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NET NEUTRALITY

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

FEBRUARY 7, 2006

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

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NET NEUTRALITY

TUESDAY, FEBRUARY 7, 2006

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

The Committee met, pursuant to notice, at 10 a.m. in room SD–562, Dirksen Senate Office Building, Hon. Ted Stevens, Chairman of the Committee, presiding.

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

The CHAIRMAN. We apologize for the room. We tried to get a larger room for the hearing, but it's just not possible today. We will try, for the other hearing.

I've had a letter from some of our colleagues about urging us to move forward on the legislation on communications. We're going to finish our hearings first. We've got another nine hearings, I believe, nine more after today? Nine? I think it's nine. And we published that schedule, we're going to go through it. And when it's finished, we'll start marking up the bills.

This hearing on Internet neutrality is one of the most difficult, but most important, issues before this Committee as we consider revisions to the Nation's communications laws. How we decide the issue will determine whether cable companies—the Bells, the local telephone companies, others—can generate the revenue needed to justify billions of dollars in investment to deploy fiber and upgrade existing broadband networks. We will also determine whether the Internet remains a free marketplace of ideas with no gatekeeper, and free of interference from regulation.

As new services, particularly video, stretch the limits of today's broadband capacity to the home, we are confronted with net-neutrality arguments from providers of broadband access, like cable, telephone companies, and wireless providers, on one side, and arguments from Internet-content and -application providers, like Google, eBay, Amazon, Vonage, and others, on the other side. All sides are exploring new businesses, new business models, providing new offerings to their customers. Groups for and against regulation, both, make compelling arguments that their way is the best way to encourage investment, innovation, and job creation. Cable and phone companies argue against net-neutrality regulation, while content and application providers generally argue for net-neutrality regulation. The FCC has announced net-neutrality principles, but Chairman Martin has stated that regulation is not needed, and that it will not be needed. We'll hear arguments firsthand

today from both sides, and we will take them into consideration as we further examine updating telecommunications legislation, upon completion of our hearings.

Now, our Co-Chairman is not going to be here today. He's asked that he—he cannot be here, for personal reasons.

First, Senator Dorgan, do you have an opening statement?

Senator DORGAN. I do, Mr. Chairman.

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

Senator DORGAN. Let me be very brief, but I think this is one of the most important hearings that we will hold this year in this Committee. I was eating some Cheerios this morning, Mr. Chairman, when I read the business section of the *Washington Post.* It says, "Verizon Executive Calls for End to Google's Free Lunch."

The CHAIRMAN. That was a free breakfast, then.

Senator DORGAN. Well, my Cheerios weren't free, but——

[Laughter.]

Senator DORGAN.—apparently my lunch is going to be free. "A Verizon Communications Inc. executive accused Google, Inc., of freeloading for gaining access to people's homes using a network of lines and cables the phone company spent billions of dollars to build."

You know, the fact is, I've had both DSL and broadband from cable. Consumers pay for both of those. I paid for the opportunity to have DSL and cable broadband, and this is not a free lunch. The reason I would have paid that is, I want access to content that exists. And I really believe that net neutrality is a very important concept. Four years ago, I wrote to the FCC on this subject. I understand where the equities are from various companies. I understand why they advocate as they do. But, it is not a free lunch for any one of these content providers to come into the Chairman's home or to my home or any home of anybody in this country over the lines of cable companies or telephone companies. Those lines and that access is being paid for by the consumer. And I worry very much if we start moving down the road of deciding that "the Internet shall not be free."

I think the refrain of this Committee ought to be keep the Internet free, provide for net neutrality. Were it not for the decision by the FCC to decide that this was an information service, we wouldn't be needing this hearing. But, because they did that, we do need to have this hearing and make judgments about the future. Will the Internet be kept "free?" I hope so. The answer is, I hope so.

And, once again, I'd just conclude by saying, when I read the paper this morning that suggests that that which I call up on my broadband, asking for information from Google or eBay or any number of providers, it is not a free lunch. I've already paid the toll, the monthly toll to be able to do that over a DSL line or over a cable modem.

Mr. Chairman, thank you for calling this hearing. I think it's very important.

The CHAIRMAN. Thank you.

Senator Burns?

STATEMENT OF HON. CONRAD BURNS, U.S. SENATOR FROM MONTANA

Senator BURNS. Thank you, Mr. Chairman. It seems like I'm involved in a couple of issues today, so I won't get to stay and listen to the whole thing, but we take a high interest in this particular issue.

During the time of intense market deregulation, concerns over fair business practices by the Internet service providers that control the pipe to the consumers' homes have prompted corporations and activists to call for a regulation when the market fails. This concerns me, and it's been a gathering storm out there, and there's been swirl of information in the press, especially the communications press. And now there is quite a lot of concern among all of us that this is an issue that we're driven to deal with. And I'm not real sure that we're prepared to do it yet.

The concern by both companies and citizens alike, is that the ability to provide an access content on the Internet is not dictated or restricted by the consumer's choice of an ISP. The guiding principle of this discussion today is a belief that there should be an unfettered access without discrimination or courtesy to a particular type of transmission, business, or software. The Internet should remain open to all users and should have access to its—all users should have access to its content. At the same time, however, we must recognize and balance a company's interest in managing its own—therein—there, when you go to jumping into that briar patch, therein lies the challenge. How do we strike the balance? A company must remain certain—at a certain level of service quality on its network to stay in business. At the same time, consumers demand liberated access to the content on the Internet. My concern is that if we legislate prematurely in this area, we will not let these different approaches play out in the marketplace.

I'm hopeful that this hearing will start the debate here in this town of 17 square miles of logic-free environment, and——

[Laughter.]

Senator BURNS.—because it is a debate that has to be started and completed and completely aired before Congress makes a step, in one way or the other. The answer to the question—there's going to be more questions in—coming out of this hearing than there will be answers, I'll guarantee you that. But I look forward to working with the Members of this Committee and the parties interested in this, because the Internet—we've been around it a long time. We've seen it grow. We've seen it prosper. We've seen it become a marketplace and an information place, something that a lot of people rely on. And free and open access, and the availability of it, should be free to all Americans, and the same with us who pay for the services—like Senator Dorgan said, we all pay the fee every month for that access and that freedom.

Thank you, Mr. Chairman, and I look forward to hearing from the witnesses. And now I must go over and deal with asbestos. It's a little old issue over there that's not——

The CHAIRMAN. Senator Ensign?

STATEMENT OF HON. JOHN ENSIGN,
U.S. SENATOR FROM NEVADA

Senator ENSIGN. Thank you, Mr. Chairman.

I want to applaud you, first of all, for the aggressive schedule of hearings that you've laid out for the Committee this year. I have introduced, as many people know, the Broadband Investment and Consumer Choice Act—and every topic that's contained in my legislation is covered in your hearing, so I want to thank you for that. We just signed up our 16th cosponsor for our legislation, so we're getting a lot of support building on that.

