrel in a lot of instances, according to a lot of indicators. So we decided that we first

had to take a step back and address those basic building blocks—broadband access, general technology literacy, the awareness of the importance of technology at the most grassroots level and the actual use of technology.

So we determined to devise an extremely aggressive plan at that time and we used the structure of a public/private partnership to ensure that the strategies and our approach remain market-driven to the largest degree possible. And that has been important over the life of the project.

We worked with the Kentucky Governor, Ernie Fletcher, to develop this plan and to execute this plan that was launched in October 2004 as Kentucky's *Prescription for Innovation.* It was a plan that found immediate support from the legislature and was able to engage local communities from the very beginning.

We established aggressive goals and tactics with this plan that has proven to be comprehensive in nature and I'll talk briefly about the three overriding goals of the plan and the first one was that we would have full broadband deployment everywhere in Kentucky by the end of 2007.

Now, we realized that we first had to understand where we were and so we evaluated the regulatory landscape at the time. We began a series of in-depth demand-side studies, surveying consumers, surveying businesses on how they use technology, why or why do they not use technology and then we also looked at the supply side of the situation.

So in your packets in front of you, you have an example of some of the maps, which are also displayed here on the easel that represent an inventory of where broadband is available across all types of providers in Kentucky, all types of providers, all types of different technologies and the important thing I can tell you about these maps, Mr. Chairman, is that they allowed us to do the inverse analysis and to look at the unserved areas and to focus our attention on how to address those unserved areas of Kentucky, those areas that did not have broadband.

Second, we decided we needed to dramatically improve technology literacy and impact computer and Internet use specifically. Third, we wanted to effect a localized approach and so we said we will create and form local leadership teams, what we have called e-Community Leadership Teams in each of Kentucky's 120 counties. The bottom line is we wanted a comprehensive approach that accounts for both supply and demand realities and one that relies on research to determine where we were at the start, where we needed to go and to track our progress along the way.

I'm glad to be able to sit here with you today and report very dramatic and positive results that came from this work over the past two and a half years. In terms of broadband availability, when we began, Kentucky was covered to the degree of about 60 percent of households were able to access broadband. Today, 92 percent of households can access broadband and that represents roughly 550,000 households over one and half million people roughly.

We're on track to reach that 100 percent goal by end of this year in terms of broadband coverage. Broadband use at home, we've seen a 73 percent increase and that's a data point that to me is perhaps as significant as the coverage aspect because that's one of

those indicators where Kentucky ranked near last in terms of household use and so our growth rate in broadband use has actually led the Nation and has allowed us to catch up with at least half the states in the country.

PC ownership, computer ownership has increased by 20 percent over the last couple of years relative to a 4 percent growth rate nationally. We have those e-Community Leadership Teams, those grassroots teams working on planning at the local level in each of our 120 counties.

Private telecom investment has reached an unprecedented level in Kentucky and in just over the last 2 years, we've seen at least 650 million invested from the private sector, which is a level unprecedented in Kentucky.

I can also report that the impact in Kentucky has been even more significant than the outcomes. So before we began, Kentucky was plagued by what was termed as a brain drain problem. Our university graduates were leaving at an alarming rate. Today, we can report that graduates are staying in Kentucky at a rate of 86 percent of the total and that's relative to 73 percent when we began.

Today, 95 percent of Kentucky natives who graduate from universities and colleges are remaining in Kentucky. Our Ph.D. candidates who finish their programs, the rate that they are remaining in Kentucky has nearly doubled, up from 27 percent to 52 percent today.

The reasons why are manyfold but certainly we can directly correlate the job growth that has occurred in Kentucky over the past 2 years and in that timeframe, 14,500 new technology jobs have been created in Kentucky. In the IT sector alone, in the past 2 years, Kentucky's growth rate for jobs has been 31 times the national growth rate in the IT sector. So that's actually a reversal of the trends, the job trends prior to the implementation of this program.

In summary, Kentucky as a microcosm, has demonstrated the importance of the national broadband discussion and the relevance of technology to America's ability to compete. Based on our experiences in Kentucky, we know that technology diminishes the significance of distance.

In the past, opportunities to thrive have depended largely on one's proximity to major markets. Technology has made the distance factor irrelevant. In other words, Mr. Chairman, with the availability of cutting-edge technology, businesses and entrepreneurs can thrive just as well in rural America as in other places, such as Los Angeles and New York. Technology has become the great equalizer, creating opportunities, fueling better education, higher quality healthcare and better quality of life, regardless of where an individual or community happens to be located. This same dynamic, however, represents both a huge opportunity and a major threat for the United States. Other countries have invested in broadband and related technologies toward achieving universal access and like Kentucky, they have managed to leapfrog their previous standings and to become a competitive force in the economy.

It is the hope of Connected Nation that this Congress—that this Committee can call the country to arms on this issue by conveying the sense of urgency that exists for action. The Nation needs a comprehensive approach that is good for markets and communities. No doubt, it is a challenge of historic proportion. Just as previous times called for a national response to the need for railroads, highways, electricity and telephone service, the broadband challenge of today calls for an aggressive and comprehensive response to ensure that America remains the dominant leader in the global economy. Thank you, Mr. Chairman.

[The prepared statement of Mr. Mefford follows:]

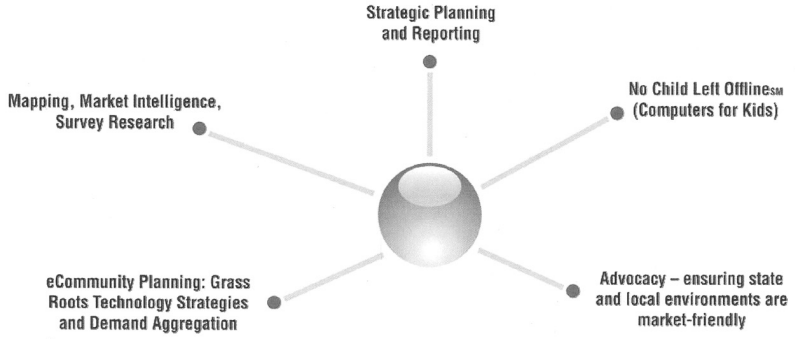
PREPARED STATEMENT OF BRIAN R. MEFFORD, PRESIDENT AND CEO, CONNECTED NATION, INC.

Background

Connected Nation, Inc. is a national non-profit organization known for its ability to close the digital divide. Through its partnerships, programs, and policies Connected Nation makes technology work for previously underserved communities and markets, improving community life and economic development while enhancing markets for technology providers. Connected Nation's proven methodologies are delivering dramatic results that translate into more efficient public services and enhanced quality of life. Connected Nation's work in Kentucky, ConnectKentucky, has been identified as a national model for the expansion of broadband.

Connected Nation's proven methodologies enable comprehensive technology expansion efforts that effectively enhance the supply of available broadband while dramatically increasing demand through state and local grass roots awareness/adoption campaigns. Connected Nation specializes in increasing technology access and literacy towards greater digital inclusion for all. This technology expansion improves economic development, healthcare, education, and public safety; and provides a better way of life for Americans.

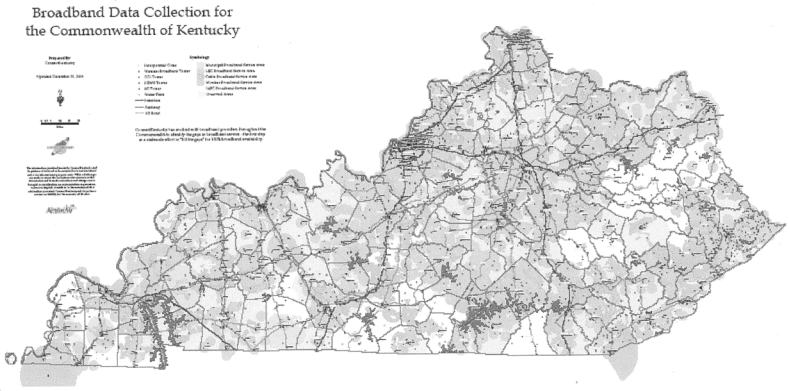
Charting the course for the United States' technology-centric future, Connected Nation creates partnerships between the public and private sectors. These partnerships encourage cooperation for mutually beneficial purposes—making the cost of technology expansion go down and the demand for technology go up. Our comprehensive approach to technology expansion works for communities and markets.



Research and Mapping

Connected Nation's broadband inventory maps are industry leaders. These GIS maps create an inventory of existing broadband services based on provider deployment data. This analysis effectively helps broadband providers to more effectively target their build out resources. Connected Nation's market intelligence (maps, survey data and grassroots demand aggregation) benefits companies by causing the cost of doing business to go down and the ease of doing business to go up.

This broadband inventory map is publicly available and based on provider deployment data.



Beyond accurately measuring the inventory of broadband services, Connected Nation's research measures other important items related to the expansion of broadband. For example, What are the consumer barriers to broadband? Or, How do businesses use broadband?

Based on these findings, programs can be developed that encourage digital inclusion. For example, our research indicated that while industry assumed that the monthly fee was a primary barrier to the adoption of household broadband the lack of a computer at home ranked even higher. We developed No Child Left Offline as a partnership based solution. No Child Left Offline has facilitated cooperation among private partners, corporate foundations and state governments to place computers and printers into the homes and schools of disadvantaged children.

Connected Nation's Impact

Connected Nation's model is based in a simple premise that technology can be good for communities and markets. Comprehensively engaging both supply and demand realities is the best plan for success. The results from ConnectKentucky confirm the strength of Connected Nation's model.

Launched in 2004, Kentucky's *Prescription for Innovation* is a comprehensive plan to accelerate technology statewide, particularly in the areas of broadband availability and computer literacy and use. ConnectKentucky is implementing this initiative which maintains four key objectives for impacting statewide technology-based economic development:

- Full broadband deployment;
- Dramatically improved use of computers and the Internet by all Kentuckians;
- A meaningful online presence for all Kentucky communities, to improve citizen services and promote economic development through e-government, virtual education, and online healthcare; and
- Local technology leadership teams in every community to develop and implement technology growth strategies for local government, business and industry, education, healthcare, agriculture, libraries, tourism, and community-based organizations.

As identified by the *Prescription for Innovation,* technology can dramatically expand economic development opportunities and improve the quality of life for Kentuckians. With expanded technology, opportunities are within reach, such as:

- Developing a competitive economic advantage for attracting today's high-tech jobs to replace the decline of traditional manufacturing jobs;
- Residing in one of Kentucky's rural communities and succeeding in a career that formerly required moving to a major metropolitan area;
- Better and less expensive healthcare; and
- An education that prepares Kentucky's children to prosper in a globally networked world.

To fully address each of these opportunities and to ensure that Kentucky provides an increasingly attractive environment for technology expansion, ConnectKentucky employs a comprehensive approach that has been identified as a national leader and

a model program for the rest of the country to follow.[1] Last year, ConnectKentucky received the U.S. Economic Development Administration's 2006 Excellence in Innovation Award.

What Is ConnectKentucky?

ConnectKentucky connects people to technology in world-altering ways: improving the lives of the formerly disconnected; renewing hope for previously withering rural communities; driving increases in the number of tech-intensive companies and jobs; and nurturing an environment for lifetime learning, improved healthcare, and superior quality of life. Through its partnerships, programs and policies ConnectKentucky makes technology work for previously underserved communities and markets, improving community life and economic development while enhancing markets for technology providers.

ConnectKentucky works with supply and demand realities in a manner that respects communities and gets results. ConnectKentucky is engaged with all 120 Kentucky counties, local business and community leaders, and private sector technology companies to facilitate comprehensive technology expansion efforts that both enhance the supply of broadband-related technology and create demand by catalyzing and delivering grassroots awareness, literacy and use of technology.

Impact of ConnectKentucky

Through the work of ConnectKentucky and its partners, Kentucky's *Prescription for Innovation* has led to the following successes during the last 2 years:

- Kentucky is recognized as the *national leader* in technology acceleration with the *Prescription for Innovation* repeatedly acknowledged as the national model for states;
- *Broadband availability has increased from 60 percent to 92 percent* of households able to subscribe, representing 504,000 previously unserved households and more than 1.2 million residents that can now access broadband;
- *Broadband use at home has increased 73 percent,* a rate that has led the nation;
- Broadband use among Internet connected businesses rose from 65 percent to 85 percent;
- *Home computer ownership grew by 20 percent* while the national average rose by 4 percent;
- More than *$650 million in private capital has been invested in Kentucky* (unprecedented);
- Nearly *2,000 home computers have been distributed* to the homes of underprivileged Kentucky students through the No Child Left Offline program;
- *eCommunity Leadership Teams have been established in every Kentucky county* creating grassroots technology growth plans across nine sectors;
- More than 70 percent of Kentucky counties now operate or are in the process of constructing a meaningful web presence for e-government and online citizen services. Two years ago, only one-third of Kentucky counties had a website, and many of these were not functional;
- 22,000,000+ positive media impressions have covered Kentucky technology growth; and
- *Kentucky is on track to be the first state with 100 percent broadband coverage.*

ConnectKentucky's Economic Impact: A Case Study

At an increasing rate, companies are locating to Kentucky, entrepreneurs are developing businesses in Kentucky, and jobs are growing in Kentucky because the Commonwealth now has the technology infrastructure and an increasing technology-savvy workforce to support business growth. *On track to become the first state with 100 percent broadband coverage with nation-leading increases in broadband use at home and work.*

Over the last 2 years, more than 14,500 total technology jobs have been created in Kentucky.[2] The most appropriate place to isolate and measure the direct employ-

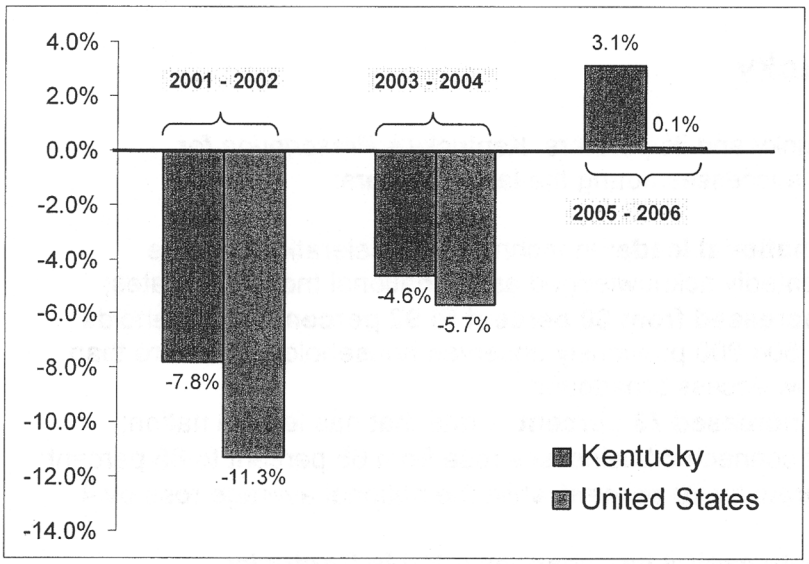
[1] ConnectKentucky has been cited as a national best practice by: the U.S. Economic Development Administration, the U.S. Government Accountability Office of Congress, the White House Office of Technology, Federal Communications Commission, Appalachian Regional Commission, USDA Rural Utilities Service, Congressional Research Service, Center for Digital Government, Southern Growth Policies Board, Communications Workers of America, Rural Telecommunications Congress and numerous states across the Nation.

[2] Bureau of Labor Statistics (BLS) for the 2-year period beginning January 2005 through December 2006. Includes jobs created in the following NAICS sectors: information; finance; profes-

ment impact of broadband expansion efforts is in the Information Technology (IT) sector. During the same 2 year period, *in the IT sector alone, Kentucky jobs have grown at a rate 31 times the national growth rate: 3.1 percent for Kentucky versus 0.1 percent nationally.*

Chart 1

Kentucky Growth vs. National Growth in Information Technology Jobs



During the first 2 years of the *Prescription for Innovation*, Kentucky IT jobs grew by 3.1 percent, outpacing national growth by 31 times.

Connected Nation's Kentucky engagement, ConnectKentucky, has been recognized as a national leader by: the U.S. Government Accountability Office of Congress, the White House Office of Technology, U.S. Economic Development Administration, Federal Communications Commission, Appalachian Regional Commission, USDA Rural Utilities Service, Congressional Research Service, Center for Digital Government, Southern Growth Policies Board, Communications Workers of America, Rural Telecommunications Congress and numerous states across the Nation.

Reversing the "Brain Drain" in Kentucky

The closing of the digital divide is already yielding dividends in the quality of life for Kentuckians. By closing the digital divide, computer literacy has increased, the number of high tech jobs has increased, and Kentucky communities are enjoying the return of their offspring. Consider these developments in higher education related to how ConnectKentucky has helped Kentucky address the "brain drain" challenge that all states face:

- Today, 86 percent of all Kentucky graduates remain in Kentucky to live and work—a 17 percent increase since 2000.
- Since 2000, there has been a 50 percent increase in the number of out-of-state students who remain in Kentucky.
- For those graduates who came in as Kentucky residents, 95 percent of them now stay.
- The percent of doctoral degree students who stay in Kentucky has nearly doubled (27 percent to 52 percent).

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sional, science, and technical; management; and healthcare. These sectors are comprised primarily of high tech jobs and all jobs within these sectors are "technology based". Other sectors include additional technology jobs; however, these jobs are aggregated with other nontechnology jobs, such as in the manufacturing sector. As BLS does not disaggregate these jobs, they could not be included in the figure above, which results in an understatement in the reporting of technology jobs.

Connected Nation's Legislative Agenda

Connected Nation provides the leadership that delivers technology for strong communities and open markets. Our work is predicated on the notion that there's no reason for anyone in America to be on the wrong side of the digital divide. Here's why:

- Connected Nation's work has proven to be effective in state based engagements like ConnectKentucky.
- Each state has underserved communities that desperately need access to affordable and dependable broadband.
- National public and private entities are looking for a means of cooperating for our greater national good.

Therefore, Connected Nation encourages legislation that bridges the digital divide for all of America.

Connected Nation advocates a national legislative agenda that accomplishes the following:

- Provides solution for ubiquitous broadband deployment and increased adoption by encouraging and funding public-private partnerships at a state level;
- Establishes a grant program to enable each state to develop a comprehensive approach to broadband deployment while simultaneously driving broadband adoption and technology development at a local community level;
- Allows nonprofit organizations that have established a partnership with state government to apply for funding to:
  - Identify and map the gaps in broadband service—those areas without broadband availability—and then work collaboratively with all providers to fill those gaps in a manner that supports their business plans and works for communities;
  - Measure and track broadband and information technology use among citizens and businesses, investigate barriers to adoption at a local level, and provide market analysis for unserved areas;
  - Develop local technology planning teams with members representing a cross section of the community, including business, telecommunication labor, K–12 education, health care, libraries, higher education, community-based organizations, local government, tourism, parks and recreation, and agriculture;
  - Equip and facilitate local technology planning teams with the tools and resources to improve technology use within each sector; and
  - Establish effective programs to improve computer use and Internet access for disenfranchised populations.

This public-private partnership approach establishes the collaborative environment that encourages investment, drives technology adoption, and empowers grassroots-led community development and ultimately, strengthens America.

The CHAIRMAN. Thank you very much, Mr. Mefford. It's a very impressive testimony. May I now recognize Mr. Ben Scott.

STATEMENT OF BEN SCOTT, POLICY DIRECTOR, FREE PRESS; ON BEHALF OF FREE PRESS, CONSUMERS UNION, AND CONSUMER FEDERATION OF AMERICA

Mr. SCOTT. Thank you, Mr. Chairman, Mr. Vice Chairman and Members of the Committee for the opportunity to testify today. I am a consumer advocate from a public interest organization and I'd like to start this morning with a quick analysis that we conducted of the five things that matter most to a broadband consumer.

Number one is availability. Can I get broadband? Number two is competition, do I have choices? Number three is speed—is my connection fast enough to run the applications on the Internet that I like best? Number four is value—is the price affordable and reasonable for what I'm getting and finally, adoption. Did I actually buy the service?

In each case, we found serious problems. Roughly 10 percent of households still do not have a wireline broadband provider. We found the market is not competitive. It remains a rigid duopoly at the residential level and 96 percent of residential advanced service lines are either cable or DSL and there is no viable third technology that can compete head-to-head on price and speed.

Broadband capable cell phones, like BlackBerries and Trios, much as I love mine, are expensive. They are slow and they are seldom used as substitutes for a wireline connection at home. We would be wise to shelf the hype on this point about wireless broadband and face the reality that it is not yet a substitutable competitor. Regrettably, even the 700 megahertz auction that is currently pending at the FCC appears unlikely to realize the goal of a true wireless third pipe.

We also found that over half of all broadband connections in the United States are slower than 2.5 megabytes per second, at best, 1/10 the speed of those connections common in Europe and Asia and not fast enough to run next-generation applications. Worse, American consumers routinely pay between $7.00 and $10.00 a megabyte. Compare that to the less than one dollar that the top nations in the world pay.

In short, American consumers are paying more for less than our global counterparts. About 60 percent of Americans are not yet broadband subscribers, either because it isn't available, it isn't affordable or it simply isn't attractive enough for them to buy.

Mr. Chairman, as you mentioned, new data released this week by the OECD shows that we dropped from 12th to 15th in the OECD nations. This is down from 4th in 2001. We're still, in my mind—our growth rate between 2005 and 2006 puts us 20 instead of 30. This isn't just a matter of pride at stake. This is real money because the network affects the economic benefits of higher broadband penetration, which accumulate exponentially. That means that even a small increase in our broadband penetration rate translates into billions of dollars in consumer surplus. While we aren't capturing those dollars, somebody else is.

Now, defenders of the status quo will argue that America's poor performance is misleading because of our low population density and there is a certain intuitive logic to this. But when you look at the data very closely, the geographic differences between countries don't really explain our performance relative to our global counterparts.

What matters much more is household income and poverty. Those factors swamp geography in their explanatory value in the models. In the aggregate, it's not that broadband isn't available to most Americans—we're just not buying it. In other words, we need more competitive, affordable services with more attractive features to make it worth a family's hard-earned dollars.

So how do we fix these problems? I think we need a bold vision for a national broadband policy. To begin, I couldn't agree more with Mr. Mefford—we need better data from the FCC. We need to find the unserved areas in this country on a block by block basis, not on a Zip Code basis and we also need to measure price and speed to monitor the progress of competition.

We also need to study the traffic on the Internet. Currently, not a single data link on the Internet backbones are available for researchers to study the problems of cyber security, privacy, spam and congestion. Further, I think we need to invest in programs that bring equipment and training to under-served communities so that it makes sense to connect to the Internet. If you don't have a computer, broadband connection doesn't do you much good.

Above all, we need competition policy to drive down prices. We need competition policy to accelerate speeds and deliver a more attractive product to consumers. Up to now, we have bet the farm on competition between technologies like DSL and cable. It just hasn't worked out. We've only managed to more deeply entrench vertically integrated telephone and cable incumbents.

By contrast, most of the global leaders have embraced policies that bring competition not just between technologies but also within each technology platform. We must seriously consider that this combination is the key to regaining our stature as the world's leading technology nation. We must not sacrifice the long-term interests of the country for the short-term interest of incumbents that have long shielded themselves from an open market.

In the short term, we should move forward on a variety of progressive policies, including the opening of TV white spaces for unlicensed wireless use. We should protect the rights of local government to offer broadband service. We should transition the universal service programs to broadband and we should safeguard the Internet market for goods and services through net neutrality rules. Finally, we should explore opening our networks to unleash more competitive market forces.

In my view, this is a paradigm shifting moment for American telecommunications. It is imperative that we choose wisely and we as consumer advocates, look forward to working with this Committee on your legislative agenda. I thank you for your time and attention and I do look forward to your questions.

[The prepared statement of Mr. Scott follows:]

PREPARED STATEMENT OF BEN SCOTT, POLICY DIRECTOR, FREE PRESS, ON BEHALF OF FREE PRESS, CONSUMERS UNION, AND CONSUMER FEDERATION OF AMERICA

Summary

Free Press,[1] Consumers Union,[2] and Consumer Federation of America[3] appreciate the opportunity to testify on broadband competitiveness. As consumer advocates, we strongly support policies that will bring more broadband competition to American households. The current broadband problems we face are severe and the

[1] Free Press is a national, nonpartisan organization with over 350,000 members working to increase informed public participation in media and communications policy debates.

[2] Consumers Union is a nonprofit membership organization chartered in 1936 under the laws of the state of New York to provide consumers with information, education and counsel about goods, services, health and personal finance, and to initiate and cooperate with individual and group efforts to maintain and enhance the quality of life for consumers. Consumers Union's income is solely derived from the sale of *Consumer Reports*, its other publications and from noncommercial contributions, grants and fees. In addition to reports on Consumers Union's own product testing, *Consumer Reports* with more than 5 million paid circulation, regularly, carries articles on health, product safety, marketplace economics and legislative, judicial and regulatory actions which affect consumer welfare. Consumers Union's publications carry no advertising and receive no commercial support.

[3] The Consumer Federation of America is the Nation's largest consumer advocacy group, composed of over 280 state and local affiliates representing consumer, senior citizen, low-income, labor, farm, public power and cooperative organizations, with more than 50 million individual members.

consequences of resting on the status quo unacceptable. Recent broadband policy at the FCC has not embraced a free market approach to enabling competition, but rather supported the entrenched incumbency of a rigid duopoly. Going forward, we must break out of this box and reassert the principles of public interest communications policy enshrined in the Communications Act—to bring essential communications services at affordable rates to all Americans.