But one of the things that has to be pointed out here, that when we're talking about the idea of net neutrality and consumer choice and all of the issues that we're going to be dealing with, is the fact that the country that invented the Internet is now 16th in the world in broadband deployment. That is a fact, and that—it is not something that is getting better; it is getting worse. Just a couple of years ago, we were 11th. Now we're 16th. And many other countries are taking a different approach than the United States. We're more of a free-market country. And I think that we should be that way. But the fact is, is that our regulations and our laws need to be modernized to reflect the realities of technology today, to create more incentives for companies to invest so that we have that—those broadband networks that are higher quality, that are faster, that give consumers more competition.

In today's marketplace, while we have competition, we don't have nearly the type of competition that could be had that would benefit the consumer, and that would benefit American competitiveness in the world.

The idea of net neutrality is going to be one of those sticky issues that we deal with, because everybody here says that we should—and everybody agrees that we want the Internet to be free, and nobody wants anybody to block the access to any website, for instance. You know, I mean, everybody can agree on that. But we also have to recognize that there is a balance. And, Senator Burns, you mention the balance, and that is going to be—the critical aspect is how we strike this balance when we're dealing with net neutrality.

If you are a company that is going to be borrowing money from Wall Street, and Wall Street is looking at, "What kind of return are you going to have on that investment?" and we have a law that says that you cannot have somewhat control—not who—what websites and things like that, but, for instance, if a—if the phone companies are building out their networks, and going to fiber, and they want to have IPTV, for instance—well, let's just say, for instance, that they offer 30 megabits per second. IPTV may take up a fairly significant portion of that, and they want to guarantee that they can offer their IPTV. That's the incentive for them to build out their network. The problem is, is that if there are other Google or Yahoo!, or whatever, that wants to do the same thing, and they have to guarantee them access through that at the same—it may take all of their bandwidth, is what I'm trying to say.

Now, technology in the future is probably going to answer all this, and we'll have all the bandwidth that we need, but to give the initial incentive for the companies to build that network, this is

the—this is where the balance is going to have to come in. And we're going to have to pay attention to that, because you do deserve a return on your investment, is the bottom line, if you're going to build out these networks. Otherwise, if we can't give them a return on their investment, Wall Street is not going to loan them the money to do this.

Thank you, Mr. Chairman.

The CHAIRMAN. Senator Lott, do you have a comment?

STATEMENT OF HON. TRENT LOTT,
U.S. SENATOR FROM MISSISSIPPI

Senator LOTT. No, I don't, Mr. Chairman. I came to hear the panel and get some wisdom. So, I'm looking forward to hearing them.

The CHAIRMAN. Very good.

Senator Pryor, do you have a comment?

Senator PRYOR. I don't, thank you.

The CHAIRMAN. Thank you very much.

Our former member, Senator Wyden, asked for a comment—an opportunity to make a comment before the hearing.

Senator Wyden?

STATEMENT OF HON. RON WYDEN,
U.S. SENATOR FROM OREGON

Senator WYDEN. Thank you very much, Mr. Chairman. I want to thank you and your staff for being so kind to me, as a frustrated ex-member of this Committee. I think you're dealing with some of the most important issues, and I want to thank you for this opportunity.

The reason I wanted to come today, Mr. Chairman and colleagues, is that 10 years ago a bipartisan group of Senators from the Commerce Committee decided that, even though we hadn't invented the Internet, we wanted to make sure that we were taking steps so it would prosper. And our bipartisan group came together 10 years ago to deal with the fact that the net, at the time, was being subject to discriminatory taxation. So, we wrote a law, the Internet Tax Freedom Act—really ought to have been called the Internet Nondiscrimination Act, because it had a simple principle. There ought to be technological neutrality and, in terms of taxes, you ought to do to the online world what you do to the offline world. In my view, that law was a real success. It's been a catalyst for the net's growth. And I just wanted to suggest, today, that we ought to be dealing in a bipartisan way with another important challenge.

In my view, there are powerful interests who own the pipes and access to the net that are trying to break the net. These interests want to expand their control over Internet access to the limitless world of content, where consumers play the games and watch online TV and enjoy video. Now, we all know consumers use high-speed access to the net now, that they've paid for, for whatever content they want, and they don't have to worry about someone such a cable company or a phone company interfering with the use of the net.

Now, some of these cable and phone companies are saying that they ought to be able to discriminate in the delivery of content. They're saying that, instead of making available to everyone the same content at the same price, they ought to be allowed to set up sweetheart arrangements to play favorites.

Now, in my view—and I'll wrap up with this, Mr. Chairman—I think this is a fundamental shift in the way the Internet has worked and prospered. The small startups and the scores of others that began tiny and dreamed big were able to succeed because every user has had equal access to all the websites. So, I'm going to introduce legislation to try to keep it that way, and the legislation is essentially built on the idea that all information ought to be made available on the same terms, so that no bit is better than another one. We need to assure that information from a company like J. Crew is not treated worse than information from a company like L.L. Bean.

Second, my legislation will assure that a company like Comcast, that offers Internet access, does not give preferential treatment to its own information bits, compared to information bits from, say, another company, like Yahoo!

Third, broadband service providers should not be able to create private networks that are superior to the Internet access that they offer consumers generally. This principle is important, because it would prevent Internet access providers from tipping the competitive advantage toward their own services, such as phone calls over the Internet, VoIP, or television over the Internet.

What it comes down to, Mr. Chairman, is, we ought to build on the good bipartisan legislation of 10 years ago, with respect to taxes. Act now to preserve the spirit of the Internet, which is fair treatment for everyone.

Again, I want to thank you for the opportunity to come. You've been very kind to me to let me come on several occasions in the past. We got it right with the Internet Tax Freedom Act, 10 years ago. I think we can do it again by working together.

And I thank you.

The CHAIRMAN. Thank you very much, Senator.

I made the mistake of leaving this Committee for one Congress. Maybe you made one, too.

[Laughter.]

The CHAIRMAN. Thank you.

Our first panel is Vinton Cerf, the Vice President and Chief Internet Evangelist of Google; Walter McCormick, President and Chief Executive Officer of the U.S. Telecom Association; Jeffrey Citron, Chairman and Chief Executive Officer of Vonage; Kyle McSlarrow, President and Chief Executive Officer of National Cable and Telecommunications Association; Earl Comstock, President and Chief Executive Officer of COMPTEL.

Gentlemen, we welcome you. Again, I apologize for the size of the room—probably 150 people out in the hall. But that's—we're still having rooms up there in the Senate redone, and it's just impossible to get another room.

I'm going to go just in—the way we put them on the schedule, so, Mr. Cerf, we'd be pleased to have your statement.

All of your statements will appear in the record in full. We look forward to listening to you, and hope that you will understand our time limitations. And we'll have questions when you're finished.

Mr. Cerf?

STATEMENT OF VINTON G. CERF, VICE PRESIDENT/CHIEF INTERNET EVANGELIST, GOOGLE, INC.

Mr. CERF. Good morning, Mr. Chairman, Members of the Committee. Thank you very much for allowing me to testify this morning. I'll try to be brief and concise.

Let me begin by pointing out that our Nation's policies on important issues related to Internet access involve consumer choice, economic growth, technological innovation, and global competitiveness. These are very important national concerns which this Committee——

The CHAIRMAN. Mr. Cerf, would you pull that mike up to you?

Mr. CERF. I'm sorry. Is that better? Shall I start one more time?

I'll try to be brief about this. Thank you, again, for allowing me to participate.

The matters before you involve a broad range of issues: consumer choice, economic growth, technological innovation, and global competitiveness. These are very important and very major issues that this Committee and the rest of the Congress face. Nothing less than the future of the Internet is at stake in these discussions.

I was fortunate to be part of the original team that designed and built the Internet. We've learned some lessons from its design over the last 30 years. The first lesson is that it was structured as a layered architecture, like a layer cake. Certain parts at the bottom were for physical transport of bits moving over wires, or over optical fibers, or over radio channels. The next layers up supported packet switching. The next layers up, beyond that, supported the actual transport of information. These various layered structures allowed for changes in underlying transmission systems and switching systems over the course of the 30-year period so that new kinds of technology could be integrated into the system and everything would still work.

More critically, we had an end-to-end principle which said that most of the intelligence in the network was at the edges of the net, where all of the applications were implemented. The core of the network was fairly "stupid," actually; it just moved packets back and forth, like little electronic postcards.

The standards for the Internet were published and open and globally available, even from the very beginning, when the Defense Department was supporting this system, because we wanted this to be an open standard that anyone could use to implement and to test new kinds of applications.

The overarching rationale for all of this was to make the system completely open and completely distributed, with no central control. This, actually, was important to the military to make sure that it was a highly resilient system.

There were key decisions made by the executive branch and by the legislative branch, some of which you've heard about earlier this morning, that helped to commercialize the Internet. Your decisions coming up in this debate are equally important.

There are something like 250,000 networks around the world that make up the Internet. Every one of them is compensated by its users for access to those systems. They are fully interconnected in order to create this gigantic network of networks.

The FCC had some very important elements in its policies: safeguards for user choice and nondiscrimination. We've heard a bit about that earlier this morning. That's terribly important. Users got to decide which ISPs serviced them, and no ISP determined what a user did with access to the network.

What we have today is innovation without permission. For example, Tim Berners-Lee, in the invention of the World Wide Web, did not have to ask permission of any ISP to invent this new and wonderful idea. Yair Goldfinger did not with IM, and David Filo, and Jerry Yang didn't have to ask permission for the creation of Yahoo! Jeff Bezos didn't have to ask permission for the creation of Amazon. And Larry Page and Sergey Brin didn't have to ask permission for the invention of Google. What we seek is to continue this very successful policy, this engine of innovation, which openness and freedom of access permits.

The challenge we have is that there isn't enough competition in the broadband world. If there were enough competition, you wouldn't have me sitting here expressing these concerns. According to the statistics from the FCC in 2004, only 53 percent of Americans had a choice of broadband access, either from cable companies or from the telco's with their DSL service. Only 53 percent. Twenty-eight percent have only one choice, either cable or DSL. And 19 percent don't have any choice at all; there is no broadband. There are alternate transport techniques—for example, radio access and broadband over power lines—but they occupy maybe about 1.5 percent of the market. So, there aren't any competitive alternatives, other than cable and DSL, and they don't necessarily compete head to head.

It's very important for us to understand what's going on in the rest of the world. If you look at places like Hong Kong and Singapore and Japan and South Korea, you discover extremely high-speed service is available, up to 100 megabits a second, for $50 a month, with no constraints as to how that bandwidth is used. That is an engine of innovation which we cannot afford to lose. We must preserve neutrality in this system in order to allow new Googles of the world, new Yahoos!, new Amazons to form.

Mr. Chairman, we risk losing the Internet as a catalyst for consumer choice, for economic growth, for technological innovation, and for global competitiveness. We thank the Committee for its leadership, and we look forward to helping it fashion carefully tailored legislation that protects the interests of America's Internet users. And that includes the future interests of the next Google just waiting to be born in someone's dorm room or garage.

Thank you very much, Mr. Chairman.

[The prepared statement of Mr. Cerf follows:]

PREPARED STATEMENT OF VINTON G. CERF, VICE PRESIDENT/CHIEF INTERNET EVANGELIST, GOOGLE INC.

Good morning Chairman Stevens, Senator Inouye, and Members of the Committee. My name is Vint Cerf, and I am currently Vice President and Chief Internet

Evangelist with Google. You may be more familiar with me for my work over the last few decades as one of the network engineers involved in devising the software protocols that underpin the Internet. Thank you for inviting me here today to discuss the important concept of network neutrality. As this Committee considers the future of U.S. communications law, it faces choices linked inexorably to important American values: consumer choice, economic opportunity, and technological innovation. In turn the way we approach those policy choices will have a tremendous impact on our ability as a nation to compete effectively on a global stage. In short, I appreciate the opportunity to share some of my thoughts about issues affecting nothing less than the future of the Internet.

I. Introduction and Overview

The Internet's open, neutral architecture has proven to be an enormous engine for market innovation, economic growth, social discourse, and the free flow of ideas. The remarkable success of the Internet can be traced to a few simple network principles—end-to-end design, layered architecture, and open standards—which together give consumers choice and control over their online activities. This "neutral" network has supported an explosion of innovation at the edges of the network, and the growth of companies like Google, Yahoo!, eBay, Amazon, and many others. Because the network is neutral, the creators of new Internet content and services need not seek permission from carriers or pay special fees to be seen online. As a result, we have seen an array of unpredictable new offerings—from Voice-over-IP to wireless home networks to blogging—that might never have evolved had central control of the network been required by design.

Allowing broadband carriers to control what people see and do online would fundamentally undermine the principles that have made the Internet such a success. For the foreseeable future most Americans will face little choice among broadband carriers. Enshrining a rule that permits carriers to discriminate in favor of certain kinds or sources of services would place those carriers in control of online activity. Allowing broadband carriers to reserve huge amounts of bandwidth for their own services will not give consumers the broadband Internet our country and economy need. Promoting an open and accessible Internet is critical for consumers. It is also critical to our Nation's competitiveness—in places like Japan, Korea, Singapore, and the United Kingdom, higher-bandwidth and neutral broadband platforms are unleashing waves of innovation that threaten to leave the U.S. further and further behind.