We recommend this Committee undertake a sweeping inquiry into a variety of broadband policy options and begin moving toward a comprehensive national broadband policy. Step one in this process will be a thorough confrontation with the problems in the current broadband market. It is important that we set aside the myths and excuses we have used to justify our broadband troubles up to now. The reality is that the U.S. broadband market has significant failures in the three metrics that matter most: availability, speed, and value (cost per unit of speed). Despite years of promoting universal availability, there are still roughly 10 percent of American households that lack a terrestrial broadband provider. We pay more for a lot less bandwidth than our global competitors. Finally, we do not have a competitive market that is pushing speeds up and prices down at a rate sufficient to raise our stature relative to the rest of the world. In a study released this week by the Organization for Economic Cooperation and Development, the U.S. has dropped from 12th to 15th in broadband penetration among the 30 member nations in the last 6 months. Our growth rate relative to the other OECD nations over the past year ranks at 24th place.

Tackling these challenges will take bold, aspirational leadership. To begin, we need to improve the depth and breadth of the data the FCC collects from broadband providers so that we better understand our problems and our progress. We must then undertake a variety of policy initiatives to bring competition to the marketplace including: ensuring spectrum auctions produce real competitors not vertical integration; opening the TV white spaces for unlicensed use; protecting the rights of local governments to offer broadband services; guaranteeing the interconnection of networks on nondiscriminatory terms; transitioning USF programs to broadband; safeguarding the Internet's free market for goods, services and speech through network neutrality rules; and investing in programs that bring equipment and training to underserved communities.

We rely on the market forces of a duopoly to produce robust cross-platform competition at our peril. When the chief supporters of the status quo, wait-and-see approach to the arrival of a third competitor to DSL and cable are the incumbents themselves, we should understand that they do not expect it will happen. Further, we can see that most of the global leaders in broadband performance have embraced so-called "open access" network rules, policies that bring competition both *between* and *within* technology platforms. This combination of "intermodal" and "intramodal" competition is the key to regaining our once-lofty stature as the world's technology leader. We must not sacrifice the long term economic and social interests of the country for the short term interests of a duopoly marketplace that has long shielded itself from free market competition. This is a paradigm shifting moment for American telecommunications. It is imperative that we choose wisely. We look forward to working with the Committee as it moves forward.

Part I. What Is the "Broadband Problem"?

For many years now, the Congress has grappled with the policy challenges of realizing universal, affordable access to high-speed Internet services. The facts are unambiguous. A significant number of American households—around 10 percent—have no available terrestrial broadband service.[1] A much larger percentage—over 40 percent—have service available to them, but they do not subscribe, foregoing the social and economic benefits of connectivity because of high prices, a lack of equipment and training, or simple disinterest.[2] Rural areas lag behind urban areas in broadband access. The poorest among us are the least likely to gain access to the technologies that could lead to social mobility. The cost to our economy and the quality of life in our society mounts each successive year that these problems go unsolved. Meanwhile, alarmingly, the U.S. is falling behind the rest of the world in broadband penetration and market performance, ceding the tremendous benefits of leading the world in network connectivity to others.

Once called the digital divide, this policy issue is now often recognized by the simple but unenviable moniker: the "broadband problem." Dozens of scholarly articles and books about the subject have been written in an effort to clarify the stakes, the options, and the evidence in favor of one solution over another. It is one of the most important policy issues of our time. It would be impossible for us to provide in this setting a full accounting of the broadband problem. Instead, we will offer the Com-

mittee a discussion and recommendations to answer two central questions: what is going wrong and what should be done about it.

We are unique among the world's leading technology nations—we lack a comprehensive national broadband policy. There is no time like the present to remedy this situation by applying visionary leadership in this space and establishing a broad set of policy initiatives to right the ship.

Evaluating the U.S. Broadband Market

For years now, the U.S. Government has set goals to realize universal, affordable broadband service for the country. This is consistent with our long history of using policy to promote the expansion of essential communications services. In 1934, when the Communications Act set the goal for communications policy "to make available to all people of the United States, a rapid, efficient, nationwide and world-wide wire and radio communications service with adequate facilities at reasonable charges," two-thirds of the American people did not have telephone service. It was this forward looking commitment, sustained over decades, which gave America the finest communications network in the world.

The President called for us to reach the universal broadband milestone by this year. There is now no chance we can achieve that result. While it is true that the total number of broadband lines deployed in the U.S. is rising and the total number of broadband users is now near 50 percent of the country, the U.S. growth rate in broadband penetration compared to other nations is not encouraging. Looking at the amount of growth in broadband penetration between December 2005 and December 2006, the U.S. is ranked 24th out of 30 among OECD nations.[3] Simply put, other nations are surpassing us. In 2004, when the U.S. was ranked 10th in broadband adoption among industrialized nations, the President quipped, "Tenth is 10 spots too low, as far as I'm concerned."[4] Since then, study after study evaluating the broadband performance among the world's leading nations has shown the steady decline of the U.S. down the ranks. Though some have scrutinized the data from these studies to find some qualifications to ease our wounded pride, the trend lines are not in error. We trust the President's displeasure has grown with our underwhelming performance and that he will gladly work with Congress to solve these problems as rapidly as possible.

The broadband problem is most commonly assessed through a raw headcount of households that have access to high-speed Internet service, what services are available, and how many consumers subscribe to those services. These are valuable data points that give us a picture of competition in the marketplace and consumer behavior. Accordingly to the best available data:

- *Extrapolating from FCC data, nearly 60 percent of U.S. homes are not broadband adopters.*[5]
- *The rate of residential broadband adoption continues to slow.* From June 2005 to June 2006 the number of residential advanced service lines increased 34 percent. But from June 2004 to June 2005 the increase was 62 percent.[6]
- *37 percent of ZIP codes have one or less cable and/or DSL provider.*[7] Given that FCC ZIP code data overstates the level of broadband deployment, this should be viewed as a conservative figure.
- *Some states have large gaps in coverage.* Over 40 percent of South Dakota households are not wired for cable broadband. Over 40 percent of New Hampshire and Vermont households are not wired for DSL.[8]
- *The broadband market remains a duopoly.* 96 percent of residential advanced services lines are either cable or DSL.[9]
- *There are no viable 3rd "pipe" competitors.*
  - From June 2005 to June 2006 there were only 637 new broadband over powerline (BPL) connections added, bringing the total to just over 5,000 nationwide, or 0.008 percent of all U.S. Broadband connections.[10]
  - From December 2005 to June 2006 the number of advanced service satellite broadband connections DECREASED by 40 percent.[11]
  - Mobile wireless broadband from cellular carriers enjoyed a rapid growth rate in the last year. However, these connections remain slow and costly compared to wireline alternatives. They are not substitutable competitors with DSL and cable modem, but rather form a complementary market dominated by vertically integrated firms with little incentive to cannibalize wireline market share. (See below for analysis).

This record of performance has not positioned us well in the race for global competitiveness—with all of the economic and social benefits at stake. According to the

OECD, the U.S. is 15th among the 30 member nations in broadband penetration, lagging behind the acknowledged world leaders, the Netherlands and South Korea, but also Canada and all of Scandinavia.[12] The ITU, evaluating a larger number of countries than the OECD, places the U.S. at 16th.[13] A separate ITU study measuring a variety of factors in the Digital Opportunity Index, places the U.S. at 21st.[14] This is a particularly valuable analysis because it explores eleven different variables of technology development to assess each country in the study including the proportion of households with telephones, mobile telephones, computers, and Internet access; the rates of connectivity to the communications infrastructure; and the cost of connectivity relative to per capita income. Notably, the U.S. dropped from 8th place in the Digital Opportunity Index in 2000 to 21st place by 2005. We are ranked 36th relative to other nations in the increase in the absolute value of our Digital Opportunity Index score between 2000 and 2005.

It is critical to recognize that our evaluation of the health of the broadband market must not end with a calculation of the available services, platform market share, and subscribership. There are three key metrics for understanding the broadband problem: availability, speed, and value (cost per unit of speed). In crafting a national broadband policy, we must recognize that true marketplace competition is the touchstone that yields marked improvements in all three metrics. Though the sizable service gaps that leave rural America without a viable broadband connection are a huge problem, this is likely the easiest issue to resolve. Far more challenging are the starkly unfavorable comparisons in speed and value which separate us from the world leaders in broadband. These data-points suggest that we have a long way to go to catch up with the rest of the world, even if we manage to reach the goal of universal availability.[15]

- According to Takashi Ebihara, Senior Director of the Corporate Strategy Department at NTT East Corp, Americans pay 7 times as much on a cost-per-megabit basis for bandwidth compared to the Japanese—$.70 versus $4.90.[16]
- According to the OECD, Subscribers in Japan, Sweden, Korea, Finland and France pay the least per Megabit per second (Mbps) of connectivity
  - Japan: $0.22
  - Sweden: $0.35
  - South Korea: $0.42
  - Finland: $0.59
  - France: $0.82
  - In the U.S. a 3 Mbps DSL line retails for about $30, or $10 per Mbps, while a 6 Mbps cable line sells for about $45, or $7.50 per Mbps.
- A 50 mbps connection in Japan costs $30 per month. Such speeds are not even available in the U.S. American customers can expect to pay $20–$30 per month for (at best) 3 mbps of DSL connectivity or between $40–$50 per month for 4–8 mbps of cable modem connectivity. Not only do American consumers settle for less, we often pay more for it.[17]
- A French company offers the "triple play"—50 mbps of symmetrical broadband service, unlimited telephony and cable television—for 30 euros per months. Neither this level of service nor this price point is available in the U.S. by a wide margin.[18]
- The proportion of slow connections is on the rise. In December 2005, 15 percent of broadband lines had upload speeds slower than 200 kbps. By June 2006 this had increased to 22 percent of lines. The proportion of DSL lines that had upload speeds slower than 200 kbps increased over the 12/06–6/06 time period from 18.4 percent and 18.9 percent.[19]
- Over half of all broadband connections in the U.S. are slower than 2.5 Mbps.[20]
- Prices aren't dropping. Pew data[21] showed a year-to-year increase for cable, and a slight decrease for DSL—but the bulk of that is due to low-intro slow-speed teaser rates. Yes, broadband speeds are slowly increasing, but we would expect a competitive broadband market to yield BOTH quality increases and price cuts.

The consequences of lagging performance are severe. Thomas Bleha, in his widely read 2005 article describes the situation so aptly it is worth quoting at length:

> In 2001, Robert Crandall, an economist at the Brookings Institution, and Charles Jackson, a telecommunications consultant, estimated that "widespread" adoption of basic broadband in the United States could add $500 billion to the U.S. economy and produce 1.2 million new jobs. But Washington never promoted such a policy. Last year, another Brookings economist, Charles Ferguson,

argued that perhaps as much as $1 trillion might be lost over the next decade due to present constraints on broadband development. These losses, moreover, are only the economic costs of the United States' indirection. They do not take into account the work that could have been done through telecommuting, the medical care or interactive long-distance education that might have been provided in remote areas, and unexploited entertainment possibilities.

The large broadband-user markets of Northeast Asia will attract the innovation the United States once enjoyed. Asians will have the first crack at developing the new commercial applications, products, services, and content of the high-speed-broadband era. Although many large U.S. firms, such as Cisco, IBM, and Microsoft, are closely following developments overseas and are unlikely to be left behind, the United States' medium-sized and smaller firms, which tend to foster the most innovation, may well be.

The Japanese and the South Koreans will also be the first to enjoy the quality-of-life benefits that the high-speed-broadband era will bring. These will include not only Internet telephones and videophones, but also easy teleconferencing, practical telecommuting, remote diagnosis and medical services, interactive distance education, rich multimedia entertainment, digitally controlled home appliances, and much more.[22]

The Elusive Third Pipe—Why Wireless Won't Save Us

To the extent that U.S. broadband policy has been guided by any logic, it is the argument that intermodal or cross-platform competition will be the savior of national broadband performance in the marketplace. While much of the rest of the world has opened up vigorous competition *within* platforms, we have staked our broadband future on competition *between* platforms. So far, it has not worked out—the U.S. broadband market has long been a rigid duopoly that shows few signs of weakening.

The lack of price competition between DSL and cable modem is apparent in the marketplace. Cable operators have made no attempt to match DSL on price. Comcast CEO Brian Roberts poured cold water on the idea that he is concerned about introductory price cuts in DSL. "We continue to believe and continue to charge for our services a rate that we think is a great value because the product is so much better. When Hyundai cuts their prices, BMW isn't exactly upset about it."[23] Though they have ticked off consumers who want higher speeds, they primarily rely on bundled services to hold customers. The DSL operators have aimed their marketing strategy at transitioning dial-up customers with introductory rates to low-end DSL. However, this practice is ebbing. Recent industry analysis shows that introductory DSL prices are rising; so are prices for bundled services. According to a recent press report, Banc of America analyst David W. Barden noted that "a duopoly is emerging where cable and phone companies can avoid provoking price cuts in their core services. Carriers, for instance, can discount DSL service while keeping prices up on phone service, and cable firms can drop prices for phone service but maintain higher pay-TV rates."[24]

The broadband problem in the U.S. flows from a simple policy mistake—a decision to rely upon a duopoly of telephone and cable companies to decide where and when to deploy this vital infrastructure with no overarching social responsibilities whatsoever. They have slow rolled deployment, kept prices far above those in other nations, and emphasized bundles of services targeted to upper income Americans built around "franchise" services. The results is restricted availability and a network that is intended to maximize short run profits, not the long run national interests of social welfare.

Though some might maintain that duopoly competition is sufficient, it is the expectation of a third pipe competitor that has propped up the logic of relying on intermodal competition to reach our policy goals. The steady promise in hearings such as this one over the last year or two has been that a viable wireless competitor is right around the corner. This hypothetical wireless competitor will throw open the gates of competition, unleash market forces, and the genius of the invisible hand will drive down prices, increase innovation, and turn the U.S. back onto the path toward regaining global leadership in broadband technology. Some commentators claim that the wireless competitor has already arrived in the form of 3G mobile cellular broadband. For example, Steve Largent, the President and CEO of CTIA made this comment before this Committee in May of 2006: "As we enter our third decade, the wireless industry is poised to enter a Wireless Renaissance, bringing advanced services like wireless Internet, to more than 200 million mobile Americans."[25] Recent data from the FCC seem to support this point of view. Sixty percent of the increase in broadband connections over the past 6 months is due to mobile cellular wireless connections.[26]

But these promising statistics are only promising because they are misleading. The FCC counts a broadband capable PDA subscriber exactly the same as a residential DSL or cable modem subscriber when counting broadband connections. The problem is that the wireless and wireline broadband products are in completely different product markets. They are not comparable in either performance or price; they are not substitutable services; and they are certainly not direct competitors. Though no precise data exists, it seems obvious that the overwhelming majority of subscribers to mobile broadband devices have not canceled their wireline broadband service as a result. The wireless product is a complementary product for which the consumer pays extra. Most consumers do not use mobile wireless broadband on cell phones for the same purposes as a residential broadband connection. Consider these facts:

- These new mobile broadband lines are for the most part mobile devices with a data service capable of accessing the Internet at >200 kbps speeds. They are highly unlikely to be used as a primary home broadband connection. In fact, 89.5 percent of mobile wireless connections are business subscribers, not residential subscribers.[27]
- In total, 17 percent of all broadband lines counted by the FCC are now mobile wireless. But only 3.8 percent of advanced service lines are mobile wireless (>200 kbps in both directions), and only 2.5 percent of residential advanced service lines are mobile wireless.[28] What's more, the three largest mobile data carriers are AT&T, Verizon and Sprint. Two of these three carriers are also ILECs, and are the number one (AT&T) and number three (Verizon) most subscribed to broadband Internet service providers, and are the top 2 DSL providers in the United States.[29] Sprint's joint venture with cable operators also diminishes any potential role it could play as a third pipe.
- It is important to note that the multi-functionality of cellular phones with broadband data components may contribute to an overstating of the true level of mobile broadband use. A provider of a DSL line only reports to the FCC the lines that are actively subscribed to (and presumably used). However, if a cellular customer's mobile device is capable of data transfers at >200 kbps, then they are counted as a broadband line, even if the customer rarely uses the device for non-voice purposes.
- Cellular broadband connections are duplicate connections—that is, very few people subscribe to and use a mobile broadband connection as their home broadband connection. Furthermore, mobile wireless connections are not substitutes for cable or DSL connections. These connections are slow, have strict bandwidth caps, and other restrictions, such as users not being allowed to use the connection for VoIP applications (Internet phone) and numerous other Internet-based functionalities.[30]

Appendix A gives the exact specifications of price, speed, and bandwidth limits of mobile wireless broadband products from the major carriers—AT&T, Verizon and Sprint. These services, while valued by consumers, are not competitors to wireline broadband service. They have not brought the competition necessary to drive down prices and drive up speeds in the overall broadband market. It would be unwise to bet that they will. Vertically integrated carriers that dominate the wireline broadband market are highly unlikely to offer a wireless broadband product that can potentially cannibalize their wireline marketshare. It is far better business to offer a complementary service.

If 3G mobile broadband won't bring us competition, surely the auction of the 700 MHz band will do so, right? Will 4G finally bring us the third pipe in this "Wireless Renaissance"? Not likely. The DTV transition has long been touted as the moment when wireless broadband will come into its own. A senior executive at Motorola made these comments in July of 2005: "The spectrum that will be made available at 700 MHz as a result of the transition to digital television provides a unique opportunity to provide facilities-based competitive broadband services."[31] His comments are typical of the hopes many have expressed to this Committee. The frequencies vacated by the broadcasters in 2009 are up for auction early next year, and this "beachfront spectrum" is thought by many to be the answer to our broadband competition woes.

To be sure, the 700 MHz auction could be the last, best chance to bring a third pipe to the market. It has been hailed as such by legislators, regulators, and industry leaders alike. Yet the favorites to win this auction (the major cellular carriers) really do not intend to deliver the third pipe. Further there are technical limitations that come with the proposed structure of the auction that would make it very difficult for any licensee to produce the desired outcome. It is quite a striking dis-

connect. All of the rhetoric about this auction promises the inauguration of the elusive third pipe in wireless broadband. But none of the facts of what the FCC is doing will realize those lofty goals. Why is there such a divide between the rhetoric of 700 MHz as the promised land of the third pipe and the reality of the auction?

First, there is nothing that says the winning bidders must use the frequencies to offer wireless broadband services that are true competitors to DSL and cable. Looking at the likely winners of the auction, it is clear that a competitive market is the last thing on their minds. The incumbent carriers are thought by most odds-makers to be the most likely winners in this auction—just as they were in the last spectrum auction for Advanced Wireless Services frequencies. These companies are the Nation's leading providers of DSL service. Why would they use the 700 MHz licenses to offer a wireless broadband service that cannibalizes their own market share in DSL? The answer is they would not—not here anymore than they have in 3G cellular broadband. They are far more likely to use this spectrum to offer new services which consumers will buy on top of their existing wireline voice service, wireline broadband service, and wireless voice service. This new service, 4G wireless, will be an enhanced mobile data service capable of delivering limited amounts of video and audio to a handheld device. This is not an unwelcome product, of course, but it will not solve the broadband problem; it will not bring a "third pipe"; and it will not bridge the digital divide to poor and rural communities.

Second, most of the other bidders in the pool will be looking to grab spectrum to fill out the geographic coverage area of their existing cellular networks. This will also allow them to compete, to some degree, with AT&T and Verizon Wireless, the industry leaders. This is not an unwelcome development either, but by itself, it will not solve our broadband problem.

Third, none of the spectrum blocks up for auction are large enough to provide a true alternative to DSL and cable modem no matter the intentions of the bidders. The largest block up for auction is 10 MHz. That translates into about 15 mbps of capacity spread over a cell sector. Depending on the density of users in that sector, the actual throughput performance experienced by a customer will struggle to exceed 2 mbps on the download, and probably will be less.[32] That's not bad today, but down the line as DSL and cable providers eventually increase speeds to 5–10 mbps of throughput for each user, that wireless service will not be a true competitor. It will be a reasonable broadband experience for a wireless device used for limited applications, but it will not be a substitute for a residential wireline connection. To have that, we would have to allocate at least 30 MHz to the task.

Fourth, at present, none of the spectrum blocks up for auction are conditioned on "open access" rules—though we have filed comments at the FCC asking for this and other proposals to maximize the utility of the auction.[33] Why are these important? Essentially, this is the only way to make a spectrum allocation into a truly competitive market for connectivity to the Internet, software applications, and devices that attach to the network. Open access simply means that the licensee sells access to the network on a wholesale basis at commercial rates. Any number of ISPs that choose may come and buy bandwidth and compete for customers. Everyone shares the same transmitter and connectivity; they compete on customer service and price. These networks are neutral in two important respects. First, bandwidth on this network is available to any ISP on nondiscriminatory terms. Everyone pays the same rates for the same wholesale products to compete fairly in the market. Second, the network is neutral toward the devices and applications running on the network. Provided they do not harm the network, any innovative piece of software or hardware a company can dream up may connect to the network and sell to consumers. In turn, the broadband network provider is fully compensated for use of its network. This is the ultimate free market.

Such a system of intramodal competition in the 700 MHz band using blocks of spectrum large enough to compete with wireline products is the only chance to realize the impact of the elusive third pipe. Few observers are optimistic enough to believe the FCC intends to go in this direction. If Congress is interested in preventing a serious disappointment and the loss of a golden opportunity to deliver broadband competition, intervention in this auction process is imperative.

Myths, Excuses, and the Deplorable State of Broadband Data Collection

A former, senior FCC official once quipped: "you can't manage what you don't measure." By that standard, the FCC hasn't been managing much of anything effectively in the broadband market. For years now, analysts have been pointing out the poverty of the data collection regime used by the Commission.[34] The GAO did a study pointing out the embarrassing flaws in the FCC's methodology, showing that FCC overstated broadband provider availability by 400 percent in some instances.[35] Finally, the FCC seems to be getting the message. They have opened a Notice of

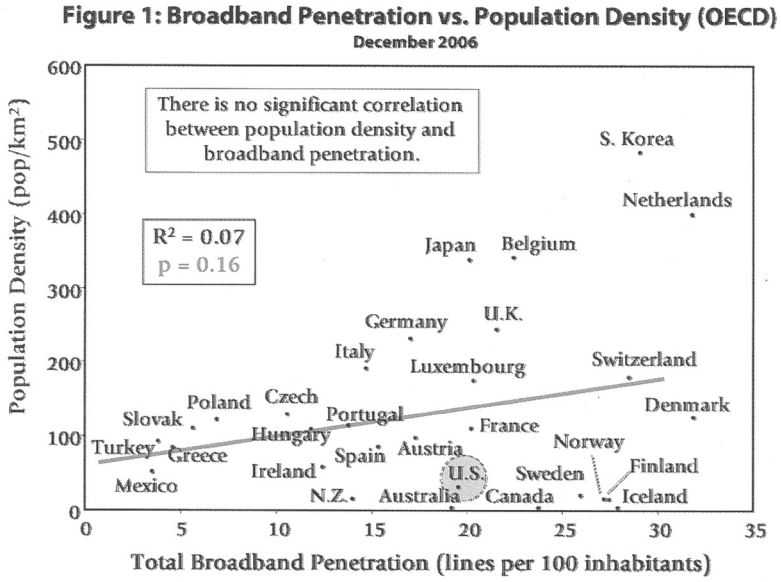
Proposed Rule Making into the matter.[36] Until such time as the Commission issues new rules, however, we are still suffering with a set of long standing problems:

- The FCC still uses an absurd standard of broadband, 200 kbps. This was barely fast enough to have a tolerable Internet experience in 1999, but in 2007 it is too low to enjoy streaming video, flash animation, and other features common to today's Internet applications.[37]
- The FCC still uses the highly discredited metric of broadband availability, the ZIP code system that the GAO has criticized as vastly overstating the level of availability and competition within the broadband market.[38]
- Though there is a steady increase in number of providers in ZIP codes, the GAO report shows these numbers are inflated over 400 percent.[39]
- The GAO put the median number of providers available to an individual family at 2, and determined that at 1 out of every 10 households had no access whatsoever.[40]
- The ZIP code method misses micro gaps in service availability. If the data were collected at ZIP+4, we would see that service availability varies from block to block in many areas.
- The FCC measures only 1 of the 3 major indicators of broadband performance: availability. Price and speed data, critical to understanding how to make good policy, are simply unavailable.
- The FCC erroneously treats wireless broadband service as a complete substitute for wireline broadband service, rather than as a more expensive and feature-poor supplement.