My testimony will explain briefly why network neutrality has been so important to the Internet's success and should be preserved. Among its key points:

- The Internet was designed to maximize user choice and innovation, which has led directly to an explosion in consumer benefits. The use of layered architecture, end-to-end design, and the ubiquitous Internet Protocol standard, together allow for the decentralized and open Internet that we have come to expect. This created an environment that did not require Tim Berners-Lee to seek permission from the network owners before unveiling a piece of software enabling the World Wide Web.
- Most American consumers today have few choices for broadband service. Phone and cable operators together control 98 percent of the broadband market, and only about half of consumers actually have a choice between even two providers. Unfortunately, there appears to be little near-term prospect for meaningful competition from alternative platforms. As a result, the incumbent broadband carriers are in position to dictate how consumers and producers can use the on-ramps to the Internet.
- A number of justifications have been created to support carrier control over consumer choices online; none stand up to scrutiny. Open-ended carrier discrimination is not needed to protect users from viruses, stop spam, preserve network integrity, make VoIP or video service work properly—or even ensure that carriers are compensated for their broadband investments. In particular, we firmly believe that carriers will be able to set market prices for Internet access and be well-paid for their investments—as broadband carriers in other countries have successfully done.
- Even as we welcome the deregulation of our telecommunications system, we must preserve some limited elements of openness and non-discrimination that have long been part of our telecommunications law. In this regard, Google supports tailored, minimally-intrusive safeguards to promote net neutrality. Legislative approaches in both chambers have helpfully acknowledged the need for some form of net neutrality. We look forward to helping strengthen those provisions to provide the safeguards needed.

Google believes that consumer should be able to use the Internet connections that they pay for the way that they want. This principle—that users pick winners and losers in the Internet marketplace, not carriers—is an architectural and policy choice critical to innovation online. Google itself is a product of the Internet. We care passionately about the future of the net, not just for ourselves, but because of all the other potential Googles out there. Indeed, we are not alone: Our concerns are shared by Internet companies, small businesses, end users, and consumer groups across the country. The vibrant ecosystem of innovation that lies at the heart of the Internet creates wealth and opportunity for millions of Americans. That ecosystem—based upon a neutral open network—should be nourished and promoted.

Mr. Chairman, Google commends you and the Members of this Committee for your thoughtful leadership and attention in this area, and we look forward to working closely with you in the weeks and months ahead.

II. The Lasting Lessons of the Internet

Some believe that the Internet was born and flourished out of a fortuitous accident, a random interaction of market forces and technology. But that simply is not the case.

The advent of the Internet took tremendous vision and initiative, by numerous network engineers, and software developers, and hardware vendors, and entrepreneurs. That advent also included visionary U.S. policymakers who recognized that the government largely needed to get out of the way, and allow the free market to work its genius in this new interactive, online environment. At the same time, as I will explain below, that policy judgment rested on an existing regulatory framework that allowed open and nondiscriminatory access to the Internet.

I was fortunate to be involved in the earliest days of the "network of networks." From that experience, I can attest to how the actual design of the Internet—the way its digital hardware and software protocols, including the TCP/IP suite, were put together—led to its remarkable economic and social success.

First, the layered nature of the Internet describes the "what," or its overall structural architecture. The use of layering means that functional tasks are divided up and assigned to different software-based protocol layers. For example, the "physical" layers of the network govern how electrical signals are carried over a physical medium, such as copper wire or radio waves. The "transport" layers help route the user's data packets to their correct destinations, while the application layers control how those packets are used by a consumer's e-mail program, web browser, or other computer application. This simple and flexible system creates a network of modular "building blocks," where applications or protocols at higher layers can be developed or modified with no impact on lower layers, while lower layers can adopt new transmission and switching technologies without requiring changes to upper layers. Reliance on a layered system greatly facilitates the unimpeded delivery of packets from one point to another.

Second, the end-to-end design principle describes the "where," or the place for network functions to reside in the layered protocol stack. With the Internet, decisions were made to allow the control and intelligence functions to reside largely with users at the "edges" of the network, rather than in the core of the network itself. For example, it is the user's choice what security to use for his or her communications, what VoIP system to use in assembling digital bits into voice communications, or what web browser to adopt. This is precisely the opposite of the traditional telephony and cable networks, where control over permitted applications is handled in the core (in headends and central offices), away from the users at the edge. As a result, the power and functionality of the Internet is left in the hands of the end users.

Third, the design of the Internet Protocol, or the "how," allows for the separation of the networks from the services that ride on top of them. IP was designed to be an open standard, so that anyone could use it to create new applications and new networks (by nature, IP is completely indifferent to both the underlying physical networks, and to the countless applications and devices using those networks). As it turns out, IP quickly became the ubiquitous bearer protocol at the center of the Internet. Thus, using IP, individuals are free to create new and innovative applications that they know will work on the network in predictable ways.

Finally, from these different yet related design components, one can see the overarching rationale—the "why"—that no central gatekeeper should exert control over the Internet. This governing principle allows for vibrant user activity and creativity to occur at the network edges. In such an environment, entrepreneurs need not worry about getting permission for their inventions will reach the end users. In essence, the Internet has become a platform for innovation. One could think of it like the electric grid, where the ready availability of an open, standardized, and stable

source of electricity allows anyone to build and use a myriad of different electric devices. This is a direct contrast to closed networks like the cable video system, where network owners control what the consumer can see and do.

In addition to this architectural design, the Internet has thrived because of an underlying regulatory framework that supported openness. Wisely, government has largely avoided regulating the Internet directly. Google firmly supports this deregulatory approach, which is supported by the openness and consumer choices available in this new medium. At the same time, the underlying network through which consumers access the Internet has rested on a telecommunications regulations that ensured openness—including a century's-old tradition in American law that telephone companies are not allowed to tell consumers who they can call or what they can say.

In the zone of governmental noninterference surrounding the Internet, one crucial exception had been the nondiscrimination requirements for the so-called last mile. Developed by the FCC over a decade before the commercial advent of the Internet, these "Computer Inquiry" safeguards required that the underlying providers of last-mile network facilities—the incumbent local telephone companies—allow end users to choose any ISP, and utilize any device, they desired. In turn, ISPs were allowed to purchase retail telecommunications services from the local carriers on non-discriminatory rates, terms, and conditions.