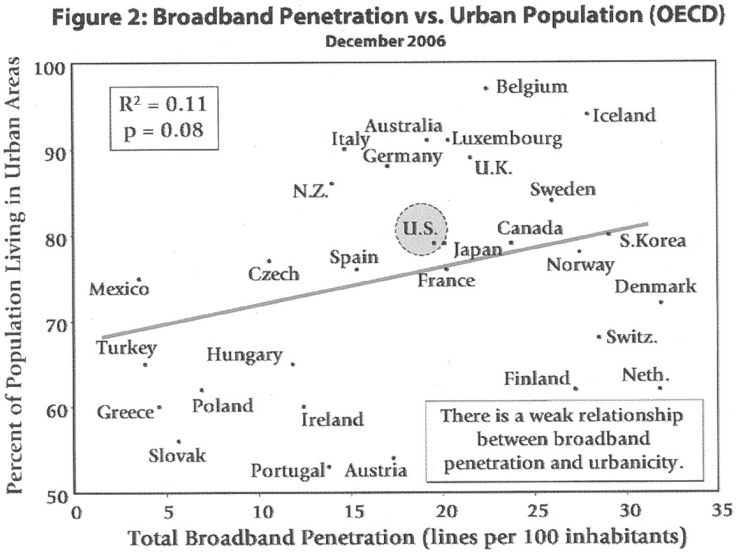
Associate Director John Horrigan at Pew Internet noted that a key problem with the study of the U.S. broadband market "is the fact that there's not good data in the U.S. on connection speed. Yes, people are adopting broadband at a good clip in the U.S., but we don't know how fast their connections are. The FCC has no good data on network speed, and that's not a question that you can reliably get by doing a telephone survey."[41]

Another serious problem with the debate over the health of our broadband market has been the red herring of population density. Apologists for the poor U.S. broadband numbers are quick to attribute the low penetration level to this country's relatively low population density. FCC Chairman Kevin Martin authored a piece in the *Financial Times* stating: "Given the geographic and demographic diversity of our nation, the U.S. is doing exceptionally well. Comparing some of the 'leading' countries with areas of the U.S. that have comparable population density, we see similar penetration rates."[42]

Martin blamed U.S. geography for our poor broadband performance, but the facts tell a different story. For the 30 nations of the OECD, population density is not significantly correlated with broadband penetration. Indeed, one of the world's leading broadband nations, Iceland, has one of the lowest population densities in the world. Furthermore, 5 of the 14 countries ahead of the U.S. in the OECD broadband rankings have lower population densities than the U.S.



While there may be a theoretical reason to think that population density should be correlated with broadband penetration, in real world measurements comparing performance at the national level that is not the case. What Martin is likely trying to convey is the phenomenon of "economies of density." In theory, it should be less costly on a per-line basis to deploy broadband to an area that is highly populated than one that is sparsely populated—all other things being equal. But population density is not the relevant metric to capture this phenomenon—as people tend to cluster in cities, regardless of the overall geographical area of a particular country. The relevant metric is "urbanicity," or the percentage of a nation's population living in urban areas or clusters.



When the relationship between urbanicity and broadband penetration is examined, there's only a very weak, statistically insignificant correlation. Countries like the Netherlands and Switzerland have lower percentages of their population living in urban areas than the United States yet have higher broadband penetration rates. Similarly, countries like New Zealand and Germany have higher percentages of urban population than the United States but lower broadband penetration levels. In total, 8 of 14 countries ahead of the U.S. in the OECD broadband rankings have lower percentages of their population living in urban areas.

In short, geographic factors alone cannot explain why the United States lags behind. Factors like income, income distribution, public policy, and market competition play a far bigger role.

Part II: Fixing the Broadband Problem

The first step is establishing a serious national broadband policy. Currently, we are "the only industrialized state without an explicit national policy for promoting broadband."[43] In response to a recent request to compare Japanese and American broadband policy, a Japanese telecom executive noted: "I don't think at the moment, the United States has any national policy. The idea is, let the market do it."[44] The key problem is that U.S. broadband policies have not even engaged the free market, choosing instead to wait for the elusive intermodal competition to come along and challenge the stagnant duopoly of DSL and cable. It is in this void that we must reassert the commitment to a ubiquitous, affordable 21st century communications network for all Americans. The framework of public-private partnership in policy-making that characterized the technology boom of the 1990s worked because public policy guided the thrust of development. As Thomas Bleha describes it: "The private sector did the work, but the government offered a clear vision and strong leadership that created a competitive playing field for early broadband providers."[45] When we talk about public private partnerships, we do not mean situations in which the private sector profits at the expense of the public; we mean partnerships that serve the public interest, which is difficult when public policy is not clearly articulated.

The national broadband policy should be designed around aspirations to particular social and economic outcomes, not the business models of the incumbent telecommunications carriers. We need to identify our goals and work backward to find the right policies. We suggest goals that address our shortfalls in each of the three major indices of broadband performance: availability, price, and value (cost per unit of speed).

Goal #1—Establishing universal availability of broadband services

Goal #2—Bringing competitive, affordable services and programs to stimulate adoption in undersubscribed areas

Goal #3—Enhancing the speed, coverage, and reliability of communications networks to spawn the next generation applications that will raise the social and economic value of connectivity

What would success look like? To regain global leadership in broadband and maximize the social benefits of a network economy, we need to establish a framework that supports an evolving communications infrastructure that will ultimately provide 100 megabits of symmetrical connectivity to every home in America in the next decade. From the passage of the Communications Act in 1934 to the Telecommunications Act in 1996, the American telephone network evolved through rapid technological change and an immense expansion of service and services. It was an infrastructure built with private capital subject to public obligations and oversight. We must certainly adapt to the more dynamic world of today, but we are suffering because we have abandoned the key role of public policy.

To achieve the goal, we will need vigorous, multi-modal competition—that is, competition between delivery platforms (*e.g.,* DSL, cable, and wireless) as well as competition within delivery platforms. We cannot and should not bet our digital future on one form of competition. We should ensure that the content/applications market that sits adjacent to the connectivity/access market also retains maximum competitiveness, as it always has, by precluding market power in network ownership from distorting the market for Internet content. This will maximize innovation in the content market and increase the likelihood that the next "killer application" will attract more and more Americans to subscribe to a network. Indeed, this virtuous cycle of greater demand for advanced applications leading to greater uptake of broadband, leading again to greater demand for advanced applications, seems to be completely missing in the FCC's thinking. We should also invest in social programs that bring the equipment and training needed to help disadvantaged communities into a place where it makes sense to connect. So-called digital inclusion programs are often overlooked in the consideration of the broadband future.

To realize these goals, we will need to establish a national broadband policy framework that is comprehensive and aggressive in pursuit of market competition and advanced network capabilities. Not all of these changes will be supported by the incumbent industries. But it is essential that we recognize that the short-term financial interests of dominant firms must not be permitted to overshadow the larger national interest in charting a successful path for our digital future.

Where should we start?

Study the Problem—Improve Data Collection

We should begin by addressing our data problems. We should conduct a broad inquiry into costs, feasibility, technologies, and deployment strategies that can be initiated through creative policymaking. To do this effectively, we needed better data. We need to know at a granular level—block by block—where broadband service is available and where it is not. But we must go beyond that. We must collect information about the price and speed of connections as well. We need to know about service agreements as well—early termination fees in long term contracts and other switching costs may distort our understanding of the real levels of competition in the market. Without this information, we cannot quickly identify the gaps in the service market and remedy market failures that hold prices high and service quality low.

Programs like ConnectKentucky represent a valuable model to consider for Federal policy—particularly in its focus on working with local communities. But the Federal Communications Commission must also play its role of central administrator—collecting and evaluating the massive amounts of information we could be using to make broadband policy. Simple changes in the Section 706 requirements for telecommunications carrier reporting would dramatically clarify the picture of what is happening in our broadband market.

We should also set to work studying the cost and feasibility of broadband technologies. For many years, it has been the stated goal of the U.S. Government to make broadband connections universal. Yet we do not have reliable cost estimates for realizing that goal, much less have we compared the costs of deploying different technologies to accomplish the task. For years, we have heard that technologies like broadband over power lines and satellite wireless broadband were inches from transforming the marketplace. Yet we did not study these issues sufficiently to determine that those estimates were overblown and unrealistic. A paucity of information has led us to false expectations and delay, distracting from the need to seek out the necessary data points to make policy.

Beyond the collection of market data, we should look to empower the research community (both government and university led) to study the Internet. It is hard to believe, but not a single data link on the privately-owned Internet backbone today is available for study by researchers. Our understanding of the flow of traffic over the network is very limited as a result. Using the proper safeguards to guarantee privacy and protect proprietary commercial information, we should empower the research community to study the problems of the Internet that inhibit our progress, including security issues, spam, routing tables, peering, packet loss, latency, jitter, and a wide variety of topics that could benefit from the application of scientific scrutiny. We should put the country's greatest minds to work on these problems to assist our network owners. This collaborative model of research and production has always been the basis of technological leaps in the Internet space. At present, the only government programs looking into these matters are not driven by competition policy, but rather by national security. The Department of Homeland Security's PREDICT program offers a useful model for this Committee to explore.[46]

Possessing data about our own broadband market will be an enormous advantage, but we should look beyond our borders. We should look at the nations that have surpassed us in the creation of competitive broadband networks to learn which strategies have proven successful and why. There has been no serious effort to do this to date. Yet the research is being done in our universities. Two recent studies have compared the policies that have shaped the U.S. broadband market with those in Europe and South Korea. In both cases, the findings show that the root cause of our problems is based in a lack of competition policy.[47]

It is worth dwelling on this point. The policy that scholarship indicates is the MOST responsible for success in the international broadband market—open access to network infrastructure for intramodel competitors—is precisely the policy that the U.S. has abandoned. Ironically, this policy was originally initiated in the FCC's own Computer Inquiry decisions of the 1970s and 1980s, which allowed Internet service providers to purchase underlying telecom inputs on a nondiscriminatory basis. Many believe this ISP "open access" policy, along with the Carterphone principles of the 1960s, helped pave the way for the rise and enormous success of the

Internet. Later, the Telecommunications Act of 1996 briefly opened up the local network so that competing carriers could use the local loop to provide DSL and other advanced data functionalities. Unfortunately, in both cases these pro-competitive precedents were eviscerated in subsequent legal and regulatory disputes, essentially because they were not in the short term financial interests of incumbents. Asia and Europe adopted and embraced open access—betting on the long-term benefits of the policy—and they have used it to leap-frog the U.S. in the race for global broadband supremacy. Professor Amit Schejter's ground-breaking analysis of this dichotomy is laid out in a working paper attached to this testimony.

A similar analysis comparing U.S. and South Korean broadband policy also highlights the divergent paths on open access rules that have led to higher and lower barriers to entry (respectively) in the broadband market. The study concludes:

> The sluggish progress of intermodal and intramodal market competition explains a part of the sluggish demand in the residential high speed Internet access market in the U.S., while the South Korean market was able to grow rapidly due to fierce competition in the market, mostly facilitated by the Korean government's open access rule and policy choices more favorable to new entrants rather than to the incumbents. Furthermore, near monopoly control of the residential communications infrastructure by cable operators and telephone companies manifests itself as relatively high pricing and lower quality in the U.S. The more favorable terms from which the dominant providers have benefited, and government's deregulation, may limit business opportunities for other Internet service providers.[48]

Japan's NTT East continues to make heavy investments in fiber-optics despite requirements that it must share its network with competitors. When asked to explain why, an NTT executive cited the long term benefit to the country. "We see the future, and then we do what we feel is right," he said.[49] As a result of this vision, Japan (like many of the world's leading broadband nation) has multiple wireline competitors offering broadband in each market. In the United Kingdom, BT has agreed to a split between its retail and wholesale operations, which has both created intramodal competition over BT's local loops and led to greater overall investment in broadband facilities. The evidence is clear: the results of broader consumer choice are lower prices, higher speeds, and greater innovation.

Professor Schejter points out that the U.S. may be well served to learn from the European and Asian examples: "Observing international broadband adoption trends and rates, one cannot fail to notice that while Europe is plunging ahead, with some countries leaving even Asian powerhouses behind, the United States, which was the original leader in both making the first regulatory moves and adopting Internet technology, is slowly falling behind. What is it then that makes Europe different than the United States, and what can the United States learn from the European experience in order to revive broadband penetration?"[50]

Enact Multi-Modal Competition Policy

The vision for our national broadband policy should be bold, aspirational, and comprehensive. The problems in the marketplace will not be solved by tweaking around the edges; nor will they be solved by enacting policies that are functionally subsidies of status quo, incumbent business-models. We need to reject the conventional political wisdom of complacent incrementalism and embrace a policy inquiry into all the possible options for putting our broadband future back on track. Now is not the time to make artificial declarations that some ideas are off the table and narrowly focus on particular proposals. No one policy idea is the silver bullet. It will require many different initiatives aimed at different levels of the broadband market to accomplish our goals. In short, it must be "multi-modal"—by which we mean that it must foster competition both *within* and *between* broadband technology markets.

A useful way to categorize policy proposals is to group them according to the network layer to which they apply. To simplify for present purposes, the broadband market can be understood as two separate arenas: (1) a physical connection to the Internet and the technologies used to transmit information over the network; and (2) the applications and content delivered via that Internet connection and the devices used to receive them. We can and should target broadband policy in both layers of the network to maximize the productivity of both markets. This policy has two broad components: engendering greater competition at the physical layer, and crafting protective safeguards for the application layer. Though each of these proposals deserves analysis and explanation, for the purposes of this testimony, we will simply list them out for discussion. This may serve as a consumer blueprint of ideas for a national broadband policy. We would encourage other stakeholders to offer the Committee similar, comprehensive proposals for consideration.

Policies for the Physical Layer

The physical layer is not just wires and cables. It is any means of delivering a broadband connection and the baseline rules and consumer protections governing that delivery system. By extension, policies aimed at the physical layer include any effort to expand the reach, capacity, competitiveness or efficiency of these networks to serve residential and business customers. In turn these networks support the spread of advanced Internet applications that can be accessed and used by all Americans.

- Allocation of licensed public spectrum aimed at creating a viable wireless broadband competitor—We should approach policy opportunities like the auction of 700 MHz frequencies with the goal of bringing new entrants into the market that are independent of wireline incumbents.
- Expansion of unlicensed public spectrum—The greatest success of recent broadband policies is WiFi, or unlicensed spectrum. We should expand the availability of unlicensed spectrum into lower frequencies by opening up the unassigned television channels (also known as "white spaces") for wireless broadband. We applaud this Committee for its work on this issue and recommend the Kerry-Smith bill for passage.
- Reform and transition the Federal universal service programs from dial-tone to broadband—We should move our valuable USF programs into the 21st century with targeted subsidies and accountability benchmarks to support broadband deployment in high-cost areas.
- Reasonable and nondiscriminatory interconnection between facilities-based providers—Since the Internet is nothing more than a global network of interconnected private and public networks, it is imperative that each interconnects with one another to maximize the efficiency and utility of the overall network.
- Reintroduce intramodal competition into the broadband market—Though recent FCC decisions have moved away from this model of competition policy, it is imperative that it is not abolished. Intramodal competition through open access to network infrastructure has been the cornerstone of international broadband successes. We should embrace open access plans in the licensing of the 700 MHz band and establish policies to bring competition back in the wireline space.
- Explore financial incentives to expand broadband capacity in the last mile—Successful policies overseas have included direct government investment in wiring public facilities, low-interest loans for public and private broadband projects, tax incentives for networking equipment, accelerated depreciation, debt guarantees and other targeted investments in our digital future.[51]
- Authorize and protect the right of local governments to provide broadband services—Municipalities have led the charge in recent years to fill gaps in the broadband market and build services that exceed those offered by commercial incumbents. This effort to bring competition and innovation to the marketplace should be encouraged. We applaud the work of the Committee on this issue and recommend a bill offered by Senators Lautenberg and McCain.
- Collect data and map the broadband market on an ongoing basis—We cannot solve problems that we do not understand. Our current state of broadband data collection is unacceptable. FCC should be instructed to collect more granular information on service as well as price and speed data on all broadband connections. Programs should be initiated to help map the broadband market.
- Require network owners to offer customers stand-alone or "naked" DSL or cable modem service—The promise of VoIP competition in the voice market has been stymied by the bundling practices of the incumbent operators. To give this alternative a viable chance, policymakers should put in place protections for this consumer benefit.

Polices for the Applications Layer

The applications layer, in this analysis, refers to the marketplace for content, applications, services and devices that flow over, or connect to, the Internet. This economic space at the "edge" of the network architecture has been a remarkable engine of economic growth in the last decade. In addition, this is the space where network technologies meet democratic discourse and open cultural expression. Because of the open marketplace at the edge of the network, an open sphere for public speech has developed that rivals the printing press as the most important development in modern political communication. Policies aimed at the application layer should recognize its centrality to the economic and democratic health of the Nation.

- Network Neutrality should be established as the cornerstone of broadband policy—We should protect an open market for speech and commerce on the Internet for consumers, citizens and businesses alike. To do this, we should apply nondiscrimination safeguards to the broadband ramps leading onto the Internet that prohibit owners of the physical layer of the network from gate-keeping the applications layer of the network.
- *Carterphone* rules should apply to the wireless broadband platform—We should recognize and remedy the contradictions in fostering an open market for wireless broadband on a platform emerging from the closed networks of cellular telephony. The walled garden of the PCS world should not be permitted to cripple the potential of mobile wireless broadband. All devices, applications and services that do not harm the network should be permitted access.
- Pair broadband expansion with digital inclusion programs—Bringing broadband to underserved areas will do no good if local communities lack the computers and training necessary to access the network. We should design and empower social programs to bring technology and skills to communities and work with local leaders to establish meaningful connections.
- Facilitate ongoing research into network traffic and data management—The dearth of information about what is happening on the Internet cripples our efforts to address some of the most pressing problems in the application layer: spam, cyber-security, privacy, and traffic management. Policymakers should seek to make available the tools researchers need to provide the best available answers to these problems.

Conclusion

The status quo is unacceptable. If we watch and wait, trusting that today's artificially-constrained marketplace will magically solve the broadband problem, we will see the U.S. slip farther behind the rest of the world and widen the digital divide—both domestically and internationally. The consequences are too severe to tolerate this narrow path.

The current trend lines are clear. We continue to have large gaps in broadband service across the Nation. Worse still, the networks we do have are slower, more expensive, and less competitive than the global leaders in broadband performance. Our reliance on intermodal competition has not proven successful, as we remain mired in a rigid duopoly. The optimistic predictions about mobile cellular broadband do not appear to hold any real promise of a viable "third pipe." Meanwhile, network operators are following the demands of quarterly returns—investing in networks where costs are lowest and profits highest and leaving the rest of the market behind. Perversely, the proposals of the incumbents include dismantling the open, neutral marketplace for commercial applications and political speech to squeeze out higher revenues. The result in the value chain and in the public sphere will be a resounding net loss. This is robbing Peter to pay Paul, and the Congress should reject and look beyond such a short sighted approach to real solutions. We must reject the argument that an open Internet and a high capacity network are mutually exclusive goals. We must have both for our information marketplace to prosper.

The first step on the road to broadband recovery is understanding the problem. We must rectify the deplorable state of data collection in the broadband market. What we do not know undercuts our ability to craft and target viable solutions. Second, we must shed the myths about our failures and the false promises that a magical resurrection of our fortunes is right around the corner. Third, we must study the successes of other nations to determine which policies are the best bets for the digital future of the U.S. Now is not the time to take ideas off the table, it is a moment for aspirational inquiry and bold vision.

Finally, the Congress should move forward with a comprehensive national broadband policy. This should be a broad platform of initiatives that addresses the complexity of the issue and maximizes our chances for near and long term success. The focus of these policies should be: (1) enhancing competition between and within the technologies that deliver broadband connectivity; (2) protecting competition and speech in the content flowing over the Internet; (3) expanding opportunities to bring new broadband providers to the market using new technologies; (4) using targeted economic incentives to stimulate investment in underserved areas; (5) establishing programs that couple broadband deployment with technology provision and training; and 6) promoting a permanent research agenda that facilitates the collection of data in the market and on the network.

Solving the broadband problem is a serious challenge of signal importance. We look forward to working with the Committee to find productive solutions.

APPENDIX A

Sample Mobile Broadband Offers

Mobile broadband service programs are expensive, slow, not universally available, and severely restrictive. A sample of available offers:[52]

Sprint

In Rev A coverage areas (available to 100 million people)

- Download Speed: 600–1,400 kbps
- Upload Speed: 350–500 kbps
- Price: $59.99 per month with a 2-year contract. OR $79.99 per month with a 1-year contract.
  - $36 activation fee
  - $200 early termination fee.
  - Numerous taxes, surcharges, and fees

In non-Rev A coverage areas (available to 94 million additional people)

- Download Speed: 400–700 kbps
- Upload Speed: 50–70 kbps
- Price: Same as above

Service restrictions:

- "Use as a private line or frame relay service substitution, service, or like equivalent, is prohibited. Not available while roaming. Premium content not available. Shared data not available."
- "We reserve the right to limit or suspend any heavy, continuous data usage that adversely impacts our network performance or hinders access to our network. If your Services include unlimited web or data access, you also can't use your Device as a modem for computers or other equipment, unless we identify the Service or Device you have selected as specifically intended for that purpose."

Verizon

In Rev A coverage areas (available to 135 million people)

- Download Speed: 600–1400 kbps
- Upload Speed: 350–500 kbps
- Price: $59.99 per month with a 2-year contract., AND customer must also be a Verizon voice customer. OR $79.99 per month with a 1-year contract.
  - $25–$35 activation fee
  - $175 early termination fee.
  - Numerous taxes, surcharges and fees

In non-Rev A coverage areas (available to 67 million additional people)

- Download Speed: 400–700 kbps
- Upload Speed: 50–70 kbps
- Price: Same as above

Service restrictions:

- "Examples of prohibited uses include, without limitation, the following: (i) continuous uploading, downloading, or streaming of audio or video programming or games; (ii) server devices or host computer applications, including, but not limited to, Web camera posts or broadcasts, automatic data feeds, automated machine-to-machine connections or peer-to-peer (P2P) file-sharing; or (iii) as a substitute or backup for private lines or dedicated data connections.
- Will terminate service if you exceed 5GB per month—or about 6 CD's worth of data (800MB each).

AT&T

(No mention of Rev A deployments)

- Download Speed: 400–700 kbps
- Upload Speed: 50–70 kbps
- Price: $59.99 per month with a 2-year contract AND subscription to a voice plan that's at least $39.99 per month. OR $79.99 per month with a 1-year contract.

- $36 activation fee
- $175 early termination fee.
- Numerous taxes, surcharges and fees

Service restrictions:

- "Prohibited uses include, but are not limited to, using services: (I) with server devices or with host computer applications, including, without limitation, web camera posts or broadcasts, continuous jpeg file transfers, automatic data feeds, telemetry applications, PeerMto-Peer (P2P) file sharing, automated functions or any other machineMtoMmachine applications; (II) as substitute or backup for private lines or dedicated data connections; (III) for Voice over IP"
- *"Unlimited plans cannot be used for uploading, downloading or streaming of video content (e.g., movies, tv), music or games."*
- "Service is not intended to provide full-time connections, and the Service may be discontinued after a significant period of inactivity or after sessions of excessive usage. Cingular reserves the right to (i) limit throughput or amount of data transferred, deny Service and/or terminate Service, without notice"

Endnotes

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[20] *Ibid.*

[21] John B. Horrigan, "Home Broadband Adoption 2006," Pew Internet & American Life Project, May 28, 2006.

[22] Thomas Bleha. "Down to the Wire." *Foreign Affairs,* May/June 2005. *http://www.foreignaffairs.org/20050501faessay84311/thomas-bleha/down-to-the-wire.html*.

[23] See: *http://www.dslreports.com/shownews/65917*.

[24] See: James S. Granelli, "Prices going up for phones, Net," 1 Feb 2007, *Baltimore Sun, http://www.baltimoresun.com/business/bal-bz.pricing01feb01,0,1370518.story?coll=bal-business-headlines*.

[25] Testimony before the U.S. Senate Committee on Commerce, Science, and Transportation, *S. 2686, Communications, Consumer's Choice, and Broadband Deployment Act of 2006,* May 18, 2006.

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[30] See: Tim Wu, "Wireless Net Neutrality," New America Foundation, February 2007, *http://www.newamerica.net/publications/policy/wireless_net_neutrality*.

[31] Michael D. Kennedy, Senior Vice President, Motorola, Before the U.S. Senate Committee on Commerce, Science, and Transportation, July 12, 2005.

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The CHAIRMAN. Thank you very much, Mr. Scott. May I now recognize Dr. Eisenach?

STATEMENT OF JEFFREY A. EISENACH, PH.D., CHAIRMAN, CRITERION ECONOMICS; ADJUNCT PROFESSOR, GEORGE MASON UNIVERSITY SCHOOL OF LAW

Dr. EISENACH. Thank you, Mr. Chairman, Mr. Vice Chairman, members of the Committee. It's an honor for me to be here today. I'm going to summarize the written testimony, which I presented but I am going to refer to the charts in the back of that testimony so you may want to have those in front of you. I apologize to the audience if they didn't get all of those.

I would start by saying that the connection between broadband deployment and prosperity is now widely acknowledged and most advanced nations have adopted policies to increase broadband investment and make broadband services widely available at affordable prices. It makes sense to ask as we do today and as you today, how well or poorly the U.S. is doing in this regard.

Now, just as some saw Russia's 1957 launch of the Sputnik satellite as an indicator that the U.S. had fallen behind in a key technology, some today look at the familiar OECD statistics and conclude that we're behind or at least falling behind in the broadband race.

Happily, it turned out our fears about losing the space race to the Russians, to say the least, were exaggerated and I suspect the same is true with respect to our fears about broadband. But Sputnik did get Americans' attention. It spurred us into action and a little of both today on the broadband front is very much needed.

With that in mind, my testimony focuses primarily on two topics—the need for better information about broadband deployment and the state of broadband deployment in rural America.

First the data we do have tells us we are doing a lot of things right. Figure 1 in my testimony, for example, shows that investment in communications equipment as reported by the Bureau of Economic Analysis at the Commerce Department, has increased over 40 percent since we significantly de-regulated broadband back in 2003.

Figure 2 from the FCC shows that the overall number of broadband connections is growing rapidly—52 percent between June 2005 and June 2006. It also shows that wireless broadband is growing explosively, from under 400,000 in 2005—400,000 connections to over 11 million a year later and that's a growth rate of about 2,800 percent. This growth, these two figures, are directly connected—the growth as a direct result of the high rates of investment that we have and appear to be continuing, as shown in Figure 1.

But how do we compare with other nations? A lot has been written on that topic and a lot has been said today and more will be said but today, I would like to just add one thought for your consideration and simply put, that thought is that where you are depends a lot on where you have been.

Figure 3 shows what may be a familiar graph and that is how new technologies, especially technologies like telephony, fax machines and the Internet, where network effects are important. It shows how those new technologies propagate through society—how they spread. They tend to follow an "S" pattern. Initially, uptake

is slow. Then a tipping point is reached and propagation accelerates as if suddenly, everyone has to have one.

Eventually, the product reaches a saturation point when everyone who will ever want that product already has got it, where truly every major IT product, from the telephone to the fax machine to the iPod, has followed this pattern and broadband is no exception.

Now, the four charts in Figure 4 show the S curve at work and I should say, these are based on what is now obsolete data from the OECD, which un-helpfully released its statistics after my testimony was prepared but I think the data is nevertheless indicative and valid. Belgium and Korea, both of which lead the U.S. in broadband adoption, seemed to have reached at least temporary saturation points. Their S-curves flattened out. Poland and Australia, both of which lag behind—Poland far behind—have passed at least a local tipping point and adoption is growing rapidly.

Now let's turn to those OECD rankings. In Figure 5, we show the June 2006 usual OECD data with the U.S. ranked 12th in the world at that time, as measured by the number of broadband connections per 100 inhabitants. But in Figure 6, I have added another set of bars and those show the growth rate of penetration over that same period of time, this from June 2005 to June 2006. Notice first and in general, the countries where broadband adoption is growing most rapidly are the ones where the level of penetration is lowest while growth in countries with higher penetration in general has begun to slow.

Where is the U.S. on its S-curve? First note that there is about 25 percent annual growth and I think we may have seen a slow down in the most recent statistics, I don't make too much of 6 months worth of data on that front. But at 25 percent annual growth, the U.S. has one of the fastest growth rates of any of the high penetration rate countries—far above countries like Belgium and Canada and Japan and Korea, which again seem to have hit temporary saturation levels.

If you turn to Figure 7, it seems clear that broadband growth in the U.S. is continuing at a healthy pace and I'd also go back to Figure 2, which shows the same thing. So coming back to the question of do we have enough data? Clearly, we have enough data to perform a lot of useful analyses to compare how we're doing at this level to other countries and so forth.

But when you dig a little deeper, there is also a lot we don't know and in my opinion, what we don't know is hindering our ability to make informed policy choices. For example, first as the GAO has noted, the current FCC data on broadband availability is not very useful in assessing rural deployment. It tells us whether one or more providers have customers in each Zip Code but it doesn't tell us how many households or businesses in that Zip Code actually have broadband availability nor does it tell us anything about the quality or price of service.

Second, the last time the Census Bureau released data on computer and Internet adoption, including broadband adoption, was in 2005 and the data was gathered in October 2003. Now given the dynamic nature of broadband deployment, it might as well have been collected in 1903—it's simply not helpful.

Third, the most recent official data available on small business broadband penetration was collected in late 2003 as part of a study by the Small Business Administration.

Now admittedly, there is a lot of data available from both for-profit and not-for-profit sources such as the Pew Internet & the American Life Project. But these private sources cannot and do not make up for the paucity of official data from the U.S. Government. The FCC's recent notice of proposed rulemaking on improving broadband data collection is a hopeful step in the right direction but other agencies, including the Census Bureau need to do better as well.

One specific reason that has been mentioned here today: we need better data to inform the important discussion now underway about broadband deployment in rural America.

Rural America lags behind the cities and suburbs in broadband adoption. If you go to Figure 8, we see the best data, I think, that is available on this from the Pew Internet & American Life Project in 2005, which shows that only 24 percent of rural households had broadband connections compared with about 40 percent on average for the rest of the country.

On the other hand, the data we do have also suggests that broadband is now available to the overwhelming majority of rural households and that availability is increasing. In expert testimony I filed on behalf of Verizon earlier this year in Virginia, I examined in detail the state of telecommunications competition in the State of Virginia, including the availability and use of broadband. The results there, it seems to me, are quite encouraging.

Figure 9 shows the growth of broadband services based on the FCC's admittedly imperfect Form 477 data. Now we took this data and translated it into the wire center level so we were actually able to estimate for each wire center, the level of broadband availability.

Now while the FCC data are imperfect, it nevertheless shows that the trend is very much in the correct direction. If you look at the bottom line on the chart, you see that even in the most rural wire centers, there are an average of four providers providing broadband service someplace in that wire center and again, that does not go to every individual, as we know, of course. That's the weakness in the FCC data.

Figure 10 shows the availability of cable modem service and it too, is by and large, encouraging. Eighty-eight percent of households have access to cable modem service, which is equivalent to 99 percent of cable passed households. That's the good news. But the bad news is about 10 percent of households have no cable service at all and those households are concentrated in rural areas and as a result, there are some rural areas where cable modem service is available to only a small fraction of the population.

But the story still isn't over. In Figure 11, we see areas where broadband is available from fixed wireless providers, including some of the most rural areas of the state. Seventy-one percent of Virginia households have wireless broadband coverage.

I looked closely at the companies providing that coverage, like Citizens Telecom, Ntelos and Virginia Broadband and found that they are offering robust, high-speed connections at competitive prices. Virginia Broadband, for example, bundles Voice over Inter-

net service with its wireless broadband product, which is now available all over central Virginia and rolling out rapidly to large areas of the state.

Now I note in my written testimony that broadband over power line is also showing real promise, including in the State of Virginia where the Rural Utility Service is funding, through guaranteed loans, some significant projects by the Central Virginia Electric Cooperative and we should not forget the rural telephone companies, which now make broadband available to approximately 90 percent of their customers.

Unfortunately, the sort of detailed examination I was able to do of the situation in Virginia at some significant expense and over a lengthy period of time, using a lot of data that is only available from the private sector, from private providers, is not available in most states and has not been done in most states. Kentucky is an encouraging exception and perhaps a model for what needs to be done for the rest of the country.

To summarize, in my opinion, America is doing pretty well in the race to develop 21st century communications but we can do better. The first step we need to take is to become better informed because we won't get where we need to go if we don't even know where we're starting at.

Mr. Chairman and members of the Committee, that completes my testimony and I look forward to any questions you may have. Thank you.

[The prepared statement of Dr. Eisenach follows:]

PREPARED STATEMENT OF JEFFREY A. EISENACH, PH.D., CHAIRMAN, CRITERION ECONOMICS; ADJUNCT PROFESSOR, GEORGE MASON UNIVERSITY SCHOOL OF LAW

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before you today to discuss issues relating to communications, broadband and U.S. competitiveness.

I have had the opportunity to study communications and broadband policy issues over the course of many years, and in several capacities, including in my current positions as an adjunct faculty member at George Mason University Law School and as Chairman of Criterion Economics, an economic consulting firm based here in Washington. I should note that, while my consulting practice often involves issues relating to communications and broadband policy, I am appearing today solely on my own behalf.

The role of information technology in promoting economic growth and productivity is well documented. Digital computers allow information to be stored, analyzed, manipulated—and turned into useful knowledge. High capacity communications networks allow those computers to work together, and increase exponentially society's ability to create knowledge and put it to work. Ethernet inventor Bob Metcalfe formalized this notion in what has become known as Metcalfe's law: the value of a communications network is a function of the number of users, squared.

Because the relationship between broadband and prosperity is now so widely understood, nearly every advanced nation has adopted policies aimed at increasing investment in communications infrastructure and making advanced communications services widely available at affordable prices. There is virtually no limit to the diversity of policy tools being deployed, from subsidies and state ownership, on the one hand, to tax cuts and deregulation, on the other.

How does the U.S. stack up? Based largely on statistics collected by the Organization for Economic Cooperation and Development (OECD), some have argued that we are "behind," or at least "falling behind," in the broadband race. Indeed, the now familiar chart showing the U.S. at 11th or 12th in the world in broadband adoption has become sort of a modern version of the 1957 Sputnik launch—an indicator, to some, that the U.S. has fallen behind in a key technology. Now, as then, the argument is usually rolled out in service of some sort of proposed policy change—more regulation, or less; more subsidies, or stronger tax incentives; even direct govern-

ment involvement, as in the case of municipalities building their own telecommunications networks to compete with private providers.

Happily, it turned out our fears about losing the space race to the Russians were, to say the least, highly exaggerated. I suspect the same is true with respect to our fears about broadband. On balance, the U.S. is doing pretty well when it comes to broadband deployment and adoption.

That said, it is important for policymakers, including this Committee, to continue monitoring our broadband policies and making improvements. With that in mind, I would like to focus today on two topics. First, I would like to suggest that we can and should do a better job of collecting information on broadband deployment in the U.S. Second, I will comment briefly on the state of broadband deployment in rural America.

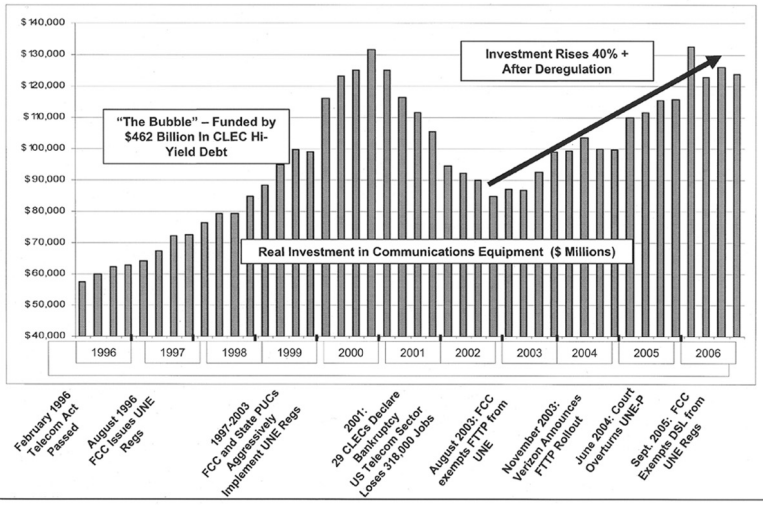
What We Know

We know a lot about broadband deployment in the U.S. We know, for example, that broadband deployment and adoption are both growing at a very rapid pace, and hence that, at least at a macro level, our current policies are working. But we don't know as much as we could or should know—or as much as we *need* to know—to further improve those policies. Let me provide a couple of examples.

First, we have good macroeconomic data on the performance of different sectors of the economy, including the IT sector. We can use this data to assess, for example, the effect of Federal Communications Commission (FCC) policies on investment. Figure 1 presents information on investment in communications equipment in the U.S., by quarter, from 1996 to the present. The data comes from the Bureau of Economic Analysis at the Department of Commerce, and is part of the National Income and Product Accounts. At the bottom of the chart I have added a timeline showing some key FCC policy decisions relating to broadband regulation. As the figure shows, investment in communications equipment began to recover from the disastrous 2001–2002 "meltdown" at almost precisely the time the FCC began deregulating broadband. Some might say that's just coincidence, but in my opinion the chart provides clear evidence that removing excessive regulation led to greater investment.

History aside, Figure 1 demonstrates an important and largely undisputed fact: investment in broadband networks is moving ahead very rapidly. The two leading providers, the telephone and cable companies, are investing literally tens of billions of dollars to upgrade their networks, with cable companies adding voice telephony, telephone companies adding video, and both increasing dramatically the capacities of their networks to carry high speed data. But cable and telephone companies are hardly alone. Wireless broadband—both fixed and mobile—is the fastest growing broadband delivery mechanism. It is widely expected, for example, that private sector firms will, later this year, pay more than $10 billion for additional spectrum in the 700 Mhz band that will be used to provide wireless broadband services.

Figure 1: Deregulation and Investment

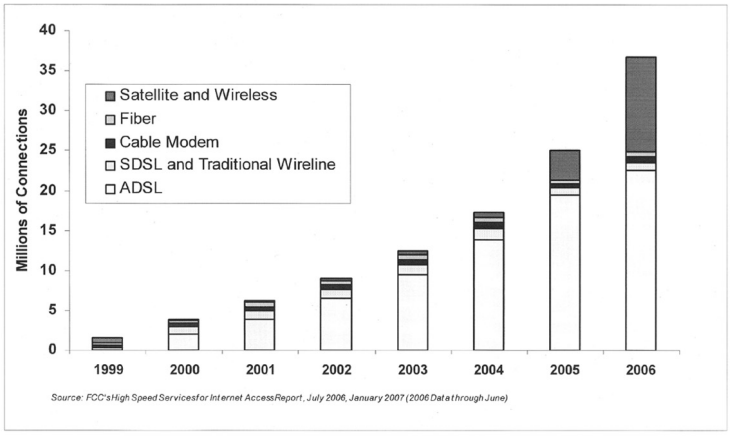


Source: U.S. Department of Commerce Bureau of Economic Analysis

Second, in addition to having pretty good data on investment, we also have good aggregate data, at a national level, on the extent of broadband adoption. We can use this data to assess the technologies people use to get broadband, and to compare U.S. broadband adoption to adoption rates in other countries.

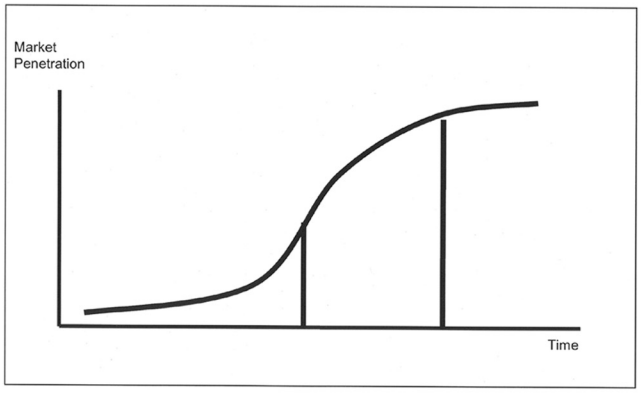
For example, Figure 2 shows the growth of high speed broadband connections in the U.S. since 1999, as reported by the FCC. Clearly, broadband adoption is proceeding at a rapid pace: Indeed, between June 2005 and June 2006, the number of broadband connections grew by 52 percent. Most remarkable, however, is the growth of wireless connections: Between June 2005 and June 2006, the number of mobile wireless broadband connections went from under 400,000 to over 11 million, a growth rate of over 2,800 percent.

Figure 2: Broadband Adoption is Growing Rapidly



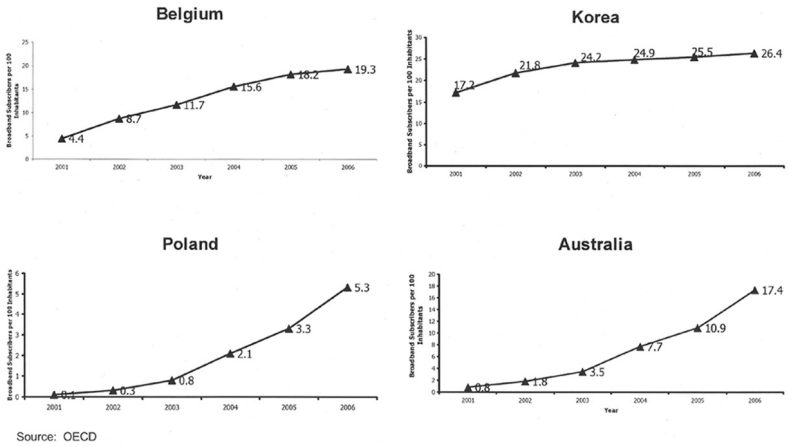
How does this compare with other nations? Before answering that question, it is perhaps useful to step back for a moment and consider the process by which new technologies spread. In general, new technologies—and especially technologies like telephony, fax machines and the Internet, where network effects play important roles—propagate in a pattern known as an "S" curve, like the one shown in Figure 3. Initially, uptake is slow. Then, a tipping point is reached, and propagation accelerates, as if, suddenly, everyone *has* to have one. Eventually, the product reaches a saturation point, and propagation slows. At that point, everyone who will ever want or need the product already has it. This pattern has characterized the propagation of virtually every major new IT product or service, from the telephone to fax machine to the iPod. Broadband is no exception.

Figure 3: The Classic "S Curve"



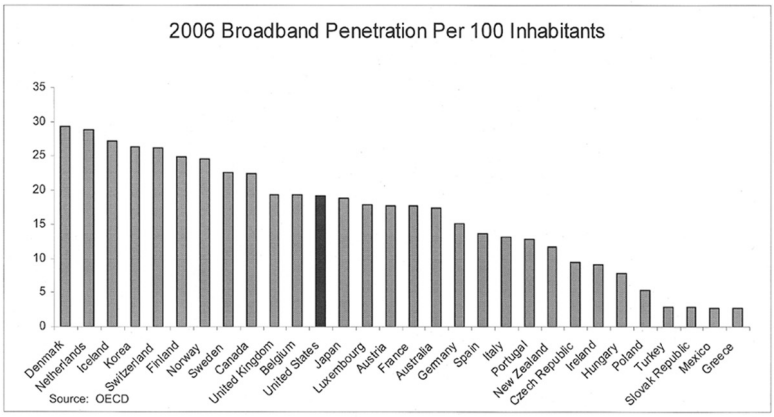
To see the S-Curve at work, consider the four charts shown in Figure 4, which show broadband propagation in four countries. Belgium and Korea, both of which lead the U.S. in broadband penetration (as measured by the OECD), appear to have reached at least temporary saturation points. Poland and Australia, on the other hand, both of which lag behind, have passed at least a local tipping point, and penetration is growing rapidly.

Figure 4: Broadband Propagation in Four Countries



With this in mind, let's turn to the OECD data. Figure 5 shows the usual OECD figure, with the U.S. ranked 12th in the world, as measured by the number of broadband connections per 100 inhabitants. In Figure 6, however, I have added another set of bars, which shows 2006 growth rates. Figure 6 shows an interesting pattern: The countries in which broadband penetration is growing most rapidly are the ones where penetration currently is lowest, while growth in countries with higher penetration has begun to slow.

Figure 5: OECD Broadband Data



Where is the U.S. on its S-Curve? Figure 6 shows that the U.S. has one of the fastest growth rates of any of the high-penetration rate countries, at 25 percent. Only the United Kingdom, at 30 percent growth, was significantly faster, while several countries, including Canada and Japan as well as Belgium and Korea, appear to have hit at least temporary saturation levels. As shown in Figure 2 above, and confirmed in Figure 7, broadband growth in the U.S. is continuing at a healthy pace.

Figure 6: Growth Rates Slow as Penetration Grows

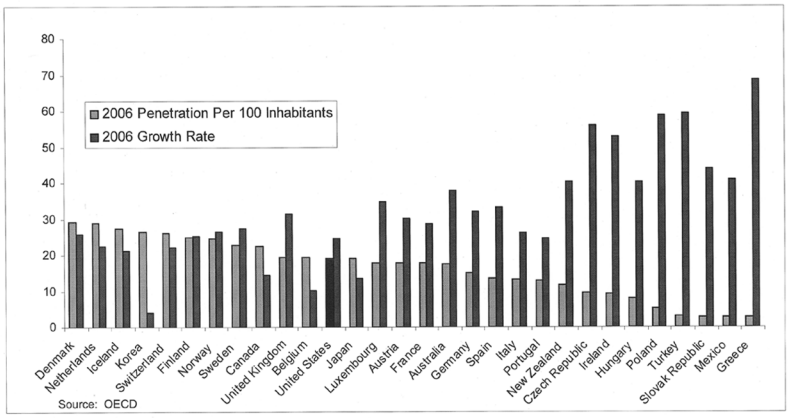
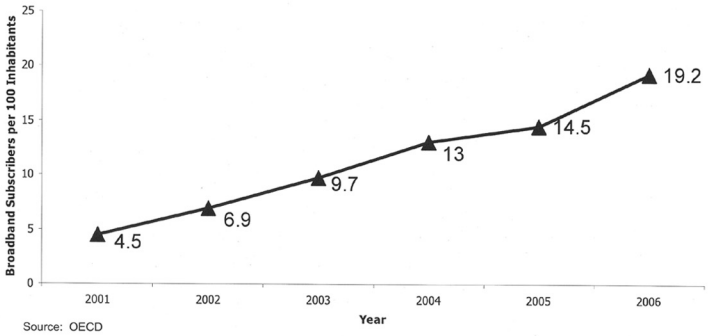


Figure 7: Broadband Propagation in the U.S.



Thus, at the national level, we have a lot of aggregate data, and we can use it to perform lots of useful analysis. And when we do, it appears the U.S. stacks up better than some people seem to think.

What We Don't Know

When you dig a little deeper, there is also a lot we don't know—and what we don't know is hindering our ability to make informed policy choices. For example:

- As the General Accounting Office noted in a May 2006 report,[1] broadband availability data reported by the FCC in its annual reports under section 706 of the Telecommunications Act do not permit an accurate assessment of broadband availability on a geographically disaggregated basis. Simply put, the data collected through Form 477, and reported by the FCC, tells us whether one or more providers have customers in each Zip Code, but it does not tell us how

[1] U.S. Government Accountability Office, Broadband Deployment Is Extensive Throughout the United States, but It Is Difficult to Assess the Extent of Deployment Gaps in Rural Areas, GAO–06–426 (May 2006).

many households or businesses in that Zip Code actually have broadband availability. Nor does it tell us anything about the quality or price of service.

- The most recent U.S. Government data on broadband adoption rates by different segments of the population (for example, broadband adoption in urban versus rural areas; adoption by people of different ages; adoption by households with children), was collected in October 2003 and published by the Department of Commerce in 2004 (in its last *Nation Online* report) and by the U.S. Census Bureau in 2005 (in Special Study P23–208). Given the overall growth rates we have seen since then, data from 2003 is virtually worthless for assessing the effects of our current policies.
- For a variety of reasons, surprisingly little is known about broadband adoption by businesses, including especially small businesses. For example, the most recent government data available on small business broadband penetration was collected in late 2003 as part of a study by the Small Business Administration.[2]

Of course, the fact that government is not collecting data does not necessarily mean that data is not available. Several non-profit organizations, including the Pew Internet and American Life Project[3] and the Center for the Digital Future,[4] conduct surveys on Internet use on a regular basis. The Pew Project, for example, regularly surveys Internet adoption in rural America. And, for those with the means to purchase data from private sector sources, much richer data can be had from companies such as Insight Research, In-Stat, Nielsen//Net Ratings and Warren Communications. I have had the opportunity to use all of these sources extensively, and while the data they provide is certainly helpful, it is far from comprehensive.

Given the importance of broadband to America's economic competitiveness, and the appropriately intense interest of policymakers in ensuring we are doing everything possible to create a healthy environment for broadband deployment to all Americans, it is clear the government could and should be doing more to collect information about broadband deployment, and to disseminate that information in a far more timely manner. While the FCC's recent Notice of Proposed Rulemaking on improving broadband data collection efforts is a hopeful step in the right direction, other agencies, including the Census Bureau, also need to look at how they can improve their efforts.

The Rural Challenge

Let me conclude my testimony with a brief discussion of broadband deployment in rural America.

As noted above, official data on rural broadband deployment are relatively sparse. In recent years, however, I have had the opportunity to look closely at the data that are available, from both public and private sources. The signs, I am pleased to report, strongly suggest our current policies are working to rapidly increase the availability of affordable, high capacity broadband services to rural Americans.

First, to be clear, there is no doubt that rural America lags behind urban and suburban regions in broadband adoption. For example, as shown in Figure 8, the Pew Project's most recent data shows that only 24 percent of rural households had broadband connections in 2005, as compared with 38 percent in suburban areas and 40 percent in urban areas.

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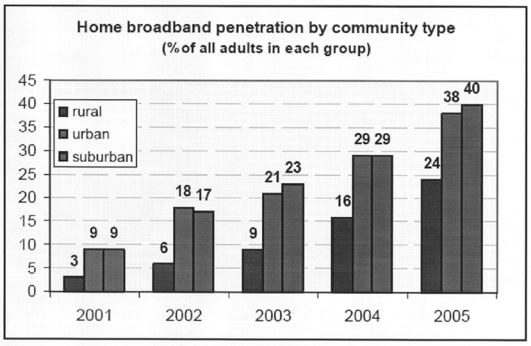
[2] *See* "A Survey of Small Businesses' Telecommunications Use and Spending," Stephen Pociask, TeleNomic Research for the Office of Advocacy, Small Business Administration Contract No. SBA–HQ–02–M–0493, Washington, D.C., March 2004 available at *http://www.sba.gov/advo/research/rs236tot.pdf*.

[3] *See http://www.pewinternet.org/*. I serve on the Pew Project's Board of Advisors.

[4] *See http://www.digitalcenter.org/*.

Figure 8: Rural Broadband Penetration, 2001-2005



Source: Pew Project on the Internet and American Life

What is less clear, however, is whether rural adoption lags behind due to lack of availability, or for other reasons.[5] Overall, the evidence is strong that broadband is generally available in rural America and that availability is increasing rapidly.

In expert testimony I filed on behalf of Verizon earlier this year, I examined in detail the state of telecommunications competition in the state of Virginia, including the availability and use of broadband.[6] The results there, it seems to me, are quite encouraging.

Figure 9, for example, shows the growth of broadband services in wire centers served by Verizon in the state of Virginia, based on the FCC's Form 477 data.[7] For reasons discussed above, these data are far from a perfect measure, but the trend it represents is nevertheless significant: The average number of broadband providers in rural areas is growing rapidly, and even wire centers with population densities of less than 100 now average more than four broadband providers.