The end result was, paradoxically, a regulatory safeguard applied to last-mile facilities that allowed the Internet itself to remain open and "unregulated" as originally designed. Indeed, it is hard to imagine the innovation and creativity of the commercial Internet in the 1990s ever occurring without those minimal but necessary safeguards already in place. By removing any possibility of ILEC barriers to entry, the FCC paved the way for an explosion in what some have called "innovation without permission." A generation of innovators—like Tim Berners-Lee with the World Wide Web, Yair Goldfinger with Instant Messaging, David Filo and Jerry Yang with Yahoo!, Jeff Bezos with Amazon, and Larry Page and Sergey Brin with Google—were able to offer new applications and services to the world, without needing permission from network operators or paying exorbitant carrier rents to ensure that their services were seen online. And we all have benefited enormously from their inventions.

III. The Challenge Posed by a Concentrated Broadband Market

As we move to a broadband consumer network, the Internet's openness is being threatened. Most consumers face few choices among broadband carriers, giving carriers tremendous market power. At the same time, the FCC has shown little willingness to extend the long-standing non-discrimination rules governing our telecommunications system to the incumbent broadband providers. As a result, carriers increasingly will have an economic incentive to use their power to block competitors, seek extra payments to ensure that Internet content can be seen, and generally control consumer activity online.

Were there sufficient competition among and between various broadband networks, Google's concerns about the future of the Internet would largely be allayed. Unfortunately, the FCC's own figures demonstrate the significant degree of concentration in the broadband market. In 2004, the Commission reported that only 53 percent of Americans have a choice between cable modem service and DSL service. Of the remaining consumers, 28 percent have only one choice, and 19 percent have no choice at all. Thus, nearly half of all consumers lack meaningful choice in broadband providers.

Moreover, the alternatives to DSL and cable modem service remain a very small part of the market. As of December 2004, the FCC's figures show that incumbent cable and telephone company broadband services together constitute 98.7 percent of the total market. This leaves only 1.3 percent of the current market for alternative broadband networks such as wireless, satellite, and BPL. Shockingly, the share of alternative networks has shrunken steadily, from 2.9 percent in December 1999. Thus, even the FCC's own figures demonstrate that there are only two dominant and only partially-competitive modalities—cable and telco—and a tiny and declining share of third modalities.[1]

To me, as a scientist, it comes down ultimately to questions of physics and economics. First, can such alternative networks be built, given the limitations of available network atoms and radio spectrum? Second, will such alternative networks be

[1] AT&T CEO Ed Whitacre also has acknowledged the highly concentrated nature of the consumer broadband market. In a recent interview with *BusinessWeek,* he noted that in the broadband space, "it's still about scale and scope. It's about owning the assets that connect customers. The assets that probably can't be duplicated except maybe by the cable companies." Certainly the FCC's numbers bear that out.

built, given the immense time and effort involved? Whether we are discussing BPL or WiMax or satellite, the prospect of a near-term, ubiquitous competing broadband platform does not appear promising.

In the absence of any meaningful competition in the consumer broadband market, and without the user safeguards that have governed similar last-mile competition to date, one would expect carriers to have an economic incentive—and the opportunity—to control users' online activity. Not surprisingly, this incentive is already manifesting itself. Just last spring, the FCC found that the Madison River Telephone Company was blocking ports used by its DSL customers to access competing VoIP services.[2] Similar examples are emerging internationally as well. More revealingly, in recent months senior executives of major U.S. carriers have indicated publicly that they intend to force competing services and content providers to pay to be seen online.[3] Together, these examples show that carrier discrimination is not a hypothetical concern.

IV. Debunking the Ever-changing Rationale for Network Discrimination

Recently, various justifications have been offered to explain why carriers need to limit the ability of end users to control their own connections to the Internet. For years many broadband carriers insisted that they would never discriminate against application providers, or limit their customers' access to the Internet. More recent arguments for carrier discrimination have included the need to insert network controls to protect their customers against spam and other security threats, or to insure the quality of VoIP services. Now they argue that their IP video services will require substantial bandwidth that otherwise would be used by Internet applications. They also have decided to look to applications providers such as Google to help pay for the expense involved in providing broadband networks—and that any attempts to curtail their network control will remove their incentives to continue investing. None of these justifications stands up under close scrutiny.

- Network neutrality need not prevent anyone—carriers or applications provider—from developing software solutions to remedy end user concerns such as privacy, security, and quality of service. The issue arises where the network operator decides to place the functionality in the physical or logical layers of the network, rather than in the application layer where they belong. Such a move is contrary to many of the fundamental architectural principles of the Internet. In particular, attempting to solve applications issues at the physical layer violates the layered, modular nature of the net. With a few very narrowly-tailored exceptions—such as defending against network-level denial of service attacks or router attacks—altering or blocking packets within the network is inconsistent with the end-to-end design principle. The end result is the insertion of a gatekeeper that—even arguably under the best of intentions—disrupts the open, decentralized platform of the Internet.
- Broadband capacity is not nearly as constrained as the network owners would have us believe. Some applications, such as voice over IP, take up very little bandwidth. Other activities, such as multi-player real-time gaming or streaming video, may require more capacity. However, such applications could be subject to additional customer charges, based on the access speeds required (as opposed to the source, destination, or content of the traffic)—but without discriminating based on who is providing the service.
- The broadband carriers already are fully compensated by their residential customers for their use of the network. These companies can charge their own customers whatever they want, in order to make back their investments. Trying to extract additional fees from web-based companies—who are not in any way "customers" of the provider—would constitute a form of "double recovery." Google takes no issue with the broadband carriers' ability to set prices for Internet access that compensate for the costs and risks associated with their network investments.

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[2] Federal Communications Commission, *In the Matter of Madison River Communications, LLC and affiliated companies, Order,* File No. EB–05–IH–0110, adopted March 3, 2005.

[3] Just three months ago, AT&T CEO Edward Whitacre observed that only telephone carriers and cable companies have broadband pipes to customers. He insisted that Google and other companies "use my lines for free, and that's bull." He then warned that "I ain't going to let them do that" because "there's going to have to be some mechanism for these people who use these pipes to pay for the portion they're using." Rewired and Ready for Combat, BusinessWeek online, November 7, 2005; *Online Extra: At SBC, It's All About "Scale and Scope,* BusinessWeek online, November 7, 2005. As noted below, Mr. Whitacre's economic theories leave something to be desired.

- Some carriers are also seeking permission to create two separate IP networks: one for the public Internet and one for a privately-managed, proprietary service. Allowing segmentation of the broadband networks into capacious "broadest-band" toll lanes for some, and narrow dirt access roads for the rest, is contrary to the design and spirit behind the Internet, as well as our national competitive interests. And by definition, favoring some disfavors others. In an environment where consumers already have little to no choice of broadband providers, the end result is a cramped version of the robust and open environment we all take for granted today. Prioritization inevitably becomes a zero-sum game.
- Many seem to forget that the rationale for reduced regulation at the FCC was based in part on the promise that carriers would build robust broadband platforms to support the Internet. Turning away from those commitments would undermine the rationale for deregulation. Moreover, retaining some type of user safeguard that promotes an outcome of net neutrality would seem a small burden in the context of the immense deregulation that has happened, and likely will continue to happen, at the FCC.