Figure 9: Broadband Providers/Wire Center

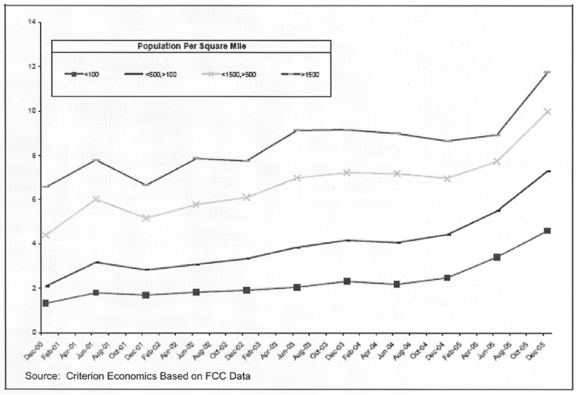


Figure 10 presents data on the availability of cable modem service in Virginia. This map, which is based on commercially available data backed up by extensive

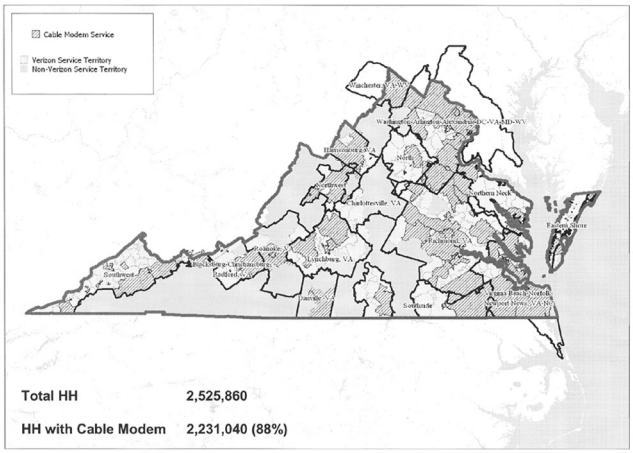
[5] There is some evidence, for example, that broadband adoption is correlated with income, and incomes in rural America tend to be lower than in urban and suburban areas.

[6] The publicly available version of my testimony is available at *http://scc.virginia.gov/division/puc/industry/vv_comp/rsc_app.htm*.

[7] To produce this figure, we mapped data for individual Zip Codes (obtained from the FCC) into corresponding wire centers within those Zip Codes.

original research *e.g.,* data from the websites of individual cable providers), shows that 88 percent of households in Verizon's service territory in Virginia have access to cable modem service. In fact, 99 percent of households passed by cable now have access to broadband cable modem service (and more than two-thirds have access to voice services from their cable operator). That's the good news. The bad news is that about 10 percent of households have no cable service at all, that these households are concentrated in very rural areas, and that as a result there are some very rural areas where cable modem service is available to only a small fraction of the population.

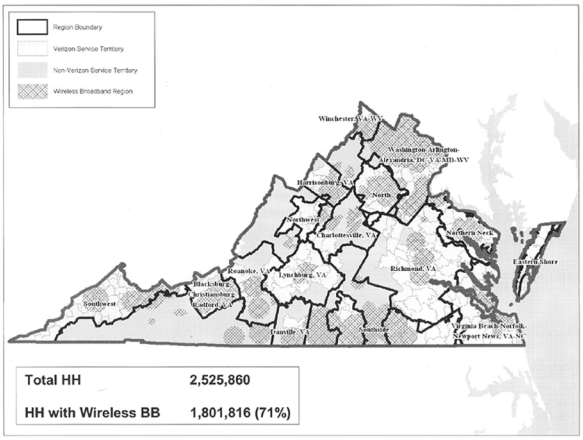
Figure 10: Cable Modem Availability in Virginia



Source: http://scc.virginia.gov/division/puc/industry/vv_comp/b3_maps/va.pdf

The story does not end here, however. Figure 11 shows areas where broadband is available from fixed wireless providers, based on information obtained from the providers themselves. It shows that wireless broadband service is available to 71 percent of Virginia households, including in many of the most rural areas of state.

Figure 11: Fixed Wireless Availability in Virginia



Source: http://scc.virginia.gov/division/puc/industry/vv_comp/b3_maps/va.pdf

I looked closely at the services offered by these providers, and was positively surprised by what I found. Companies like Citizens Telecom, Ntelos and Virginia Broadband offer robust, high speed connections, at competitive prices, with minimal set up fees.[8]

Wireless broadband providers are not the only innovative companies bringing broadband to rural areas. Broadband over powerline (BPL) providers are also showing increasing promise. In Virginia, for example, a company called IBEC has partnered with the Central Virginia Electric Cooperative to bring high speed BPL services to two service areas, and has committed to roll out service throughout CVEC's multi-county, very rural service territory. IBEC, I should note, has received significant support for the Rural Utilities Service loan guarantee program, which in my experience appears to represent, on balance, a cost-effective and efficient means of providing support for broadband deployments in rural areas.

Finally, I would note that America's rural telephone companies are actively rolling out broadband services, including fiber to the home, within their service territories. OPASTCO, the Organization for the Promotion and Advancement of Small Telecommunications Companies, reports that its members offer broadband services to approximately 90 percent of their customers.[9]

So, overall, there is a lot of activity happening to bring broadband to rural America, and a fair amount of evidence that progress is being made. Unfortunately, however, the available data is limited in both quality and geographic reach. Some states—and Kentucky certainly is a leader—have taken steps to more comprehensively assess what is available, and where, and what can be done to "fill in the gaps." Those efforts, in my opinion, need to be expanded to a national scale.

Summary

To sum up, while there are certainly flaws in our systems of data collection, the data that are available show that our current policies are working reasonably well, both in the aggregate and, specifically, with respect to promoting broadband availability in rural America. This does not mean, however, that we can or should be sanguine. Too little is known about the adoption and use of broadband, and our current data collection efforts provide little information on broadband availability, especially in rural America. Moreover, important policy issues loom in the immediate future that could have effects—positive or negative—on America's broadband infrastructure and, in turn, our competitiveness in the world economy. This Committee is correct to be concerned about these issues, and to give them careful deliberation, as it is doing today.

Mr. Chairman and Members of the Committee, that completes my testimony, and I look forward to any questions you may have.

The CHAIRMAN. Thank you very much, Doctor. May I now recognize Senator Stevens?

Senator STEVENS. Mr. Chairman, I find this very interesting. I want to hear the other witnesses also. Thank you for the charts, Doctor. I think they are very, very informative.

Let me ask all three of you—is Universal Service essential to broadband deployment?

Dr. EISENACH. I'll be happy to go first. Universal Service has played a very important but uneven role, I think, in broadband deployment. Formally, officially, we don't have within the Universal Service program, an official support program, as you know, for broadband deployment. However, rural telephone companies have been able to and I think to the benefit of certainly their customers, to in effect, use the Universal Service programs to upgrade their networks for voice purposes——

Senator STEVENS. Well—more than half of Universal Service now goes to inner cities—schools, libraries and health facilities. Isn't broadband part of that?

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[8] Virginia Broadband, for example, offers download speeds up to 15 Mbps, with 400 Kbps for $49.95 per month and 1.2 Mbps for $89.50. The company also offers a bundled VoIP service for $32.95 per month for residential customers and $31.95 per seat for businesses.

[9] OPASTCO *Ex Parte Presentation to FCC Commissioner Robert McDowell*, September 16, 2006.

Dr. EISENACH. Oh, I think that program has also been important, sir. I agree.

Senator STEVENS. Let me ask you all—anyone else have a comment about Universal Service and broadband?

Mr. MEFFORD. I would just add, Mr. Vice Chairman, that the results I have reported from Kentucky—USF did not impact those results in a big way. In other words, we haven't counted on USF dollars in a major way there, but yes, our local schools and libraries have utilized the program but report that it certainly needs some retooling and we certainly would agree with that.

Mr. SCOTT. Senator Stevens, I think that the insertion of broadband into Universal Service programs is an essential part of the national broadband strategy. I think bringing broadband to rural areas will require the same kind of progressive idea that informed our commitment to bringing telephone service to every American household. Because eventually we want everybody to have a broadband connection, just like we wanted everyone to have a phone connection and I think it is time to make Universal Service for broadband a part of this country's policy platform.

Senator STEVENS. Mobile phones are an essential part of broadband deployment, right?

Mr. MEFFORD. We don't report mobile phone broadband as part of our reporting on broadband availability on our maps.

Senator STEVENS. You're just reporting computer use?

Mr. MEFFORD. It's households ability to subscribe to broadband that is represented in our inventory and how we account for that 92 percent of households served. So we do not include mobile broadband in those numbers.

Senator STEVENS. If the household uses cell phones, it's not reflected in your figures?

Mr. MEFFORD. No, sir, it's not. We've done that for a number of reasons. There are some usage restrictions that follow mobile broadband, cellular based or just wireless broadband through mobile phone networks that would restrict some higher bandwidth type applications. That's one of the reasons that we haven't included that in this mix.

Senator STEVENS. But yours does include telephony, doesn't it?

Mr. MEFFORD. Yes, sir, it does. It covers telephony and cable—other forms of wireless, fixed wireless is represented on the map as the green circles. So we account for a lot of wireless service, just not cellular based.

Senator STEVENS. Was your study at all cellular based, Dr. Eisenach?

Dr. EISENACH. I've looked at that issue and clearly we see that wireless broadband connections are expanding very rapidly in the United States. If you come back to the question of Universal Service, if that's part of the issue, I think the question, which as we all know, is the extent to which wireless connections are duplicative of wireline connections. So as you look at the Universal Service Fund and the rate at which the growth of wireless—of subsidies are growing to wireless carriers, I think the question becomes whether that's the most efficient use of those funds as opposed to focusing on wireline or at least primary connections to households, whether they be broadband or narrow band.

Senator STEVENS. Thank you very much, Mr. Chairman.

The CHAIRMAN. Thank you. Senator Smith?

STATEMENT OF HON. GORDON H. SMITH, U.S. SENATOR FROM OREGON

Senator SMITH. Mr. Scott and all of you, I thank you for your testimony. Mr. Scott, I was very intrigued by your references to the OECD and how Europe has achieved both horizontal and vertical kinds of competition and I wonder if you can tell me what their investment model was. Do they have some form of net neutrality and if so, who made the investments to achieve that?

Mr. SCOTT. I should start by saying it varies from country to country but generically speaking about the variety of countries that are ahead of us in the broadband race, most of them have multiple competitors in the DSL platform and bandwidth is plentiful and the question of whether or not quality——

Senator SMITH. Who put it in?

Mr. SCOTT. The investment has been from the telecom carriers——

Senator SMITH. OK.

Mr. SCOTT.—for the most part. I mean, there are some countries where the incumbent telecom carrier is a legacy network that used to be owned by the state. There are very few left that still have controlling state ownership or any state ownership. That fact is sometimes rolled out but it's not actually accurate and the most important thing, I think, to recognize about these vertical competitors within the platform is that their growth rates are really off the charts.

Now, it's interesting that Dr. Eisenach raised the points of Korea and Belgium as having flattened out, I often work at night and I was up in the middle of the night when the OECD posted the new numbers so I was able to get a look at them and actually, Korea and Belgium, which on the S-curve, you would expect to be leveling off as a mature market—their growth rates have actually spiked in the last 6 months. Because of the competition in the market that has expanded the quality of those connections, they are finding consumers who want to buy broadband that weren't there in the marketplace before and that's really the direction I think we need to go.

Senator SMITH. As you probably know, the Telecommunications Act was all for voice and we're way beyond that at this point and we're struggling to get to the next level. I think the picture you paint as to what we want ultimately is very desirable.

But we're hung up on the whole issue of net neutrality and the investment model we have here is to say that the incumbent providers that you are critical of "go ahead and make this investment and we're just going to make sure you can't ever get a return on it." That's been, frankly, my stumbling block on net neutrality. I think in concept, it's a great idea but I don't know how to get it done in a country with a geography as big as we have, if we set the rules by government ahead of time so there's no return on investment.

You see the dilemma? How do we get from where you want to be and where I want to be—the same thing—but get it done? It is

Universal Service? Is it white space? I mean, is it a combination of all of those things?

Mr. SCOTT. I've struggled with the same question and my starting point is that I think as a nation, we want a network that is both open and free to commerce and speech on the application side and that is robust in its deployment and bandwidth on the physical side of the network and that we can have both. And we need not choose one or the other and that there are lots of strategies to make sure that the carriers get a return on investment.

There are Universal Service strategies. We can look abroad at how they've done in their networks. There are various tax incentives that can be put forward, accelerated depreciation. There are ways to make sure that the investment is there that doesn't require changing the fundamental nature of the Internet.

Senator SMITH. Is that then sort of a third way we might consider to how to proceed? To get beyond this?

Mr. SCOTT. Absolutely, absolutely. I think if we learn the lessons of the world leaders in broadband, we will get beyond the impasse very quickly and we'll be moving in the right direction.

Senator SMITH. Is Universal Service one of the avenues?

Mr. SCOTT. Absolutely.

Senator SMITH. How about white spaces? I mean, how do you see that reform?

Mr. SCOTT. I think opening the television white space is the quickest and easiest way to bring a ubiquitous wireless connection to the country. I think it is a space that could enjoy a tremendous boom in innovation. I think one of the greatest success stories in broadband in the last few years is WiFi. Opening the white spaces is like WiFi on steroids and that spectrum has too long sat dormant and we really ought to make it available.

Senator SMITH. What do you see happening if we aren't able to break through the impasse? What happens? Do we just continue to fall behind as a country?

Mr. SCOTT. If you look at the trend lines on the OECD numbers, they are not encouraging and frankly, that worries me because not only do I want to see the Nation fully connected but every 6 months that we fall further behind the rest of the world billions of dollars of consumer surplus that we're leaving on the table.

Senator SMITH. There is another factor—I don't know if many realize it. We want high tech to remain an American-centered industry but if they don't have the infrastructure, it's not going to remain an American centered industry.

Mr. SCOTT. I couldn't agree more.

Senator SMITH. Thank you, Mr. Chairman.

Mr. MEFFORD. Mr. Chairman, if I might add—in relation to what you mentioned in your opening remarks about the Broadband Data Improvement Act, I would just plug that as an opportunity to do exactly what you've just said, Senator Smith, and it provides a way to empower states to address these challenges at the state level and even to work in the public/private partnership context to address these challenges more through a market-based approach.

As we've seen in Kentucky and in other states now, the market-based approach can get us a lot further along the path than what

we are today. So I would encourage a look at that, the Broadband Data Improvement Act.

The CHAIRMAN. Thank you. Senator McCaskill?

STATEMENT OF HON. CLAIRE MCCASKILL, U.S. SENATOR FROM MISSOURI

Senator MCCASKILL. Thank you, Mr. Chairman. As I looked at this issue, I thought, well, there has got to be a program out there that's been done by Congress to help rural broadband access and I found one. It is a program that, according to a September 2005 Department of Agriculture Inspector General report, has authorized $2.9 billion for grants and loans in rural areas. Of that, as of March 2005, only $181 million had been advanced. Only $895 million had been funded. The interesting thing about that as I looked into the program and looked to see if there were GAO or IG reports about it, I found an IG report that nails the program for essentially spending a huge chunk of the money they've spent on suburban communities—in Houston, Texas and Los Angeles. They played with the definition, even though clearly when you read the bill and use common sense, the legislation clearly was intended to get to rural communities that were not served, not to suburban communities in order to allow someone to compete with other providers who hadn't received government loans and government grants.

But in reality, that's what happened. I'm curious, Mr. Mefford or Mr. Scott or Dr. Eisenach, if you're familiar with this program. I think, frankly, that $2.9 billion in authorization is a pretty hefty authorization.

I know that there is other legislation pending. I've been asked to cosponsor legislation to help do the things like you did in Kentucky. What's wrong with the money that we've authorized and appropriated being used for this and why isn't it being used in a way, from your perspective, that would actually help solve this problem, instead of being another example of where a government program isn't doing what it was designed to do and giving money to folks it wasn't designed to give money to?

Mr. MEFFORD. Senator, I think it's a good example of a well-intended initiative at the outset. I think that perhaps the agency would tell you that the regulations as promulgated perhaps didn't fit the intentions to give them the flexibility perhaps, that they need but instead of speaking to what they may or may not say, let me speak to my—to our experiences with RUS funding. Of the roughly 550,000 households that have been served over the past 2 years in Kentucky, I would estimate that fewer 50,000 of those were impacted by RUS funding and there are a number of reasons for that small proportion.

The process is an arduous process and it is one that is put on as the responsibility of the providers to navigate. In Kentucky, we took responsibility for that, navigating that process on behalf of providers so bluntly, I think that a lot of providers look at what they have to do to get those dollars and just decide, we don't have——

Senator MCCASKILL. It's not worth it?

Mr. MEFFORD. It's not worth it.

Senator MCCASKILL. What makes you think another program done by government is going to be worth it, if we did one and it was so bad that people threw up their hands rather than participate in it?

Mr. MEFFORD. Well, I think there is the opportunity to take the previous three and a half years, 4 years and learn from the challenges of that program, frankly. I think that one example is that the RUS funds cannot be used—the grant funds cannot be used—the definition is very restrictive and so in Kentucky, we have applied for RUS funds and received RUS funds for all of our eligible communities yet we still have our toughest to serve areas remaining unserved. So the program is now irrelevant for Kentucky, based on current regulation.

Senator MCCASKILL. It's so frustrating to me that rather than fix a program that we've created, we're going to go create other programs. Money has been authorized. Projects have been funded. Very little of that money has been advanced. It is such a good example of Congress wanting to do the right thing, and reading the law, it's pretty clear what they were trying to do was to get service to unserved areas. They weren't trying to provide competition in areas that were already served, and they certainly weren't trying to help wealthy suburbs in Houston, Texas. It seems to me what we should be soliciting is advice from you and others that have tried to utilize this program and fix that program rather than saying, "okay, let's start another one because—you know, the regulations that are so difficult?" Guess who did it? Them. They are the ones that did the regulations. It wasn't you all that did the regulations, and it wasn't Congress that did the regulations. In fact, they have rewritten the definition of rural. It was one definition and then another and now another, and the definition was such that it did not limit it to those areas that were unserved and struggling.

I know you have a community of people out there that are trying to do exactly what you've done with ConnectKentucky. I would appreciate the opportunity to try to take a 2x4 to that agency and fix that program so we can use that money and make that bureaucracy responsive as opposed to saying, "Well, we wasted that money. Let's start another one with no assurances that we're not going to have the same darn thing happen again."

Dr. EISENACH. Senator McCaskill, if I could jump in because it's a program I have some experience with. I've been through the RUS application process with a client. I've watched very closely what has happened with the Central Virginia Electric Cooperative in Virginia and I think I would say, I share your sense, first of all, that this is a program that can and should work.

Senator MCCASKILL. Right.

Dr. EISENACH. There is a lot going for this program and one of the things I think it has going for it is that it does demand of the applicant some evidence, some showing that the applicant has a business plan—the technology is going to work and so forth. In the case of IBEC and the Central Virginia Electric Cooperative in Central Virginia, we're looking at a broadband over power line deployment and that technology I think has tremendous promise.

I think its application in rural areas is on the verge of coming to fruition. And I think the fact that the RUS provided a loan guar-

antee to IBEC and CVEC to put in place that system has been essential to that initiative and I think the odds are very high that initiative is going to work. I think the potential in the RUS program is that it can be a very efficient way of leveraging dollars and for that $2.9 billion in guaranteed loan funding, we should be able to get a lot of bang for our buck, as it were and again, I'd come back and look at some other areas where we're spending a tremendous amount of money and the Universal Service program, frankly, is one of them where we're spending close to a billion dollars right now to provide what are essentially second telephone lines to wireless consumers in the United States where when we don't have broadband availability—any kind of connection in large slots of the country. So when you look at the bang for the buck that is potential in the RUS program, as compared to some other programs, I think it is extremely attractive and I think you're right. A lot more focus on what we need to do to get that program rolling is exactly what's needed.

Senator MCCASKILL. Well, I would appreciate any input you would have on the problems of that program. I don't have time because my time is up and I would also like to talk—maybe I can with the second panel—about the Universal Service Fund, monies that consumers are paying all over the country to provide phone service in under-served areas. Well, that's dated. Clearly the Universal Service Fund that is out there that consumers are paying for—it's a pass-through cost—clearly, we should be capturing those monies to do some of the things that we've talked about here this morning. Thank you, Mr. Chairman.

The CHAIRMAN. I thank you very much.

Senator STEVENS. Mr. Chairman, can I comment on that?

The CHAIRMAN. Please.

Senator STEVENS. On what the Senator said. Senator, I'm informed that the problem really is, is that broadband speeds for wireless are slower, and basically in the rural areas, we're using wireless and satellite and therefore, these areas were ineligible.

Last year, we had broadband proposals in various titles in our bill, which I hope we'll address again. We had Universal Service reform, an extra $500 million for broadband deployment by Universal Service. We tried a streamlined franchise reform. I don't want to take a lot of time but the white spaces concept and the municipal broadband title really got into the whole question of deployment on a municipal basis rather than statewide basis—all of those were designed to try and deal with the problem you mentioned.

But the problem basically is that we can't just use the legacy systems of cable and wire. In Europe, they were wired and they were able to go into broadband deployment much faster because they don't have these distant areas like we do in Alaska and Hawaii. As a matter of fact, the West itself was just not wired. Wireless brought new communications methods to these people but by definition, it's slower and not adaptable to this new concept. We have to find some way to adapt it and I think we have to find a new way to define Universal Service so it covers these areas and is not limited, as it is now, to a voice system. It is the data deployment in rural America that is necessary to catch up with Europe. Thank you, Mr. Chairman.

Mr. MEFFORD. Mr. Chairman, if I might—I'm sorry. Again, I would be remiss if I did not include in my comments in response to Senator McCaskill that the agency—we have been in contact with the agency fairly extensively on——

Senator MCCASKILL. When you say the agency, you're talking about RUS?

Mr. MEFFORD. RUS, yes, ma'am, on changes that they are hopeful to make and I think some additional flexibility would be helpful in their efforts, obviously. Another example is of where they could use some assistance, I think, is in the fact that while it is a $2.9 billion program in total, only $8 million is set aside annually for the grant program. So perhaps——

Senator MCCASKILL. That seems weird, doesn't it?

Mr. MEFFORD. It does and so when you have 50 states applying for $8 million annually, it makes it a tough program.

Senator MCCASKILL. Do the math. Right. So they are basically being stingy with the grants and wanting people to do the loans and they've made the hoops you jump through for the loans so incredible that it's not cost effective for companies to access them.

The interesting thing is, they need additional time and input, and of course, this was in the 2002 farm bill. We're getting ready to rewrite the farm bill, and they still haven't figured it out. No one would ever accuse them of going quickly on this stuff, and frankly, this is an area where we ought to go quickly. Government ought to be a lot more nimble when we're talking about technology because if you're not nimble, then you have a tendency to waste a lot of money because by the time you figure out what you've been working on, you're already 10 years behind. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. Senator Pryor?

STATEMENT OF HON. MARK PRYOR,
U.S. SENATOR FROM ARKANSAS

Senator PRYOR. Thank you, Mr. Chairman. Arkansas has just passed a new law called Connect Arkansas Broadband Act, sponsored by a friend of mine down there, John Paul Capps. The bill would create a public/private partnership aimed at increasing the broadband coverage for health, industry, education and general economic development. I would like to ask about the Kentucky program and how much can we learn from what's going on in Kentucky and how successful has the Kentucky program been?

Mr. MEFFORD. Thank you, Senator. Mr. Chairman, I'm glad to be able to tell you that we have been working hand-in-hand with the folks in Arkansas to help develop the legislation that was passed and continue to work with them on the creation of the public/private partnership. The examples and the model that we've developed in Kentucky originally is highly transferable to every state in the Nation.

Senator PRYOR. Are other states doing it?

Mr. MEFFORD. Yes, sir.

Senator PRYOR. Do you know about how many?

Mr. MEFFORD. Well, Connected Nation, our company is engaged on various levels with probably a dozen different states and they range across the board in terms of size and geography.

Senator PRYOR. Should there be a national level or does this work better at the state level?

Mr. MEFFORD. I think that there is a good opportunity in the Broadband Data Improvement Act that the Chairman mentioned earlier to empower states—for the Federal Government to empower states to develop and implement these types of initiatives. I think it's very important that this is a state-based effort but states need more impetus right now to, as Senator McCaskill said, to hurry up and get something done.

Senator PRYOR. As I understand it, you see an increase in capital investment, you see a growth in broadband availability around the state and you see distribution of computers to underprivileged children in under-served communities, which I think is great. But what are the big obstacles out there? What should Arkansas have to look forward to in terms of obstacles that we have to overcome?

Mr. MEFFORD. I think a significant obstacle in the bigger picture of this type of discussion is the fact that we need to always consider the demand-side of the equation. It is not a field of dreams prospect where we can solve all of our Nation's technology-based ills by just building the infrastructure.

We have to focus—whether it's Arkansas or Kentucky or California—no matter the state, we have to focus on demand creation, demand aggregation type efforts. We have done that through our e-Community Leadership Teams where we are at the very grassroots of each of our counties, working to raise the awareness of the importance of technology and why our parents should provide their children with an Internet connected computer for doing homework and so forth and gathering healthcare type information, and it's those basic grassroots awareness building efforts that are so important in these types of efforts.