Finally, we would do well to take important lessons from other countries. Whatever metric one uses, the United States lags behind other developed countries in the deployment and use of high-speed connections to the Internet. Ironically, many such countries employ the same principles of network openness and nondiscrimination that helped shape our own experience of the Internet. Certainly the incumbent providers in those countries do not appear to suffer from any lack of incentives under those principles. For example, in the United Kingdom, British Telecom has agreed to split itself into a retail arm and a wholesale business, with a fundamental policy of nondiscriminatory treatment governing the relationship between them and other providers. In a number of Asian countries, both incumbent and competitive providers operating in an unbundled environment sell huge amounts of bandwidth—100 megabits or more per second—at a fraction of U.S. prices. By abandoning the principles that helped foster user choice and innovation, the United States risks falling further behind in the global economy.

V. Preserving Neutrality in Our Telecommunications Law

Even as we welcome the deregulation of our telecommunications system, we should preserve some limited elements of openness and non-discrimination that have long been part of our telecommunications law. Absent real physical layer competition, Google supports a tailored, minimally-intrusive, and enforceable network neutrality rule.

Congress now is considering possible legislation in this area. We are gratified that legislative approaches in both chambers recognize the need for some form of network neutrality safeguards to protect the interests of Internet users in a concentrated broadband market. Unfortunately they do not go far enough towards creating enforceable protections against carrier interference with consumer choices.[4] Allowing broadband carriers to discriminate in favor of certain kinds of services, and to potentially interfere with others, would take control away from the end users of the Internet, and place it in the hands of those who own the network. The current draft bills take a step in the right direction, but ultimately do not go far enough to preserve the vibrant innovation at the edge of the Internet. Our concerns are shared by Internet companies, small businesses, Internet end users, and consumer groups across the country.

As Congress and the FCC consider these issues, we should establish our end goal with as much clarity as possible, and then work back from there to develop an optimal mechanism for achieving that goal. In this context, we favor an environment much like the one that gave birth to the Internet: where end users can engage in activities such as running applications, employing devices, and accessing content, unfettered by the provider of the underlying network connection. Such an environment is best engendered by retaining a public policy framework that reflects the modular, end-to-end, and open nature of the Internet.

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[4] Last July, Senator Ensign introduced S. 1504, the "Broadband Investment and Consumer Choice Act of 2005." While the focus is on establishing streamlined nationwide video franchises, the bill also contains language concerning consumer access to the Internet. In September 2005, House Commerce Committee Chairman Barton issued a draft bill, widely known as "BITS I." A revised version, "BITS II," was released in November. Both drafts include provisions requiring broadband providers to allow consumers to access content, applications, and services, and to connect devices. Both versions also contain a number of important exceptions to those duties, related to elements like value-added services and enhanced quality of service. Unfortunately, as written the exceptions in each of these bills are so broad that they undermine the underlying neutrality requirement.

The best long-term answer to this problem is significantly more broadband competition. Ideally, physical layer problems merit physical layer solutions. While the prospects for such "intermodal" competition remain dim for the foreseeable future, Congress should ensure that the FCC has all the tools it needs to maximize the chances for long-term success in this area.

We must stress here that finding a straightforward, minimally-intrusive safeguard need not deny the network operators the ability to recover their investments, and the proper incentives to further deploy their networks. In a very real way, content and application companies like Google need the high-speed access provided by broadband carriers, just as they need the attractive new Internet offerings to drive demand for that access. It is in our collective best interest for the United States to have the best broadband capabilities in the world, bar none. The prospects for continued American ingenuity and entrepreneurship deserve nothing less.

VI. Conclusion

The Internet has become an immense catalyst for economic growth and prosperity, in this country and around the world. However, our Nation is risking the loss of that catalyst, just when the broadband era should be creating the most benefits for the most people. Allowing the interests of network owners to shackle the Internet could severely undercut our Nation's ability to compete effectively in the global market. We must do all we can to preserve the fundamental enabling principles of the Internet: user choice, innovation, and global competitiveness.

Google looks forward to working with this Committee to fashion carefully-tailored legislative language that protects the legitimate interests of America's Internet users. And that includes the future interests of the next Google, just waiting to be born in someone's dorm room or garage.

Thank you.

The CHAIRMAN. Thank you very much, Mr. Cerf.

Our next witness is Walter McCormick, President and Chief Executive Officer of U.S. Telecom Association.

Walter?

STATEMENT OF WALTER B. MCCORMICK, JR., PRESIDENT/CHIEF EXECUTIVE OFFICER, UNITED STATES TELECOM ASSOCIATION (USTELECOM)

Mr. MCCORMICK. Mr. Chairman, thank you very much. On behalf of our 1,200 companies, it's a pleasure to be here before you and this Committee today, and I appreciate the honor of being able to testify.

Mr. Chairman, there is a lot of debate today about whether or not the Internet will change. Senator Dorgan really began this hearing by asking, Is our Internet going to change? And so, I want to be clear about the position of our companies.

Our companies have a 100-year tradition of connecting people to each other over our networks. We are 100 percent committed to continuing this tradition. Our commitment to our customers, our commitment to you, is this: We will not block, impair, or degrade content, applications, or services. That is the plainest, most direct way I know to address the concerns that have been raised about net neutrality.

Now, how can you be assured of our commitment, in the absence of a legislative mandate? Well, first, you can be assured of this commitment, because our culture, our history, our business has been focused, for more than a century, on connecting our customers with those they choose. If one of our customers wants to call Sears, we don't connect them with Macy's.

Second, because there already exists oversight by the Federal Communications Commission. The FCC's oversight has proven to be effective. The Commission has made it clear that it has the au-

thority and the appetite to move swiftly to intervene to protect consumers.

And, finally, because consumers aren't experiencing any problems today, and there isn't any statute in place, there isn't a problem that Congress needs to address.

Mr. Chairman, consumers expect Internet freedom. And if we don't provide it, then the consumer will choose to do business with someone else. Today, consumers have choices in the marketplace. There is vigorous competition between DSL, cable modem, wireless, satellite, and other Internet-access providers. In some areas, free Wi–Fi access is available. In others, access over power line is developing. This competition results in benefits to consumers, the latest evidence coming just in the past week, with AT&T announcing $12.99-per-month DSL service.

As Mr. Cerf said, the Internet operates on networks that are operated, in part, by our companies, networks that interconnect with other networks. That is, in fact, as he said, what the Internet is, networks interconnecting with other networks. And have we sought to control, restrict the Internet? No, we have not. We have, instead, invested, grown, and increased the scale and the scope of the Internet. Indeed, we have sought to advance public policies that will lead to increased investment in networks—broadband networks, networks that make the Internet even more robust.