Senator PRYOR. Let me ask the panel something generally. You know, when you look at some lists at least, Arkansas is 47th out of 50 in terms of broadband deployment. But how reliable are the numbers? I understand there are some gaps in the stats and the reporting from state to state or maybe even company-to-company is not maybe as consistent as it should be? When you say we're 47th, does that mean we're really 47th or do we really have a clear picture of what's going on out there?

Mr. SCOTT. You don't really have a clear picture but the picture is murky for everybody. To the extent that there are mistakes across the board, it's unlikely that one state would jump up the ranks if we had more granular data. However, when we go to solve the problems and try to identify where the gaps in the market are, that's when it really breaks down and having that data would be invaluable.

The problem with the Zip Code method is in a state like Arkansas where you've got a large area in each Zip Code and the population is spread out and if one customer has a DSL line, then everybody is counted as covered—that could mean that 90 percent of that Zip Code has no coverage but you don't know that. So in our view, you've got to collect data down to the zip plus four level so that you can aggregate those together and match them to census records so you can get a better idea of who has broadband and who doesn't and who they are so you can target your programs.

I also think you need to measure speed and price so you can identify certain sections of Arkansas that are paying way more for less speed than others and why is that and what can we do to remedy it.

Dr. EISENACH. Senator Pryor, I would add to that. First of all, I think the data are unreliable. It's not entirely clear what they are measuring for all the reasons we've talked about.

One thing I would mention that has not been talked about here yet today—it has been discussed a little bit at the Federal Communications Commission. It's something I think this Committee should consider looking at, is the power of geographic mapping software. Literally every wire center in the United States can be identified by its geographic coordinates and the streets that are served by that wire center can be mapped out. The same is true for cable—cable modem, cable voice. The same is true for maps showing the coverage areas of wireless, both fixed and mobile wireless.

I gather from the map that we see here from Kentucky that that is the sort of the software that they utilized in their project. It is the sort of software that I utilized in the work that I've done in Virginia, very similar. The maps at the back of my testimony were produced using that software and one thing I think that we really ought to be asking the FCC is, at what point do you move from what is essentially an archaic technological approach to measuring things by predefined areas to moving to a geographic mapping technology, which literally can tell you exactly where on the map—which street, which mountain, which valley—actually has coverage and from whom.

So I think we may be sort of taking a blunt 20th century instrument when 21st century technology could give us much smarter answers.

Senator PRYOR. You may have just answered my next question, which is my last question I was going to ask Mr. Scott. In your testimony, you say that the "FCC has not embraced a free market approach to enabling competition but rather supported the entrenched, incumbency of a rigid duopoly." What do you mean by that?

Mr. SCOTT. I'll try to give a short answer to a complex situation. Over the last several years, if you look at competition in broadband policy, for the last 10 years, there were efforts to introduce competition in the market that were gradually dismantled by the FCC over a series of rulings and we, as a philosophical matter, the FCC has decided that competition between technologies rather than competition within technologies is the key to the competition problem.

So they have instituted policies that support the business models of the incumbents in hopes that will produce the kind of robust competition that will bring broadband everywhere. And in my view, it hasn't worked. That's what I meant by that.

Dr. EISENACH. Senator, may I? I just have to add one thing to that. If you turn to Figure 1 in my testimony, you see what Mr. Scott is talking about. The low point on the investment curve here is the point at which the FCC took the actions that Mr. Scott complains about. What happened to investment after those actions

were taken is investment went up 40 percent. What he proposes is that we return to the low point on this chart with a lot of policies that essentially punish investment in telecommunications infrastructure. What has worked is what we are doing today and what we should be doing more of, not going back to the policies of the late 1990s, which I think unambiguously failed.

Mr. SCOTT. If I might offer one counterpoint to that, which is, there was the crash of the tech bubble around in there that resulted in a decline in investment and I would argue also that investment is far more responsive to competition. The competition in the Bell Networks is much more responsive to the cable networks getting voice capabilities and stealing phone customers than it is to the policy prescriptions that the FCC institutes or doesn't institute.

Mr. MEFFORD. I would add that these two are not mutually exclusive. I mean, there is an opportunity to gather data that is a purpose driven exercise that providers can get behind, participate in and collaborate with.

Senator PRYOR. Mr. Chairman, thank you.

The CHAIRMAN. Thank you. Senator Thune?

STATEMENT OF HON. JOHN THUNE,
U.S. SENATOR FROM SOUTH DAKOTA

Senator THUNE. Thank you, Mr. Chairman and Senator Stevens. I want to thank you for holding the hearing today and also thank our witnesses for their testimony and input on how we can improve an already lightning fast rollout of advanced telecommunication services, including broadband that we are currently experiencing here in the United States, and I would just preface it by saying that a lot of Americans are enjoying the benefits of these types of Internet connections that can enhance our quality of life in terms of education, entertainment, healthcare, business but there is more work that can be done in getting that broadband access into the farthest reaches of our country and many of those areas are in places like my home state of South Dakota.

And I know that it has got to be a combined effort at state, local and Federal levels, the government along with private industry. So we're going to have to remain flexible in terms of deployment policies and programs as well as technologies because I don't think there is a one-size-fits-all approach to this effort.

But it is important to remember that it is worth the effort. Broadband deployment means better jobs. It means better education and a better quality of life so I look forward to working with the members of this Committee and other stakeholders as we tackle the issue.

Mr. Mefford, in your testimony, you mentioned the fact that in Kentucky, you had to encourage both supply and demand for broadband services. I want to highlight that point because I think in some rural areas, we need to focus on stimulating demand for broadband as well and need to ensure that Americans living in rural areas understand the possible benefits in business, healthcare and education, simply that comes from ordering that broadband connection. Can you expand a little bit on that point and explain how you stimulated demand in Kentucky?

Mr. MEFFORD. Yes, sir. Senator Thune, thank you for the question and I'm happy to expand on that. We have created in each of the 120 counties in Kentucky, local leadership teams that we call E-Community Leadership Teams. These leadership teams are representative of a cross-section of each local community.

So we have leaders at one table from local government, education, healthcare, business and industry, agriculture, tourism, community development organizations—all these people literally sitting around the same table and we take them through a process where we first ask, how are you using technology today, in this community, in this sector? Then we do a visioning type exercise. How could you better use technology that is existing and that will become available in the near future? And we give them examples of what other, similar communities and sectors are doing around the country and in fact, around the world. Then we give them a tactical plan that says here are the things you need to do to bridge that gap. Here's where you say you want to be and here's where you need to be.

Now, the practical realities that have come out of that process—one example is in healthcare. We had one very rural county in eastern Kentucky where those folks sitting around the table—you had a public health organization that said, well, we really would like to get into E-Health somehow, telemedicine is where we would like to focus and the local community college said, well, that's a piece of curriculum that we've been interested in developing so let's partner together and make these initial investments.

Well, we had, from the business and industry sector, a local cooperator present for that discussion, and he said, well, if you'd develop a tele-health unit, we can literally roll that unit up to the top of the hill and we can do health screenings and things like that for my employees. That happened and enough time has now passed where we now know that business's health insurance rates have declined and so has absenteeism rates.

I give that as an example of a real life observation of how that demand side activity, how it works and how it provides dramatic results for a variety of sectors but at the same time, as the providers see that kind of demand creation happening, they are more interested again in a market-driven type way, they are more interested in making more investments in that community because bandwidth needs are expanding and use has increased.

Senator THUNE. I appreciate it. It's been mentioned, I think, in some of the testimony that population density is a key factor in broadband deployment and I want to just note a couple of other countries around the world. Denmark, which is at the top of the list for broadband deployment, has a population density of 128 people per square kilometer.

The Netherlands, which is second on the list, has 466 people per square kilometer. The United States, which comes in at 12th, has 32 people per square kilometer and in my home state of South Dakota, we have 3.8 people per square kilometer. But I guess the question I would have, and I open this up to anybody on the panel, is the United States implementing the right programs and policies for broadband deployment for our unique geography and population

density and will we ever be able to reach the level of broadband penetration of those countries at the top of the list?

Mr. SCOTT. I can speak to that question, Senator Thune. While I just happen to have the population density statistics in front of me and you're right that the top four countries have very high population densities. The next four have really low population densities and there is an intuitive sort of thought that it has got to be population density that's a problem.

We studied that question and studied that question and calculated all the variables and when you're comparing data on the aggregate between countries, it doesn't explain it. As you get out into the rural areas, there are policies that you need to have in place to bring broadband to those areas but it doesn't explain our performance relative to other countries. So that's one point.

The second point is, I absolutely agree that universal service programs aimed at broadband deployment are an essential part of bringing broadband to those gaps in the networks and the gaps in the networks are disproportionately in rural areas and the Dakotas are at the top of the list.

Dr. EISENACH. Senator, two things. One, your point about density, I think, is well taken and it is a little bit more complex than just people per square kilometer or square mile. One of the things that affects the speed at which we rolled out our broadband in the U.S. is the fact that the copper line links in the United States are much longer than the copper line links in Europe, all other things being equal, even setting aside population densities. So the way we built our telecommunications infrastructure 50 and 100 years ago, is now affecting our ability to roll out broadband over DSL lines because DSL only works within about 18,000 feet of a central office. So what we have had is a much higher cost per household reached over copper than they've experienced in the European Union.

Now what you've seen with rural telephone companies is you've seen them putting those universal service subsidies to work to build fiber optics much more deeply into their network. OPASTCO (Organization for the Promotion and Advancement of Small Telecommunications Companies), which is the association of small telephone companies, reports that roughly 90 percent of customers of small rural telephone companies now have DSL or in many cases, increasingly, fiber to the home.

In fact, fiber to the home is being built out in a lot of rural communities faster than it is being built out in a lot of urban communities in America, thanks to the availability of those subsidies.

The only other thing I'd say, which was discussed earlier, is that while the Rural Utility Service broadband grant and loan guarantee programs, I think, have been implemented imperfectly. The underlying principle there, which is leveraging private money and particularly with those loan guarantees, I think is very sound and that is a way to target, as we think about what do we do going forward with targeting our funding wisely on filling in the gaps on broadband. The RUS programs and programs like that, that are targeted and that leverage private sector money, I think, are the kinds of programs we ought to be looking at.

Senator THUNE. OK. I appreciate that, and that's one of my observations, too, that many of those programs are building, duplicating in areas where you already have some form of service as opposed to going into those areas that don't, and I think that really needs to be the focus of those programs, is delivering and expanding the scope. Many of the teleco's in our state, small teleco's, have done a good job of, as you said, using universal funds to reach out to under-served areas but these programs that we have that provide incentives, provide capital, I think, do need to be targeted with an eye toward those under-developed and under-served areas.

Dr. EISENACH. Senator, just one thing that I think really does deserve some attention is that we now have in Mississippi, we have areas of Mississippi where we have 16 mobile telephone companies receiving universal service subsidies for serving precisely the same service territory and we're talking about real money. We're talking about a billion dollars a year, I think over $100 million a year just going to the state of Mississippi in order that people can have second and third and fourth phone lines, in order that when a family of five gets five mobile telephones, two parents and three kids—quintuples the amount of universal service subsidies that is being received by whatever wireless carrier is providing those five telephones.

Now, we'd all like to have free cell phones for our kids but is that the best use of government funding at a time when there are big areas of the United States—Alaska and Hawaii among them and your state, of course, where we do not have any kind of broadband at all?

Senator THUNE. I appreciate that. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much. I'm glad Senator Thune brought up the matter of population density. The top five countries are Denmark, Netherlands, Korea, Switzerland and Iceland. They are all dense, densely populated, smaller in acreage than the United States. That's one of the problems. But my question is, whenever people give speeches in Washington, they often times used the word, superpower, to describe the United States so I presume an element of pride is involved. But I want to go beyond pride. What impact do these statistics have on the quality of life of Americans? On employment, unemployment, on education levels and such? Is it at a dangerous level? Should we be concerned? Or is this what we can expect?

Mr. MEFFORD. I would address it to say, in Kentucky, it has made all the difference in the world for these less densely populated areas particularly. So when you were talking about our ability to compete beyond our metropolitan areas—that is, where having this infrastructure in place is, in my opinion, critical. So as we've seen in Kentucky, we have kids who have left and took jobs in other places, have now come back to Kentucky.

Now, on a national level, if we did nothing from this day forward, which we're confident won't happen but if that happened, then those kids would be going to other countries for jobs that were attractive instead of just moving from state to state within the United States. Our ability to work efficiently and effectively from any location is enabled through this advanced infrastructure. Education is able to improve just exponentially in what type of content

we can deliver directly to our children, again, no matter where they live. Healthcare is able to be delivered in a similar fashion where we have folks in rural Kentucky who are accessing physicians from our major metropolitan areas. So again, we have seen that this is just vitally important, particularly to our rural communities.

Mr. SCOTT. Mr. Chairman, I think I can provide some numbers and I'm pleased to say these numbers come from a study that was done in 2003 by Dr. Eisenach's firm, Criterion Economics. I thank you for those. They are very informative. In 2003, the broadband penetration rate in this country was 20 percent and the economists at Criterion determined that the consumer surplus for the country at a 20 percent penetration rate was $10 billion.

But what they showed is that for every point of increase in the percentage of penetration, the amount of consumer surplus doesn't increase linearly. It increases on an exponential curve. So if we had a 50 percent broadband penetration rate, the annual consumer surplus would be $38 billion and if we had a 95 percent broadband penetration rate, the annual consumer surplus would be $350 billion, at which point we're talking about real money in this economy. Every single point matters as we go up that scale.

Dr. EISENACH. Senator, I guess I'd make first of all the point that coming back to my reference to Sputnik earlier on, maybe the parallel really is there. When the Russians launched Sputnik in 1957, I think there was tremendous concern that was emblematic that the U.S. had really fallen dramatically behind in a key technology, that the Russians were ahead of the U.S. in space technology. That wasn't true.

What was true is that they were more focused on it and at that particular moment in time, they managed to do something that we sure wish we had done first. I suspect the same is true today, that the underlying fundamentals in the United States are pretty strong, but that we do need to get focused as we did in 1957 and thereafter, on making sure that we do the right things.

Now the larger question is, is the fundamental underlying approach that we're taking today, which is essentially to rely on the marketplace and to generate competition among infrastructures. Is that the right approach or should we go back to the approach we tried in the late 1990s?

As I see what is happening in the markets—Mr. Scott talks about a cable/telephone duopoly but then he says that, in fact, every time cable invests, telephones invest more. Telephones invest, cable invests more. That's what I see with my eyes. That sounds like competition to me and then I look at Sprint making a $3 billion investment in a nationwide WiMax network.

I look at what the wireless—mobile wireless companies are doing in rolling out what are really very capable broadband networks. I look at what Virginia Broadband is doing in Rappahannock County and this whole central part of Virginia, which is another wireless network and I see competition among infrastructures. And I see that as being extremely healthy and a path that we should continue, not back away from.

The CHAIRMAN. I have many other questions I'd like to submit. I just note that we have another panel but I was very shocked by the statistics I just read a few days ago. Last year, in all the col-

leges and universities, 40 percent of the Ph.D. doctorates were granted to non-Americans and of that number, I think 80 percent went home to their countries. Is that a matter that should concern us?

Mr. MEFFORD. Again, that validates and substantiates this fear that there is a risk of exodus of our intellectual talent, particularly and so the point earlier of what we've seen in Kentucky as we have focused on this infrastructure and seen jobs created—again 14,500 in the last 2 years in Kentucky, technology jobs alone—that Ph.D. trend has reversed itself. So now we have nearly double the number of Ph.D. candidates who finish programs staying in Kentucky.

The CHAIRMAN. To the panel, thank you very much. The record will be kept open for 2 weeks and if we may, we'd like to submit questions to you for your consideration.

Mr. MEFFORD. Absolutely.

The CHAIRMAN. Thank you very much.

Mr. MEFFORD. Thank you, Mr. Chairman.

The CHAIRMAN. Our next panel is the Chief Technology Officer and President of Advanced Technology Solutions, of Telcordia Technologies and Advisor to the Board of Communications Research, Telecommunications Industry Association, Dr. Adam Drobot; Professor, University of California at San Diego and Vice President of Technology at QUALCOMM, Inc., Dr. Jack K. Wolf; and Senior Fellow and Director of Communication Policy Studies, Progress and Freedom Foundation, Dr. Scott Wallsten.

Gentlemen, welcome and may I call on Dr. Drobot.

STATEMENT OF DR. ADAM DROBOT, CHIEF TECHNOLOGY OFFICER AND PRESIDENT, ADVANCED TECHNOLOGY SOLUTIONS, TELCORDIA TECHNOLOGIES; ADVISOR TO THE BOARD, COMMUNICATIONS RESEARCH, TELECOMMUNICATIONS INDUSTRY ASSOCIATION

Dr. DROBOT. Thank you, Mr. Chairman, Ranking Member Stevens and Members of the Committee. I am appearing today as the Chief Technology Officer of Telcordia. I'm responsible for its research organization and also an advisor to the Board of Telecommunications Industry Association, where I chair the Research Division, which is composed of the CTOs of our 600 members and I'm grateful for this opportunity to be able to testify before you today.

I think the first point I would like to make is that communications technology is not just another thing that's out there. It is truly vital to the global economy, to serve as its central nervous system, essentially, and it is really the foundation of what our societies will be based on in the future.

As an industry, as you look at it broadly in the United States today, it represents 7.1 percent of our GDP. It affects all other sectors in a very fundamental way. It impacts the productivity of our industries, of our economy, educational systems, public safety, healthcare and countless other functions in our daily lives. I think those functions will only grow as a matter of time.

I think with all the advances we have seen over the last years, I'd say in the years since Sputnik, what you will find is that we haven't seen anything yet. The underlying technologies that have made this possible continue to grow at exponential rates and the

nations that I think will harness these technologies are ones that will prosper in the future.

If I were to steal the words from Bush, I think they ring as true today that all of this affects the health, general welfare and defense of our population. So if I look at two of the issues we'd like to address today, one is communications and broadband deployment and the other is the role of research.

In broadband deployment, if you look at our next-generation systems, I think it is necessary to have incentives to deployment. We have heard that in the previous panels but just as much, removal of barriers and experimentation with new business models make this sustainable.

In the past several years, we have witnessed a demand for broadband growing at tremendous rates. In the U.S., the market last year grew at 9.3 percent to come to almost $923 billion in revenue, 11.2 percent worldwide. Somehow we have the feeling this is important to the world as a whole. We have seen technologies like broadband video in the entertainment sector, Voice over IP, mobile data services—all of those flowering at this point in time and as a result, cable teleco's, wireless operators and all others in this field, I would say going from voice to Voice over IP, the bundle packages to consumers, I think are continuing to drive down costs and increase the services that are available.

Broadband video is one of the driving forces behind the current deployment of things like fiber. It allows telephone carriers to compete with the cable providers. The demand for broadband has also been propelled by Voice over IP. Whether it is by peer-to-peer Vice over IP or between service providers, again something that has had a great take up by consumers.

The forecast is that 34 percent of all U.S. residential landlines in 2010 will, in fact, be based on broadband Voice over IP service.

I would say there is a tremendous amount beyond entertainment. The creation and sale of information and communication technology equipment creates jobs in our economy. I think if you look at our problems in healthcare, it has a tremendous role to play there, the same as in education, financial services, transportation and public safety.

What is important to TIA and its membership is that next-generation communications capabilities will be available and will facilitate public safety, allow our nation's first responders to assist the public in times of emergencies and that technology also plays a crucial role in the safety and security of our country.

The expectation of technology in telecoms is important because it has a day to day impact that improves the productivity of individuals, of governments and corporations and that allows us to do new things and to do things that we have done in the past at much lower cost. The impact on the economy is really profound.

There was a point in time that for information and communications technology the U.S. was an undisputed source of ideas and their implementation. Increasingly, we're finding that the source of new ideas is as likely to come from Europe and Asia as it was from the United States.

I'll cite one example of that. SAP, the German company, recognized early in time that the use of distributed systems, PCs, would

allow you to run large corporations in a very efficient way. They deployed their systems ahead of anybody else. If you look at the world's largest corporations, they tend to run on those systems today and so the ability to creatively use new technologies is no longer a monopoly that we have. We share it with the rest of the world but it has an effect on our standing.

I believe that in the United States, we must focus on next-generation broadband services and capabilities, especially in rural areas because it brings in those areas to become part of the world economy, essentially.

I think it was mentioned earlier by some of the speakers, the USDA has made progress through no-interest loans, to spur broadband deployment for this purpose. While there may be questions of how the program is being administered, I think repairing it and making it deliver on its promise would be of tremendous value.

I think this is something where we must all work together to balance the role between government involvement and incentives in the private sector that are going to build our systems for us for the future. We should first determine where broadband deployment has not occurred and why so that we can identify those incentives and eliminate the barriers to moving forward.

Let me now turn to long-term telecommunications research. I think it is the underpinning of what we do and that the impact on next-generation systems there again, is profound.

Other countries have discovered the importance of basic research and now are starting to reap the benefits. If you were to take a look at Framework Programs in the European Union, they are now starting their seventh Framework and actual programs in Korea, Taiwan, Hong Kong, Singapore and Japan—all of those are partnerships between their national laboratories, their private institutions and government. Those programs are really starting to accomplish pretty profound things.

A good example of that would be deployment of what's called WiBro in Korea. It is a form of WiMax. What they have done is perfected the mobile form of that, which delivers high speed services anytime, anyplace and they are likely to be the first geography in which that kind of service is actually deployed universally.

Another technology that again started in the United States, IPV6, the next generation of protocols for the Internet, was really perfected in Europe in the Fifth and Sixth Framework. While the United States is still the single largest market for communications and has the most robust economy, we now fall behind others in the penetration of high speed broadband and we have not commercially brought next-generation services to consumers.

What I believe is important is that those who have done the deployment are now experimenting with next-generation business systems, next-generation e-Government systems. They have the test beds on which we can do the experimentation. We do not, at this point in time.

The experience from my own corporation, in fact, finds that the ability to fund research of a pre-competitive nature early on is very, very difficult to do and sustain for the long term. While we were part of the Bell System before divestiture, where there was

a mechanism for funding this kind of broad research, it is very difficult to do today in a very competitive industry.

To maintain our edge, we are finding the necessity to rely on growth in foreign markets and are facing increasing foreign competition, which is advantaged by public spending in the local markets and long range government funding.

So in summary, we believe there are a number of things that Congress can do and I think the first of those is to do no harm. It is vital that Congress continue in its current path and facilitate deployment of next-generation broadband technology. I think Congress has already taken steps in that direction and in particular, we commend you for making available valuable spectrum through legislation over the last few years. Congress must continue to recognize that application services with a use for entertainment, public safety, business or health will continue to be the single largest driver of future broadband deployment.

I'm not going to through the list but the TIA has a number of governing principles that it has enunciated, including universal availability, but in regard to our assessment of high speed Internet services in the U.S., we believe it will be very useful for the Federal Government to create a set of metrics. This is both valuable to the public and to the service providers so we have transparency on the impacts of broadband, where it exists, where it doesn't, the quality of services, what the rate of penetration is, and what it is being used for. That kind of information, in fact, would allow people to make much more informed decisions on the way we do our investments. Second, we are asking the Federal Government to invest more of its research dollars in this critical area.

Before closing, I would like to share a number of examples where the impacts of this would really be profound on our citizens. In everyday life, devices with much simpler interfaces but at the same time, much more functionality, can be greatly adopted throughout our society. Everything from having a PC or a camera, HDTV, music players, things of that sort, without a button in sight. If I look at transportation, the deployment of communication networks, car-to-car communications, and car to roadside appliances, can cause a reduction in traffic accidents and deaths and again, a profound impact on our Nation.

If I look at our aging population, healthcare for the elderly, the ability to look after chronic diseases from diabetes to congestive heart failure, all of those kinds of things are made possible by the infrastructure that could be deployed. I would say last, new commercial systems can really propel the economy.

These are a few of the examples among many that correlate our Nation's next-generation communications infrastructure and its related services. New partnerships between industry and government are needed to meet tomorrow's challenges to position the United States as a leader in the world's economy. Let me thank you for this opportunity and in particular, let me thank Senator Inouye for his interest in funding future research in this vital area. Thank you.

[The prepared statement of Dr. Drobot follows:]

PREPARED STATEMENT OF DR. ADAM DROBOT, CHIEF TECHNOLOGY OFFICER AND PRESIDENT, ADVANCED TECHNOLOGY SOLUTIONS, TELCORDIA TECHNOLOGIES; ADVISOR TO THE BOARD, COMMUNICATIONS RESEARCH, TELECOMMUNICATIONS INDUSTRY ASSOCIATION

Thank you, Mr. Chairman, Ranking Member Stevens, and members of the Committee. I am appearing today as the Chief Technology Officer of Telcordia Technologies and an Advisor to the Board of the Telecommunications Industry Association (TIA).

I am grateful for the opportunity to appear before you today among this distinguished panel of witnesses to discuss the importance of communications technology and broadband deployment to the United States' competitiveness.

Communications technology is vital to the global economy, serving as its central nervous system, and broadband technology will be the foundation of 21st century global communications networks. Telecommunications, as an industry, represents about 7.1 percent of our gross domestic product and plays a fundamental role that touches all other industries, impacts the productivity of our industries and our economy, and pivotally affects public safety, education, health care, and countless other functions in our daily lives.

The advances we can expect are as profound and far-reaching as what we have experienced over the last quarter century—the explosive growth of the Internet, computers connected by high speed networks driving commerce around the world, the convenience of wireless mobility, and information services which are changing everything from how we spend our time to how we interact with our fellow citizens.

It is vital for the United States to maintain the leadership and future competitiveness in this critical industry—for the health, general welfare and defense of our population.

Communications and Broadband Deployment Incentives

Next-generation broadband communications capabilities are dependent upon incentives, removal of barriers, and experimentation with new business models for deployment. In the past several years, we have witnessed the demand for broadband and high-speed services fuel the revitalization and growth of telecommunications industry, as carriers invest in new fiber, new IP technology and new wireless infrastructure to provide state-of-the-art voice, video and data services. The U.S. market grew 9.3 percent in 2006 to total $923 billion in revenue, and the worldwide telecommunications market grew 11.2 percent to total $3 trillion, according to TIA's Market Review & Forecast.

We have seen technologies like broadband video, Voice over Internet protocol or VoIP, as well as new mobile data services, spark new growth in the telecommunications industry. As a result, cable, telcos, wireless, and others are offering more competitive all-in-one bundled packages, and consumers are seeing lower prices and more services.

Broadband video is one driving force behind deployment of the state-of-the-art fiber needed to carry the high-capacity signal; it allows telephone carriers to provide a competitive TV service comparable to cable TV. Demand for broadband has also been propelled by VoIP. The broadband-based phone technology is forecast to make up 34 percent of all U.S. residential landlines by 2010, or 25.5 million subscribers, up from just 10 percent and 9.5 million subscribers in 2006.

Beyond entertainment, the creation and sale of information and communications technology equipment creates thousands of jobs, fosters health care, education, financial services, transportation, and public safety. Important to TIA and its membership, next-generation communications capabilities will facilitate public safety communications and allow our Nation's first responders assist the public in times of emergencies. Technology plays a crucial role in the safety and security of our country.

The exploitation of technology in telecom is important because it has a day-to-day impact that improves productivity for individuals, government and corporations. For example, advancements in technology have led to the removal of economic barriers in the enterprise market. Advancements of technology accomplishes two things, it promotes creativity, and as we mentioned earlier drives the economy to improvements in productivity. In other words, there are new things that can be done, and old things can be done at a lower cost.

There was a point in time that for information and communications technology the U.S. was an undisputed source of ideas and their implementation. Increasingly, we are finding that the source of new ideas is as likely to come from Europe or Asia as it is from the United States.

A good example is SAP, a German-owned and operated company, which recognized early on that technology could improve day-to-day business. SAP created Enterprise Research Planning (ERP) systems, which perform accounting functions for large corporations around the world. With the proliferation and use of PCs and the Internet, SAP recognized that large centralized mainframes were not necessary and that it is possible to share data within large enterprises if one took advantage of the fundamental communications technologies that are available already. SAP perfected a system that allows data to travel wherever the user demands the information, using basic telecommunications capabilities available to ordinary users. SAP created a new way of doing business by taking advantage of the telecommunications infrastructure that already exists.

In the United States, we must focus on next-generation broadband services and capabilities, especially in the rural areas of our country where deployment is costly due to challenges associated with terrain, low population density, etc. Health care in rural areas are in demand, which will serve as an incentive to next-generation broadband deployment in those areas. The USDA has made progress through no interest loans, in order to spur broadband deployment for this purpose. We applaud this effort, and we believe that it serves as another example of how innovative products and services can stimulate deployment of next-generation broadband infrastructure.

We must work together to determine what is the proper balance between government involvement and incentives, and the hands-off approach which has proven successful in the last several years. We should first determine where broadband deployment has not occurred and why, so that we can identify incentives and eliminate barriers to moving forward.

Basic Long-Term Telecommunications Research

I now turn to the importance of long-term basic telecommunications research and the impact that it can have on next-generation communications capabilities. Other countries have discovered the importance of basic research early on, and they are now reaping the benefits. The Framework Programs in the European Union; national programs in Korea, Taiwan, Hong Kong, Singapore and Japan conducted through national laboratories and economic development authorities; and growing investments in China targeted at all aspects of communications. These programs are further accompanied by coordinated transitional activities which forge academic, national laboratory, and local industry partnerships aimed at native deployment and eventual domination in international markets. An example would be the deployment of "Wibro" in Korea—this is high speed Internet connectivity at speeds greater than 10 megabits per second for ubiquitous fixed and mobile wireless services based on the WiMax standards. A by-product of the early stage investment in innovation that these geographies have made is the deployment of next-generation systems significantly ahead of the United States.

Another technology that came out of Europe and is being deployed around the world is IPV6, which has been widely adopted by leading countries including the United States.

While the United States is still the single largest market for communications and has the most robust economy, we now fall far behind others in penetration of high-speed broadband, and we have not commercially brought next-generation services to the consumer. As a consequence, it is more than likely that the next wave of services and technologies will be developed where test beds and deployment of infrastructure will support experimentation of new concepts and ideas and where the human capital is concentrated—locations where business executives, scientists and engineers are familiar with the technology.

The experience from my own corporation confirms this. Telcordia, which traces its heritage to "Bell Labs" and which participated in the invention of much of modern communications, is the largest seller of Operations Support Systems to the telecommunications industry. To maintain our edge, we are finding it a necessity to rely on growth in foreign markets and are facing increasing foreign competition, which is advantaged by public spending in the local markets and long range government funding.

What Must Congress Do

First, do no harm. It is vital that Congress continue on its current path and facilitate deployment of next-generation broadband technology. And indeed, Congress has already taken steps in this direction. In particular, we commend you for making available valuable spectrum through legislation over the past few years. Congress must continue to recognize that applications and services—whether used for enter-

tainment, public safety, business, or healthcare—will continue to be the single-most driver of *future* broadband deployment.

TIA believes that public policies should foster a climate conducive to innovation and investment, avoiding overly-prescriptive regulatory regimes. The constant goal must be to achieve a market-based policy framework that fosters investment in network facilities and competition in the provision of converged, multimedia services and applications. TIA's key governing principles are as follows:

- Universally available, high quality, and affordable broadband connectivity
- Competition among existing and emerging platforms and providers
- Increased availability of unencumbered, prime spectrum in adequate blocks for commercial services
- Utilization of market-based mechanisms to drive spectrum to its highest and best uses
- Light-handed, narrowly focused regulation, where it is necessary
- Technology neutrality and flexibility
- Uniformity in regulation, where appropriate, including national rules wherever possible
- Elimination of regulatory barriers to investment

In regard to an assessment of high-speed Internet access service already available in the U.S., our industry would greatly benefit from an increase in accurate reporting that is monitored at the Federal level, based on metrics that are valuable to the public and the service providers. This would be a good first step in determining which parts of the country are most in need of access to broadband communications technology. We look forward to working with Congress to determine the next steps.

Second, we are asking that the Federal Government invest more of its research dollars in the critical area of basic telecommunications-specific research. Fierce competition and financial realities have made it difficult for U.S. industry to self-fund long-term, basic research, and because the U.S. Government is not devoting sufficient resources on long term communications research, the U.S. position in this vital area is waning.

I would like share some examples where the investments that we propose could impact the citizens of our great country:

- In everyday life—devices with much simpler interfaces, but at the same time, much more functionality with greater adoption in our society—Imagine a single device the size of your cell phone today, which is your PC, your camera, a projector, shows HDTV, plays music, is a portal to the Internet—without a button in sight?
- Reduction in traffic accidents and deaths—sensors on a car that could alert you to hazardous conditions, such as black ice, another vehicle in your blind spot when you are about to change lanes, a deer in the roadway, a washout in the highway, and the communications system that can convey warnings about such hazards to traffic behind you.
- Health care for the elderly—a handheld device that your grandmother has, which could diagnose and warn about medical problems, call for a nurse or a doctor's intervention, or improve quality of life by fostering the ties with a grandchild three time zones away through effortless, high-quality communications.
- New commercial systems—a slim and light portable device to securely purchase, receive, redeem, and store concert tickets, airline boarding passes, subway tickets, and conduct financial transactions from anywhere—without printing a thing?

These are only a few examples, among many, that correlate our Nation's next-generation communications infrastructure and its related services and applications to the economic growth of the United States and the world and the quality of life for all consumers. New partnerships between industry and government are needed to meet tomorrow's challenges and to maintain the competitive position of the United States in the communications industry.

Thank you again for the opportunity to appear before you today.

The CHAIRMAN. Thank you very much. Dr. Wolf?

STATEMENT OF DR. JACK KEIL WOLF, STEPHEN O. RICE PROFESSOR, UNIVERSITY OF CALIFORNIA AT SAN DIEGO; VICE PRESIDENT, TECHNOLOGY, QUALCOMM, INC.; MEMBER, COMMITTEE ON TELECOMMUNICATIONS RESEARCH AND DEVELOPMENT, NATIONAL RESEARCH COUNCIL, THE NATIONAL ACADEMIES

Dr. WOLF. Good morning, Mr. Chairman, Mr. Vice Chairman and Members of the Committee. My name is Jack Keil Wolf. I'm a Professor of Electrical and Computer Engineering at the University of California at San Diego and Vice President of Technology at QUALCOMM. I was a member of the Committee on Telecommunications Research and Development of the National Research Council that authored the report, "Renewing U.S. Telecommunications Research," which was issued in August 2006, on which you've asked me to testify.

The modern telecommunications infrastructure made possible by research performed over the last several decades is an essential element of the U.S. economy and society and it plays a vital role in U.S. national security and homeland defense. Yet, telecommunications is not a mature industry and major innovation and change, driven by research, can be expected.

Without making an expanded investment in research, however, the Nation's position as a leader is at risk. Strong competition is emerging from Asian and European countries that are making substantial investments in R&D. As many telecommunications products and services become commodities, continued U.S. telecommunications strength requires a focus on high value innovation that is made possible only through research.

However, as our report concluded, the U.S. position as a leader is at risk because of the recent decline in domestic support for long-term fundamental research. Prior to the restructuring of the telecommunications industry that began in 1984, the Bell Systems Research Labs played a vital role in U.S. telecommunications research and stable funding was provided through what amounted to a tax on the service revenues of the Bell operating companies.

Following the 1984 restructuring, industrial support for research has declined, become more short term in scope and become less stable. Because the benefits of much telecommunications research cannot be appropriated by individual firms, especially in today's much more competitive environment, public funding of such research appears necessary. However, Federal funding of long term research has not increased to cover the decline in industry's support. No systematic efforts such as took place for the semiconductor industry with SEMATECH have emerged.

The National Science Foundation and the Defense Advanced Research Projects Agency have been the two primary sources of Federal telecommunications R&D support. NSF, long a broad supporter of telecom R&D, is currently emphasizing new approaches to telecommunication through its Networking Technology and Systems program and its proposed Global Environment for Network Innovations experimental facility.

DARPA, which funded a number of important past communications advances, including elements of the Internet itself, has been generally shifting its emphasis toward more immediate military needs and giving less attention to long term telecommunications re-

search. Our report's recommendations reflect the view that a strong, effective telecommunications R&D program for the United States will require a greater role for government-sponsored and university research, together with more funding of long term research by industry.

In our first major recommendation, we aim to underscore the challenge with a bold recommendation that the Federal Government establish a new research program, which we call the Advanced Telecommunication Research Activity or ATRA, to stimulate and coordinate research across industry, academia and government.

In recommending ATRA, we recognize the challenges of coming up with new funds for telecommunications research and did not want to see enhanced Federal support for telecommunications research come only at the expense of other areas of science and engineering.

I am, however, hopeful that the present budget environment in which significantly increased investment in scientific research is being considered, offers opportunities for supporting additional research in telecommunications. For more on the broad case for investment in science and technology, I would refer you to the NRC's recent report, "Rising Above the Gathering Storm."

Even with the establishment of a national research program, NSF and DARPA would remain key contributors to U.S. telecommunication research efforts. Both have successful research management cultures that compliment each other and the activities envisioned for ATRA.

Our second major recommendation was that all segments of the U.S. telecommunications industry increase their support for fundamental research, such as through participation in joint, cooperative research activities organized by ATRA, which would provide industry with a way to pool funds, spread risk and share beneficial results.

Indeed, we recommended that industry should provide a significant fraction of ATRA's funding and observe that participation in ATRA's activities by both service providers and equipment vendors would be required to help identify the most critical research needs.

Mr. Chairman and Members of the Committee, our recommendations envision an enhanced and multifaceted role for government-sponsored and university research, an additional investment by the telecommunications industry that together would strengthen the Nation's telecommunications research institutions and programs, the telecommunications industry and infrastructure and our national security. Thank you. That concludes my comments. I would be happy to take any questions you may have.

[The prepared statement of Dr. Wolf follows:]

PREPARED STATEMENT OF JACK KEIL WOLF, STEPHEN O. RICE PROFESSOR, UNIVERSITY OF CALIFORNIA AT SAN DIEGO; VICE PRESIDENT, TECHNOLOGY, QUALCOMM, INC.; MEMBER, COMMITTEE ON TELECOMMUNICATIONS RESEARCH AND DEVELOPMENT, NATIONAL RESEARCH COUNCIL, THE NATIONAL ACADEMIES

Good morning, Mr. Chairman and Members of the Committee. My name is Jack Wolf. I am professor of electrical and computer engineering at the University of California at San Diego and Vice President, Technology at QUALCOMM. I served as a member of the Committee on Telecommunications Research and Development

of the National Research Council that authored the report *Renewing U.S. Telecommunications Research,* issued in August 2006, on which you have asked me to testify. This study was requested by the National Science Foundation.

The National Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology.

I will start with an overview of the study's key findings before turning to our recommendations.

The modern telecommunications infrastructure—made possible by research performed over the last several decades—is an essential element of the U.S. economy and society. Telecommunications research has yielded major direct benefits such as the Internet, radio frequency wireless communications for cellular systems and wireless local area networks (which have enabled modern mobile voice and data communications), optical networks (which have revolutionized communications by providing extraordinary communications bandwidths at very low unit cost), and Voice over IP (which provides voice communications with enhanced flexibility and efficiency). It has also had important spinoffs, from transistors to lasers to the UNIX computer operating system.

Telecommunications has expanded greatly over the past few decades from primarily landline telephone service to the use of fiber optic, cable, and wireless connections offering a wide range of voice, image, video, and data services. Yet it is not a mature industry, and major innovation and change—driven by research—can be expected for many years to come. Promising opportunities for future research include enhanced Internet architectures, more trustworthy networks, and adaptive and cognitive wireless networks.

As our report concluded, the U.S. position as a leader in telecommunications technology is at risk because of the recent decline in domestic support for long-term, fundamental telecommunications research. The risk is magnified by the long period of time—as much as a decade or even longer—that it can take to translate a fundamental discovery or big new idea into a commercial product or service or to educate and train a new researcher.

The recent fast pace of innovation, the array of new ideas to be pursued, and the substantial investment in telecommunications by other nations are all indications that telecommunications remains a high-value sector in which the United States should strive for continuing leadership. The importance of maintaining U.S. leadership is underscored by telecommunications' critical contribution to U.S. leadership in information technology in general, its important contribution to improving productivity in nearly all industries, and its role in national security and homeland defense.

Indeed, without a continuing focus on telecommunications R&D, the United States will increasingly be forced to purchase telecommunications technology and services from foreign sources. Risks include: (1) U.S. dependence on foreign sources of technology to meet critical defense needs; (2) loss of exclusive or early access to state-of-the-art communications technology; (3) loss of know-how to employ state-of-the-art technology; (4) opportunities for other nations to introduce security holes into equipment and networks; and (5) loss of technical capability for cyberdefense.

Strong competition is emerging from Asian and European countries that have identified telecommunications as a strategic area for economic development and that are making substantial investments in telecommunications R&D. Equipment vendors in a number of countries (such as China) now compete strongly with U.S. firms and have been very successful in emerging markets.

Telecommunications products and services generally have become commodities over time as multiple firms acquire the know-how to supply similar, competing products, and such competition has benefits in terms of lower prices for goods and services. To maintain leadership—or even a strong position—in telecommunications in the face of pressures from lower costs overseas for labor and other essentials requires that U.S. firms constantly focus on achieving high-value innovation as a foundation for developing new, non-commodity products and services.

For example, notable benefits have accrued to the United States as a result of its leadership in defining the Internet's design. However—by virtue of its very success—the existing Internet architecture has become difficult to change. Despite many potential avenues for significant improvements in areas ranging from security to real-time audio and video transmission, research and development has become largely incremental in nature. Moreover, the current architecture is largely a commodity, and firms from other nations will become increasingly able to deliver competitive products and services. Research aimed at defining future architectures

promises particular benefits because U.S. firms will be positioned to offer new kinds of services and not just incremental improvements to existing ones.

Sustaining a base of researchers and research institutions is critical to the long-term health of a research discipline. Without adequate research funding, it will be hard to attract new students to the field, retain foreign students in the United States, provide critically needed support for postdoctoral researchers, or attract and develop new faculty and industrial researchers.

Nevertheless, as the report notes, research support has fallen off in recent years. Prior to the restructuring of the telecommunications industry that began in 1984, the Bell System's research labs played a vital role in long-term, fundamental telecommunications research for the United States. Stable research funding was provided that amounted to a tax levied on the service revenues of the Bell operating companies. Post-restructuring, industrial support for such research has declined, become more short-term in scope, and become less stable.

It is notoriously difficult to compile definitive data on support for industry research and development, but the general shape of the situation became clear in testimony to the study group. Industry support for telecommunications research has decreased (as measured in dollars, numbers of researchers, and publications), and the work that is funded now has become increasingly short-term in focus—evolutionary rather than revolutionary—at a time when global competitors of the United States have placed a priority on long-term research in this area. Anecdotal reports indicate that basic research scientists in industry are being shifted to development work and that publication by industry researchers in telecommunications journals has decreased.

The diverse array of competing telecommunications firms—telephone, cable, Internet, and wireless that have emerged—have for the most part left research to equipment vendors, which have themselves increasingly focused on short-term goals. As a result, telecommunications research is increasingly being done at universities rather than industry, and outside rather than inside the United States.

Another consequence of changes in the industry structure with implications for innovation is that the diversity of players in today's telecommunications industry makes it more difficult to design and deploy major, end-to-end innovations. Multiple visions are now being pursued by various segments of the telecommunications industry, and although an increased diversity of players provides more fertile ground for new ideas, it also makes widespread deployment of good ideas more difficult. Moreover, no single entity is able to appropriate the results of long-term, fundamental research or to comprehensively address the engineering and standardization issues associated with end-to-end solutions that must span multiple service providers and multiple sectors of the industry. As a result, vendors tend to favor incremental improvements to today's networks over more fundamental and high-risk research that seeks major advances in new or enhanced end-to-end applications and services and the architectural innovation that supports them.

The National Science Foundation and the Defense Advanced Research Projects Agency have been the two primary sources of Federal telecommunications R&D support. NSF, long a supporter of telecommunications R&D spanning a range of topics, is currently emphasizing new approaches through such efforts as the Networking Technology and Systems (NeTS) program and the Global Environment for Network Innovations (GENI) experimental facility being planned by NSF in collaboration with the research community. DARPA, which funded a number of important telecommunications advances in the past (including elements of the Internet itself), has been generally shifting its emphasis toward more immediate military needs and giving less attention to long-term telecommunications research.

Despite these significant investments over the years, Federal funding of long-term research did not increase sufficiently to compensate for the decline in industry support for long-term research. Because of the Bell System's ability to fund and conduct so much research in-house the Federal Government historically did not emphasize support for academic research in telecommunications and university researchers themselves tended to concentrate on research areas more amenable to work by individual investigators or small research groups, such as semiconductors, communications theory, and signal processing, leaving to industry research related to the design and operation of large-scale communications networks. Notable exceptions to this pattern, such as computer networking research supported by the Defense Advanced Research Projects Agency and National Science Foundation (which led to the Internet), illustrate the enormous potential payoff from government-supported and university-based research on new architectural ideas.

Long-term concerns similar to those now faced in the telecommunications sector prompted the establishment of research organizations for the semiconductor and power industries, with the implicit or explicit participation of government. Indeed,

the current situation in telecommunications is somewhat analogous to the crisis faced by the U.S. semiconductor industry in the 1980s when international competition and decreased R&D funding threatened that industry's long-term viability. In response, the Semiconductor Research Corporation and SEMATECH were formed. Their work is widely credited with having played an important role in the recovery, renewed leadership, and long-term viability of the U.S. semiconductor industry. Notably, there have been no parallel systematic efforts—either government- or industry-led—for telecommunications.

I will now turn to the Committee's key recommendations.

Our report's first major recommendation reflected the view that a strong, effective telecommunications R&D program for the United States will require a greater role for government-sponsored and university research, and more funding of long-term research by industry. To underscore the seriousness with which the study committee viewed the challenge, we made a bold recommendation, that the Federal Government establish a new research program with the objective of stimulating and coordinating research across industry, academia, and government. This proposed research program, called the Advanced Telecommunications Research Activity (ATRA) , was envisioned as a hybrid of activities of the sort historically associated with DARPA (which through the ARPANET program managed a research portfolio, developed a vision, and convened industry and academia to build what would become the Internet) and SEMATECH (which brought the semiconductor industry together, initially with some Federal support to complement industry dollars, to fund joint research, development, and road mapping activities).

ATRA's mission would be to: (1) identify, coordinate, and fund telecommunications R&D, (2) foster major architectural advances, and (3) strengthen the U.S. telecommunications research capability. Key suggested steps for implementing ATRA are: (1) establishment of mechanisms for carrying out project-based research; (2) establishment of advisory committees with high-level industry participation; (3) exploration of the need for R&D centers; and (4) establishment of a forum for key parties to discuss critical technology development issues.

Our report urged that telecommunications research funding should be consistent with the vital role played by telecommunications in the U.S. economy and society and with the direct contributions made by the U.S. telecommunications industry to the Nation's economy and security. The study committee recognized, however, that budgets are often a zero sum game, and that a bold proposal of this sort would have been quite difficult to implement in the budget environment at the time its report came out. Moreover, we were not charged with making budgetary recommendations nor examining tradeoffs between research needs in telecommunications and other areas of science and technology research—nor did we in any case believe that increased investment in telecommunications research should come at the expense of other areas of scientific or engineering research. But our report points to telecommunications research as an area where investment is critical.

For more on the broad case for investment in science and technology, I would refer you to the National Research Council's recent report *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.* I am hopeful that the present budget environment, in which significantly increased investment in scientific research is being contemplated, offers new opportunities for supporting an initiative in telecommunications.

As for where within the Federal Government the ATRA program could fit, there are multiple options, each with its own set of tradeoffs, and our report provides several of these. For example, ATRA's proposed mission would align with that of existing agencies within the Department of Commerce, and NSF has developed mechanisms for joint academic-industry engineering research, albeit more focused and on a smaller scale.

Even with the establishment of an ATRA research program, NSF and DARPA would remain key contributors to U.S. telecommunications research efforts. Both have successful research management cultures that complement each other and the activities envisioned for ATRA. NSF has significant strengths in supporting basic research, training researchers, and building research communities that can play an important role in strengthening the U.S. research base in telecommunications. NSF's commitment to supporting research in this area has been evident, and NSF has a number of opportunities for sustaining such attention, including making efforts to attract and develop young research talent in telecommunications. DARPA is well known for a culture of focused programs with active program management and significant industry participation. In considering investments in telecommunications research, DARPA should consider the telecommunications capabilities attainable by potential U.S. adversaries by virtue of the burgeoning commercial telecommunications sector overseas and the risks associated with the United States

having to rely on communications components and systems that are increasingly being developed overseas.

Second, the report also recommends that all segments of the U.S. telecommunications industry increase their support for fundamental research, possibly taking advantage of the avenue provided by participation in joint, cooperative research activities organized by ATRA. Indeed, the Committee recommended that industry should provide a significant fraction of total R&D funding for ATRA, which would support researchers from academia and industry and provide industry with a way to pool funds, spread risk, and share beneficial results.

Moreover, effective expansion of Federal support of telecommunications research through ATRA will require participation from both service providers and equipment vendors to help identify the most critical research needs together with complementary industry investments in research. ATRA can play an important role in facilitating mechanisms to enable service providers to pool research support.

Mr. Chairman and members of the Committee, our report contemplates a multifaceted, reinvigorated telecommunications research program. Our recommendations envision an enhanced and multifaceted role for government-sponsored and university research in telecommunications as well as additional investment by the telecommunications industry in more work of a fundamentally high-risk character, and thus a strengthening of the Nation's telecommunications research institutions and programs, industry, and infrastructure.

You can find more information about these and related studies on the website of the Computer Science and Telecommunications Board of the National Research Council at *http://www.cstb.org*.

Thank you. That concludes my comments. I would be happy to take any questions you may have.

The CHAIRMAN. Thank you very much, Dr. Wolf and may I now recognize Dr. Wallsten.

STATEMENT OF SCOTT WALLSTEN, PH.D., SENIOR FELLOW AND DIRECTOR, COMMUNICATIONS POLICY STUDIES, THE PROGRESS & FREEDOM FOUNDATION

Dr. WALLSTEN. Thank you very much. Mr. Chairman and members of the Committee, thank you for inviting me here and giving me the opportunity to testify today.

My name is Scott Wallsten. I'm a Senior Fellow and Director of Communications Policy Studies at the Progress and Freedom Foundation as well as a lecturer for Stanford University.

Notwithstanding the international rankings, the evidence indicates that the U.S. does not have a broadband problem. The remarkable investment in broadband infrastructure and rapid increases in subscribership suggest the market is working well. Any policy or regulation intended to further accelerate deployment should clearly identify and target the market failure it is intended to mitigate.

Meanwhile, government can continue to remove arbitrary barriers to competitive entry by, for example, continuing to make more spectrum available for today's high value uses.

The relatively low position of the United States in international broadband rankings creates consternation every time new numbers are released. These rankings, however, provide little real information. Part of the problem is that it is difficult to evaluate the rankings themselves because the OECD and the ITU do not explain how they derive their estimates.