The next-generation Internet holds enormous opportunities. I refer not just to movies and entertainment, but to telemedicine that can improve the accessibility and affordability of healthcare, particularly in rural areas, to telecommuting opportunities that can enhance our environment and reduce our dependence on foreign oil, and other innovations that our best minds have yet to imagine.

But the promise of the next-generation Internet is dependent upon there being investment in next-generation networks. Without broadband networks, these exciting opportunities will remain beyond our reach. Therefore, public policy must encourage and reward investment in networks. This is the 21st century, the information century, and telecommunications is at the heart of the information economy.

Again, I appreciate the Committee's interest in these issues, and appreciate the opportunity to be here today.

[The prepared statement of Mr. McCormick follows:]

PREPARED STATEMENT OF WALTER B. MCCORMICK, JR., PRESIDENT/CHIEF EXECUTIVE OFFICER, UNITED STATES TELECOM ASSOCIATION (USTELECOM)

Mr. Chairman, Co-Chairman Inouye and Members of the Committee, I am Walter McCormick, President and Chief Executive Officer of the United States Telecom Association (USTelecom). On behalf of our more than 1,200 innovative member companies ranging from the smallest rural telecoms to some of the largest corporations in the U.S. economy, I appreciate this opportunity to discuss net neutrality.

There is a lot of debate today about whether the Internet will change. Let me be clear about the position of our companies:

Our companies have a 100-year tradition of connecting people to each other over our networks. We are 100 percent committed to continuing this tradition as we invest billions of dollars—nearly $15 billion in 2006 alone—building out new, next-generation broadband networks capable of meeting America's rapidly increasing need for speed.

Today, I make the same commitment to you that our member companies make to their Internet customers: We will not block, impair, or degrade content, applica-

tions, or services. That is the plainest and most direct way I know to address concerns that have been raised about net neutrality.

If you can go there today, you can go there tomorrow. The functionality you have on the Internet today, you will have tomorrow.

Now . . . why is that the case in the absence of a legislative mandate?

First and foremost, because our culture, our history, our business has been focused for more than a century on connecting our customers with those they choose. If a consumer wants to call Sears, we don't connect them with Macy's.

Second, there already exists oversight by the Federal Communications Commission today that has proven to be effective in protecting consumers' right to be in control of their Internet experience. The Federal Communications Commission has made it abundantly clear that it has both the authority and the appetite to move swiftly to intervene on behalf of the consumer.

Finally, consumers' Internet experience is today unimpeded—in the *absence* of virtually any regulation of the Internet—because there exists a powerful *consumer* mandate for Internet freedom.

In a new communications era defined by multiple choices—multiple communications pathways—consumers simply will not continue to purchase service from a provider that seeks to block or restrict their Internet access.

When consumers have choices in the marketplace, consumers have control. There is vigorous competition between DSL, cable modem, wireless, satellite, and other Internet access providers. In some areas free Wi-Fi access is available. In others, access over powerline is available. This results in benefits to consumers . . . the latest evidence coming just last week with the announcement of $12.99/month DSL service from AT&T.

Mr. Chairman, the Internet operates today on networks operated by our companies—networks that interconnect with other networks. That is, in fact, what the Internet is—networks interconnecting with other networks. And, have we sought to control, or restrict the Internet? No, instead we have instead invested, grown, and increased the scale and scope of the Internet. Indeed, we have sought to advance public policy that will lead to increased investment in networks, broadband networks, networks that make the Internet even more robust tomorrow than it is today.

The next-generation Internet holds virtually unlimited promise to enhance our Nation's economic opportunities and quality of life. I refer not only to movies and entertainment, but also to telemedicine advancements that can improve the accessibility, affordability and quality of health care, particularly in rural communities . . . telecommuting opportunities that can enhance our environment and reduce America's dependence on foreign oil . . . and other innovations that our best minds have yet to imagine.

To take this next step in the Internet's evolution requires *vast* investment in new, next-generation networks with substantial bandwidth capacity. These are multi-*billion*-dollar investments that must be paid for by someone, in some way.

Should the costs all be loaded on the consumer? We say no.

All sides of the net neutrality debate agree that consumers should be in control of their Internet experience. Where we differ is on whether consumers alone should foot the bill for the advanced networks that drive the Internet's growth and evolution. Simply put, our side believes that businesses that seek to profit on the use of next-generation networks should not be free of all costs associated with the increased capacity that is required for delivery of the advanced services and applications they seek to market.

If you want more, then you pay more, is as American as it comes. It is a straightforward market proposition. As companies move into live video and gaming and advanced services, they will be seeking more bandwidth.

MovieLink, for example, is in talks with a leading communications provider to purchase additional bandwidth capacity that will speed movie downloads for its customers. How is this not *good* news for the consumer?

Why would public policy preclude MovieLink from investing in enhanced quality of service for its customers?

If this allows a consumer on a fixed income to buy a lower-cost Internet service and MovieLink pays for the bandwidth boost needed to download the occasional movie—how is this not an attractive choice to offer consumers in the marketplace? Why should public policy pre-empt it?

Consumers online habits are very diverse. Consumers don't need the government mandating a 'one size fits all' approach. What we *all* want are choices. Our companies want to deliver these choices to consumers as well as to companies whose business model requires exceptional amounts of bandwidth. We will deliver these choices

to the marketplace, so long as public policy encourages investment in the advanced networks that make them possible.

In your letter of invitation, the Committee posed a specific question: Should Congress limit the ability of Internet access providers to differentiate among different streams of information traveling over their networks?

We believe such action would be premature and could trigger substantial, negative unintended consequences. The Internet is the success it is today because the government has maintained a vigilant, but hands-off approach that has allowed companies to innovate in direct response to the evolving wants and needs of their customers. Regulatory or legislative solutions wholly without justification in marketplace activities would stifle, not enhance the Internet. Laws can be inflexible and difficult to fine-tune—particularly when applied to technologies that are rapidly evolving.

Instead of new laws, we believe in the discipline of the marketplace—customers voting with their dollars—alongside the continued, proven vigilance of the FCC.

Mr. Chairman, bandwidth is a finite resource. If you have spent any time on the Internet, you have likely experienced this. Some days the pages load faster than other days. This has nothing to do with management of the Internet. It's supply and demand—which is exactly why we need to ensure U.S. policy encourages vigorous investment in continually upgrading network capacity.

One visionary technologist recently compared the Internet to a Los Angeles freeway:

"Traffic jams happen," he wrote. "The more we upload and download and share:

- standard definition video,
- high definition video,
- home movies, and
- multiple megabit photos,

the more bandwidth we consume. The more PCs and servers we backup online . . . the more bandwidth we consume. The more bandwidth we consume, the more Internet traffic jams we have. The more Internet traffic jams we have, the worse our Internet applications perform."