More importantly, many factors differ across countries that affect both the cost of supplying broadband, such as population density and existing infrastructure, and the demand for broadband, such as

the ability or inability to subscribe to television services over broadband lines.

Rather than worry about rankings *per se,* it is more useful to ask whether any market failures or other obstacles hinder broadband investment, competition and adoption by consumers.

The evidence shows tremendous investment in broadband infrastructure. According to the FCC's latest data, in the first 6 months of 2006 alone, the number of broadband connections increased by 26 percent to a total of more than 60 million high speed connections. Moreover, this impressive number masks the emergence of new delivery methods and hence, enhanced competition. The latest statistics show the importance of mobile wireless, a category incidentally, that the OECD does not count.

More than 15 percent of all connections were wireless in June 2006, a figure no doubt even higher today. In addition, broadband providers like Verizon and AT&T are rapidly deploying fiber optic networks. More than 1.3 million homes are now connected to those networks and fiber is available to about 8 million homes, twice the number of only a year ago.

These are especially welcome developments given that the empirical economic research shows the importance of platform competition to spurring investment. Indeed, cable companies, which provide the largest number of broadband connections, are not sitting idly by. They are expected to invest about $15 billion this year to upgrade their IP networks.

Overall, North American telecom service providers put about $70 billion into capital expenditures in 2006 and this number is expected to increase over the next several years.

Wireless competition is poised to become even more vigorous. The recently completed AWS auction put more spectrum in the hands of firms wanting to provide high speed wireless services. T-Mobile, for example, acquired enough spectrum to build out a 3G service to compete with Verizon, AT&T and Sprint/Nextel. The upcoming auction for spectrum in the 700 megahertz band promises to bring even more options for wireless broadband access.

Congress could further stimulate wireless broadband competition by continuing to move inefficiently used spectrum into the market so that it can migrate easily to higher valued uses.

Given the large amount of investment and stunningly fast technological change, it is not obvious that there are market failures to correct. However, the quality of the available data is low so it is difficult to get a solid grasp of this market.

While some groups, like ConnectKentucky, in particular, have made remarkable strides in assembling useful data, the data problem has no simple solution. It is easy to criticize existing information but it is not easy to know what data to collect, how frequently to collect it and how often to reconsider what information remains relevant in an industry exhibiting such rapid change.

For example, the FCC currently reports how many broadband providers are in each Zip Code. These data are rightly criticized as flawed since a firm serving even only one customer in a Zip Code is counted as a broadband provider, possibly exaggerating the extent of competition.

But what is the right geographic level of analysis? A census block? The number of broadband access choices available to each household? How would one measure the availability of wireless broadband? How we should we go about measuring bandwidth to consumer?

Well, one might be tempted to demand as much information as possible at as a detailed level as possible but it is important to remember that data collection is costly, both for the firms that must report it and for the agencies that must collect and process it. The more detailed the data, the more costly they are likely to be. Any new data requirements should take into account both the costs of acquiring that data and the benefits we expect to obtain from having it.

Nevertheless, FCC data collection is due for an overhaul. The FCC still requires telecom firms to report data once used for rate regulation but they no longer perform any particular regulatory purpose. It is conceivable that both the FCC and the reporting firms would be amendable to dispensing with some of the current data requirements that were intended for regulation in another era, in exchange for more useful and perhaps less burdensome data that would better inform decisions in today's digital world.

To conclude, let me reiterate that the key issue in making broadband policy is not our rank in the world but whether we can identify particular market failures or artificial barriers suppressing broadband investment and adoption and whether any policy interventions are likely to yield net benefits. The rapid growth of broadband implies no market failure. Some policies are likely to yield unambiguous benefits such as moving inefficiently used spectrum to higher valued uses. The effects of other proposals are less clear. Precisely because the Internet is so important, it is vital that Congress be cautious and consider carefully any interventions in this fast changing industry to ensure that it does not unintentionally reduce incentives to invest in the very infrastructure we all believe is so important. Thank you very much.

[The prepared statement of Dr. Wallsten follows:]

PREPARED STATEMENT OF SCOTT WALLSTEN, PH.D., SENIOR FELLOW AND DIRECTOR, COMMUNICATIONS POLICY STUDIES, THE PROGRESS & FREEDOM FOUNDATION

Mr. Chairman and Members of the Committee, thank you for inviting me here and giving me the opportunity to testify today. My name is Scott Wallsten. I am a senior fellow and director of communications policy studies at The Progress & Freedom Foundation as well as a lecturer for Stanford University.

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The relatively low position of the United States in international broadband rankings creates consternation every time new numbers are released. These rankings, however, provide little real information. Part of the problem is that it is difficult to evaluate the rankings themselves because the OECD and ITU do not explain how they derive their estimates. More importantly, many factors differ across countries that affect both the costs of supplying broadband—such as population density—and the demand for broadband—such as the ability or inability to subscribe to television services over broadband lines.

Rather than worry about rankings, *per se*, it is more useful to ask whether any market failures or other obstacles hinder broadband investment, competition, and adoption by consumers.

The evidence shows tremendous investment in broadband infrastructure. According to the FCC's latest data, in the first 6 months of 2006 alone the number of broadband connections increased by 26 percent, to a total of more than 60 million high-speed connections.

Moreover, this impressive number masks the emergence of new delivery methods and hence, enhanced competition. The latest statistics show the new importance of wireless. More than 15 percent of all connections were wireless in June 2006—a figure no doubt even higher today.

In addition, broadband providers like Verizon and AT&T are rapidly deploying fiber optic networks. More than 1.3 million homes are now connected to those networks, and fiber is available to about 8 million homes.[1]

These are especially welcome developments given that the empirical economics research shows the importance of platform competition to spurring investment.

Indeed, cable companies, which provide the largest number of broadband connections, are not sitting idly by. They are expected to invest about $15 billion this year to upgrade their IP networks. Overall, North American telecom service providers put about $70 billion into capital expenditures in 2006, and this number is expected to increase over the next several years.[2]

Wireless competition is poised to become even more vigorous. The recently-completed AWS auction put more spectrum in the hands of firms wanting to provide high-speed wireless services. T-Mobile, for example, acquired enough spectrum to build out a 3G service to compete with Verizon, AT&T, and Sprint/Nextel.

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Congress could further stimulate wireless broadband competition by continuing to move inefficiently-used spectrum into the market so that it can migrate easily to higher-valued uses.

Given the large amount of investment, rapid adoption, and stunningly fast technological change, it is not obvious that there are market failures to correct. However, the quality of the available data is low, so it is difficult to get a solid grasp of this market.

While some groups like ConnectKentucky have made remarkable strides in assembling useful data, the data problem has no simple solution. It is easy to criticize existing information, but it is not easy to know what data to collect, how frequently to collect them, and how often to reconsider what information remains relevant in an industry exhibiting such rapid change. For example, the FCC currently reports how many broadband providers are in each Zip Code. These data are rightly criticized as flawed since a firm serving even only one customer in a Zip Code is counted as a broadband provider, possibly exaggerating the extent of competition. But what is the right geographic level of analysis? A census block? The number of broadband access choices available to each household? How would one measure the availability of wireless broadband? How should we go about measuring available bandwidth to consumers?

While one might be tempted to demand as much information as possible at as detailed a level as possible, it is important to remember that data collection is costly both for firms that must report it and for the agencies that must collect and process it. The more detailed the data, the more costly they are likely to be. Any new data requirements should take into account both the costs of acquiring that data and the benefits we expect to obtain from having it.

Nevertheless, FCC data collection is due for an overhaul. The FCC still requires telecom firms to report data once used for rate regulation but that no longer inform any particular regulatory purpose. It is conceivable that both the FCC and the reporting firms would be amenable to dispensing with some of the current data requirements that were intended for regulation in another era in exchange for more useful and perhaps less burdensome data that would better inform decisions in today's digital world.

To conclude, let me reiterate that the key issue in making broadband policy is not our rank in the world, but whether we can identify particular market failures or artificial barriers suppressing broadband investment and adoption and whether any policy interventions are likely to yield net benefits. The rapid growth of broadband contradicts the presence of an obvious market failure. Some policies are likely to

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[1] *http://telephonyonline.com/home/news/ftth-household-connections-041707/.*

[2] *http://www.infonetics.com/resources/purple.shtml?msna07.cpx.2h06.nr.shtml.*

yield unambiguous benefits, such as moving inefficiently-used spectrum to higher-valued uses. The impacts of other proposals are less clear.

And precisely because the Internet is so important, Congress should be cautious and consider very carefully any interventions in this fast-changing industry to ensure that it does not unintentionally reduce incentives to invest in the very infrastructure we all believe is so important.

Thank you.

The CHAIRMAN. Thank you very much. Senator Klobuchar?

STATEMENT OF HON. AMY KLOBUCHAR, U.S. SENATOR FROM MINNESOTA

Senator KLOBUCHAR. Thank you. Thank you to our panelists and I just wanted to first follow up with what you were talking about, Dr. Wallsten, with trying to connect and get the information that we have. I, too, have struggled with this as I've seen some statistics in our own state and then I talk to some of our smaller, local telephone companies and they assure me they are offering broadband and competing. You correctly laid out the problem with the data collection, including the FCC issues, where they're just doing it by Zip Code and so that leads one to believe that it might be an exaggerated number.

But you laid everything out on how it would be inefficient to require too much data collection. What you didn't answer is what you think would be best for collection data so that we could best measure our broadband penetration.

Dr. WALLSTEN. Well, I have some conflicting interests, I guess, because as a researcher, I'd like to have as much as possible. I'm always interested in more data. But I don't think the policy answer is obvious. I mean, in the first panel, we heard several different opinions about what the right approach should be. There was one suggestion for block-by-block analysis, another suggestion for using geographic information systems. ConnectKentucky has adopted a particular model that may actually end up serving as the model for everyone else and I think that they are really hard questions to answer.

So far, I believe that the comments have been mostly along the lines of criticizing what the FCC has done and those criticisms are certainly justified, even though people at the FCC are certainly aware of them. I don't think there has been a lot of thought yet as to what exactly the right information is that we want. I think a good question is what problem do we see or what problem do we think we see and how would we actually measure whether that problem exists and what sort of things would we be looking for to decide whether particular policies mitigate that problem.

Senator KLOBUCHAR. Your testimony also was critical of other ideas but I what I was trying to get at, and maybe you can provide it to me later, is just your idea of how we best collect this data. It just seems to me in other areas of the economy, we're able to measure how many people use phone lines and how many people go on airplanes, that we should be able to figure out how we want to measure this because as we're making major decisions about broadband investment, it would be good to get ideas, as you said, and not just criticisms.

Dr. WALLSTEN. Well, you're asking somebody who can't keep a waterfall. But no, it's an important question but I think the type

of data we want has to be driven by the particular questions we want to answer and I'm not sure yet that there is actual agreement on that. With technological change, the things that we want to measure, it seems to keep changing. And these are difficult questions to answer and I don't have the answer.

Senator KLOBUCHAR. OK. Dr. Wolf, you made this comparison to the semiconductor industry in the 1980s. I was in college then, not quite following the semiconductor industry in the 1980s. You talked about how that industry rebounded with a focus. Could you tell me the story of what happened there and how you think it is relevant to the situation we're in now, trying to compete internationally?

Dr. WOLF. I'm not sure I know the complete story but basically, in the 1980s, there was the fear that we were losing our expertise in semiconductors and that the industry was going to move overseas. So there were several efforts that were made but one was SEMATECH and basically, the U.S. Government put money into it and companies partnered in it and eventually, the government funding was weaned and they found a way where the companies could work together on a pre-competitive basis, and do research that benefited all, I'll jump to the end of the story. The end of the story was that the U.S. semiconductor industry recovered nicely. There's been some criticisms of SEMATECH. This is something we could learn from. On the other hand, the SEMATECH model, I think, is a good one.

Let me, if I could, deviate a little from your question. Let me explain why the communications field is so poorly funded by the U.S. Government. The fact is that back before divestiture, there wasn't a great need for the government to fund communications. There was Bell Labs, which at that point was spending $500 million a year on R&D. When I was a young professor, I spent a year at Bell Labs, essentially learning how to do research in telecommunications. Thus Bell Labs trained our educators, it trained our researchers, and played many other roles.

At no point after divestiture did the U.S. feel or see a need to jump in and say, okay, there is this gap. I believe we are suffering from this now and we're going to suffer from it a great deal more unless we do something about it.

Senator KLOBUCHAR. Dr. Drobot, you wanted to comment?

Dr. DROBOT. Let me actually—I had a couple of things. I actually run an organization that came from Bell Labs and in fact, was created in 1985 as part of the divestiture. It had two charters to look after the reliability and security of the U.S. communication plant and part of that organization was the researchers that then went on to support the Baby Bells, the ARBACs until the Communications Act of 1996, essentially.

Indeed, the funding for all of this came from tax collections, went on to the researchers and there were a couple of things that happened. I'd say the first one is that we were trusted enough to deal with the real communications system, the real data and the real hard problems.

One of the things that you find in the Internet age is you can go through and do what people call plug and play. I go and connect to things and I can show—hey, I can get a video signal from here

to there. It is a very different thing from saying you can get a video signal from here to there, do it twice in a row in the same way so there is consistency and number three, deploy it at large scale so it is economically feasible. Because a lot of the research was not about the glossy functional things that we find at the surface, it was the ugly things under the covers that gave you reliability, that made the system recover in a short period of time, that drove a high degree of automation that in fact, ended up driving down the economic barriers, which made this useful universally, essentially. This is what is missing today.

I think when you look at it, you see this in the marketplace and I'll start off with the following. You look at video on demand, video services, things of that sort. I have now seen five waves of deployment of video. The first one was, I can show that a place, I put a business together and I find I really can't afford to deploy this at large scale. Second, the same thing. Technology not quite ready.

Today when you ask me what are important metrics in this business, I can tell you some and they are very relevant. When you do telephony, video services, anything that is critical, I'd like to know what latencies are there in the communications plan? How can I measure them? How can I make that stuff available? Because if we can't deal with it, this stuff will not work at large scale, essentially.

Do you want to experiment and build out a national system that you tear down a few years later because there is no money for that investment? I think that kind of clarity, being able to develop that kind of data really does have tremendous value.

The next thing, I take a look at events such as Katrina. There are parts of our communications system that failed. If I'm going to go through and run voice services over IP, I need to be able to run the things that are critical for us, like 9-1-1, calls for help, things of that sort, and make sure that system is available when other things go down. It's the underpinnings of our infrastructure. If the communications system goes down and the power system goes down, you cannot bring the power system up without the availability of communications. Those kinds of ties exist in our society today.

Same is true of banking, ATM machines. You just went through something like Katrina. You want to go to the bank because you have to go somewhere else—those ATM systems are down and not functioning, essentially.

So there is a tremendous amount of stuff that has to be done and I want to come back to the question you actually asked with SEMATECH. What SEMATECH did for the semiconductor industry, is it created roadmaps. It created the common bases on which that industry could build some infrastructure that could be shared by all and competed on things that mattered. The design of the chips, the way the costs could be brought down essentially, the fundamental things that would have to be there for the next generation of chips to be able to go to higher speeds. Everybody benefited as a consequence.

While the manufacturing may have gone overseas, the intellectual property, the fundamental designs, those things stayed in the United States, essentially. I think the same is true of telecommunications if the right investments are made.

Dr. WALLSTEN. Could I make an additional comment?

Senator KLOBUCHAR. Sure.

Dr. WALLSTEN. The first point is we just heard another possible piece of data that should be collected and I think, that sort of illustrates why it is going to be hard to answer the problem because everybody points to another piece of information that should be collected and I'm not saying it's not important. It just points to how difficult it is to figure it out.

I've also done a fair amount of work on science technology policy and the question of how to spend funds on research is an important one. Research demonstrates this classic market failure that the returns can be appropriated by other people than just the investor. The old AT&T was able to get around that by being a monopolist and it could fund Bell Labs as a result and as a country, we benefited from that particular part of the monopoly. We certainly don't want to go back to those days, however, and the question is how to sort of recapture some of that.

In going forward with something like that, it's important to think in advance how you might want to measure whether such a program is successful. SEMATECH was controversial. Some of the economics research shows that SEMATECH mostly just crowded out private sector spending and wasn't successful.

There are other opinions on this, obviously and so you want to ensure, for example that when you try to evaluate whether such an approach is successful, it's not just whether it funds something that ultimately succeeds in the market because then you could just fund things that would succeed anyway. So it's hard to figure out whether you're funding something on the margin.

We've seen other programs like this that weren't successful at all. The partnership for a new generation of vehicles, we might remember that. It was a federally funded program meant to develop, I think, 100 mile per gallon car and while we were sort of playing around with that for years, we didn't develop hybrid cars.

So there are lots of examples of these kinds of research programs that need to be thought about very carefully in advance to make sure that what we're measuring is really what you want to achieve in the end and that might include, for example, funding a lot of failures, too, because people have to be able to work on something and have it not succeed. But failed programs often are not something that are politically sustainable.

Those are some things to think about if implementing this sort of program.

Senator KLOBUCHAR. So when we're not in the monopoly environment anymore, how would you suggest we do it? The funding?

Dr. WALLSTEN. Well, I haven't looked at the specific funding of research in telecom so I don't want to comment on that. I just think these principles are important to keep in mind and there are other tools as well. For example, antitrust policy has taken an increasingly lenient view toward research joint ventures, for example, starting in 1984 with the National Cooperative Research and Production Act and extending, being looser and looser until in 2004, they passed the Standards Development Organization and Advancement Act, which basically makes it easier for firms to cooperate on standards without worry of being prosecuted for antitrust

violations. There are plenty of tools to use to try to help move these interests along.

Senator KLOBUCHAR. Mr. Chairman, thank you for allowing me to go on.

The CHAIRMAN. Thank you. Eleven years ago when we completed the drafting of the Telecommunications Act of 1996, we were amazed with the broad scope of communications and I must say that we are rather proud of ourselves. Now, Dr. Drobot, you spoke of the Internet age. If my recollection is correct, the Telecommunications Act of 1996 uses the word Internet twice. We really had no idea what it was. We had a very vague idea of the potential of broadband. The thing that amazes me today as I look back to that time, we looked upon the breakup of AT&T in 1984 with the political eye. Monopolies should be broken up but then we began to realize in recent years that with the breakup, we also broke up the Bell Labs, the one thing that made America foremost in this area because they did research on a long-term basis. They did basic research and today, research is done for product and for selling and for the bottom line.

Now I'm glad all of you are here to testify but what we'd like to know is, what can we do first, simply put, to make up for the lack of a Bell Lab? How should we go about increasing our activity in research? Because obviously from what we've heard about basic research, we're going to stay where we are. And the numbers indicate that we are no longer the way we were 15 years ago or 20 years ago. So what do you suggest?

Dr. DROBOT. I'd say a couple of things on this. The first one is, when you look at Bell Labs, while there were a tremendous amount of things that came out of it, at the heart of it, it really was driven by telecommunications. The applications were in telecommunications. So you had a driver that forced you to think along a certain path.

The second thing, as Dr. Wolf said, is there was ample funding and it was long term. I think it is very important and I have to say, I don't know any other way of doing it, but encouraging a part of our population, starting at the kindergarten level, to be participants in this, to look forward to a career, I would say, in science as much as they would to a career in the arts, in law or some other endeavor. I don't see many television shows that feature a scientist in something like *L.A. Law,* where thousands or millions of people think of this as their future. I think that's important.

You mentioned earlier that 40 percent of the PhDs granted in the United States are actually not U.S. citizens. I can tell you when I look at two fields, which are sort of fundamental for telecommunications, electrical engineering and computer science, we did a survey of that recently and we found that at the undergraduate level, this country produces roughly 50,000 graduates each year. Ninety percent plus of those tend to be U.S. citizens. At the Doctorate level, it's roughly 5,000. Of those, something like 67 percent are non-U.S. citizens. So I look at it from one point of view. It's a great export for us as a country. I look at it from another point of view and say it is fairly sad that we cannot attract people to enter these exciting fields from the best and brightest in our society.

So I would say there would have to be some economic incentives—money for education and I would say money for research that is plentiful, that drives people to these disciplines and funds them well so they have careers in the future and don't experience the ups and downs that they have seen over the last 15 or 20 years, essentially. I think that's important.

I would say the next item is that in this kind of research, you do have to have access to real things. The partnership with industry has to be deep. Again, as Dr. Wolf said and I've heard this from a lot of my academic colleagues, they say, we don't know who to interact with in industry.

There isn't a place to go in the summer where you spend time with the telephone company and get to see the nitty gritty of what's actually going on. This is where you contribute your ideas. Again, who funds it? What is the mechanism? It's hard for me to tell. But I find at a corporate level, it's very hard when you are under pressure from Wall Street for the next quarter for the bottom line to actually supply those funds. This is where the public/private partnership makes a tremendous difference, essentially.

I would say last, when I look at things like USAC, I can think of some small portion of it saying this is what we do to renew the future, essentially. I think all of those are things that should be examined. I don't a see monolithic solution. I think there has to be some experimentation that is done. But having places that have the critical mass, that are focused on a problem, I think are much more likely to see the results. Thank you.

The CHAIRMAN. Dr. Wolf?

Dr. WOLF. Thank you, Mr. Chairman. In answer to the question of what should be done; our Committee did make a recommendation about an ATRA program.

Let me give you numbers as to what other countries are doing now. The European Union's Sixth Framework program funds telecommunications at about $300 million a year, U.S. Japan's National Institute of Information and Communications Technology has an almost entirely government funded budget over $500 million a year. I believe the government has to step in at this point, if something is going to be done. The only research that is being conducted now in telecommunications, outside of the universities is very, very short timeframe research and it's being done mainly by the equipment manufacturers. To the best of my knowledge, the service providers aren't doing any research at all.

As far as university research in telecommunications, as I said, the money has come in the past from NSF and DARPA. NSF has a Directorate of Computers and Information Science and Engineering (CISE) and it has a reasonable budget.

But the amount of research that is being funded in telecommunications is a very small percentage of the budget of that division. If you look at the number of proposals that are being funded by NSF, in telecommunications the success rate is very low. That means that the vast majority of the proposals are not being funded. There may be some poor ones but I can't believe it is anywhere near the number of rejected proposals.

If the U.S. Government does not pick up the slack I don't know who else will.

Dr. WALLSTEN. That's not my particular area of expertise. I'll try not to say too much. But I guess I would want to know then what the right share of PhDs should go to Americans if we think that the current number is too low. I just don't know. I mean, as Dr. Drobot said, it's good that people come here and get PhDs. I don't know what the right number is. The fact that other countries have government funding of a particular kind of research, again by itself, doesn't say that we should. We should look at the effectiveness of their programs and I know that there are big debates about the effectiveness of government funded research aimed at markets because it is so hard to figure out what exactly it is you want to measure. That's true of our Small Business Integration Research Program, the Advanced Technology Program, several similar programs around the world and it still remains controversial. I'm not going to speak to whether or not we need something like that here but we should consider carefully the evidence around the world to the effectiveness of their programs. That's all I would say.

Dr. DROBOT. Senator Inouye, let me just add one item. We actually polled the CTOs of our organizations and the TIA last year produced a White Paper that did two things. A, it pointed out the areas in which investment should be made. It pointed out the institutions that are most likely to handle these programs and they included, in fact, DARPA and DOD, NSF, National Institute of Standards and DOE as the organizations that have the infrastructure to conduct the research.

Then we also put in a section that looked at how this should be governed and the belief that you should put together some kind of a national board that has representation from industry, academia, and in fact, the Federal Government but focused on this particular problem.

I would say there is one element that is probably worthwhile sort of picking up on. You mentioned that in the Telecommunications Act the Internet was mentioned twice. A lot of what it was about wasn't anticipated. Look at technology and sort of the underlying goods from which we build the Internet and from which we build telecommunications. I'd put computing in there, storage of information, the interfaces that we use, the software that binds everything together and the ability to transmit stuff at various speeds, whether it's wireless, whether it's over fiber. All of those technologies amazingly are on exponential curves today. They follow a Moore's Law. They double every one to two years in terms of what you can expect. As far as we see technically, this will be true for the next 10 to 15 years. The roadmaps are there.

I think what is not appreciated is that as the cost of goods come down, the kind of services you can provide are also likely to grow exponentially, if there are no barriers to the deployment of those services. In economic terms, what's happening is that the transaction costs for the services have come down very significantly and will continue to do so. So you can anticipate even more than the Internet as the next round.

The CHAIRMAN. I wish I could continue this discussion for a while longer but I've just been notified there is a vote pending. You should realize that we politicians are usually much more sensitive to people's needs. For example, in this area, under the guidance of

Senator Stevens, we developed the Universal Service Fund to take care of the folks in the rural areas, in the millions. But we have done very little in the other areas where we don't have much pressure or activity like research. It has to emanate from the government itself, like the Defense Department saying, we need more research money.

Senator Stevens and I are convinced that we have to do something about this because if we do business as we've been doing it for the past few years, we're not going to get anywhere. So if I may, will you share with me your ideas of what can be done to fund research? Should it be something with a new agency or should it be a group with a board or should we just go through the process of providing monies to DARPA and providing monies to DOE and such?

Dr. DROBOT. My own feeling is, I think you should have something like a board that focuses on this area and spend as little of that money building yet another bureaucracy and another infrastructure.

The CHAIRMAN. So can you share those thoughts with us? We'll be submitting questions for the record.

And with that, the hearing stands adjourned.

[Whereupon, at 12:24 p.m., the hearing was adjourned.]

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