Internet traffic is multiplying. Network traffic is now growing about 100 percent annually. Further acceleration is expected soon. Cisco CEO John Chambers predicts broadband video and other bandwidth-intensive applications will drive a four-fold to six-fold increase in network traffic over the next decade.

The answer is investment, not legislation that would discourage it.

I urge you to proceed with caution on proposals for government regulation of the Internet.

The CHAIRMAN. Well, thank you very much.

Our next witness is Jeffrey Citron, the Chairman and Chief Executive Officer of Vonage.

Jeffrey?

STATEMENT OF JEFFREY A. CITRON, CHAIRMAN/CEO, VONAGE HOLDINGS CORP.

Mr. CITRON. Thank you. Good morning, Chairman Stevens, Co-Chairman Inouye, and Members of the Committee. My name is Jeffrey Citron. I'm the chairman and CEO of Vonage Holdings Corporation, the largest Internet-phone provider in the United States. I am grateful for your invitation to address what I believe is one of the most important technology policy questions this Committee will face.

At root, the network neutrality debate is about who will control innovation and competition on the Internet. Will innovation be controlled by a few network operators, or will the Internet remain open, with minimal barriers to entry for entrepreneurs and garage inventors, alike?

Imagine if the electric company could dictate which toaster or television you plugged into the wall. Imagine if Pepco said, "Plug

in our pre-approved affiliated toaster, and your power will work great; but, if you don't, we can't promise the same level of service."

Of course this sounds ridiculous. Power companies don't care who makes our toasters or our televisions. We plug them in, and they just simply work. The power grid delivers the same level of service to every appliance, and, as a result, the market for appliances and consumer electronic devices is vibrantly competitive. The same should be true for the Internet.

Innovations enhance the value of networks. People buy broadband because applications like Vonage cut their phone bills in half, applications like Google improve their ability to find information on the Internet. Plain and simple, it's the applications that give the network its value, and the applications are driving demand for broadband.

As the Nation's leading Internet voice provider, with 1.4 million lines in service, Vonage offers subscribers Voice-over-IP phone service. Vonage and the VoIP industry are providing consumers with new choices for telephone service that the 1996 Telecommunications Act did not contemplate. It is innovation, not legislation, that created our service and brought this competition to consumers.

For Vonage, the discussion about net neutrality is not theoretical, but practical. The very existence of the Internet phone industry disciplines the prices traditional phone companies can charge. Because Vonage competes directly with the telephone service of the network operator that also provides high-speed Internet access, the incentives to discriminate against us are very clear. In fact, Vonage has already seen several smaller network operators block our service. Most recently, major phone-company executives have suggested that our service isn't going to work as well if we don't pay them an extra fee.

Now, as a businessman, I don't get, nor do I expect, a free ride on anyone's network, but the truth is, these network operators are already getting paid not once, but twice. Vonage pays network operators tens of millions of dollars every single year to transport our services over the Internet to our subscribers. On top of that, consumers spend billions of dollars a year every year to get access to these high-speed Internet connections. No one gets a free ride.

I'm also not suggesting that companies should not be able to offer a tiered service to subscribers. The power company charges more or less, depending on how much electricity or power is used. But the power my toaster uses and the performance my toaster gets does not come at the expense of my refrigerator. Once we have paid for it, the power company doesn't pick winners and losers.

In the same regard, customers already purchase varying amounts of bandwidth; however, it would be a disaster if a network operator were able to choose how much bandwidth the customers could use for a given application on their broadband. What would happen if, tomorrow, one of the network operators decided to block Google, Vonage, Yahoo!, or Amazon? What would be the legal recourse for applications that are being blocked or degraded by a network provider? The regulatory landscape has changed. If a network operator chooses to block these Internet applications, there does not appear any legal recourse. Innovation and competition would be left behind, with no possibility of due process.

Let me underscore this point. There is nothing in a statute or a regulation today that protects consumers or Internet application providers from potential network discrimination. I believe providing marketplace certainty to prevent discrimination is as important as taking actions once a problem already occurs.

Network operators maintain they will never engage in this behavior. If, indeed, that was the case, why can't we work toward a solution that ensures flexibility for network operators while preserving the openness for application providers? If the Bells are allowed to pick winners and losers amongst the vast array of services available on the Internet, I can guarantee one outcome. The customer will lose. The customer will always lose. The customer will lose choice, flexibility, and quality of service if the Bells can dictate how the Internet is used.

The Internet gives tremendous freedom to individual users and innovators. It has given consumers access to an unprecedented variety of content, services, applications, and devices. As entrepreneurs that use the Internet to change the way people communicate and conduct business, I am increasingly concerned that the inherent economic incentives of network operators will put the creativity from the Internet in serious jeopardy.

Can the government trust the phone companies to be the exclusive gatekeepers of innovation and competition on the Internet, given their history of anti-competitive practices and customer abuse? If you do not address this issue, the Bells will exclusively decide what you read, what you see and buy, and how you ultimately use the Internet.

I look forward to working with the Committee to ensure that the Internet remains an open and competitive foundation for innovation.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Citron follows:]

PREPARED STATEMENT OF JEFFREY A CITRON, CHAIRMAN/CEO, VONAGE HOLDINGS CORP.

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Innovations enhance the value of networks. People buy broadband because applications like Vonage cut their phone bills in half, and applications like Google improve their ability to find information. Plain and simple, it's the applications that give the network its value. And it's the applications driving demand for broadband.

As the Nation's leading Internet voice provider with 1.3 million customers, Vonage offers subscribers voice over Internet protocol (VoIP) phone service. Vonage and the VoIP industry are providing consumers with new choices for telephone serv-

ice that the 1996 Telecommunications Act never contemplated. It is innovation, not legislation, that created our service and brought this competition to consumers.

For Vonage, this discussion about net neutrality is not theoretical, but practical. The very existence of the Internet phone industry disciplines the prices traditional phone companies can charge. Because Vonage competes directly with the telephone service of the network operators that also provide high-speed Internet access, the incentives to discriminate against us are clear.

In fact, Vonage has already seen several smaller network operators block our service. Most recently, major phone company executives seem to suggest that our service isn't going to work as well if we don't pay them additional fees.

As a businessman, I don't get—nor do I expect—a "free ride" on anyone's network. But the truth is these network operators are already getting paid twice. Vonage pays network operators millions of dollars a year for Internet access to deliver our service to subscribers. On top of that, consumers pay billions of dollars every year to these companies for high-speed Internet access. No one gets a free ride.

I'm also not suggesting that companies shouldn't be able to offer a tiered service to subscribers. The power company charges more or less depending on how much power is used, but once we have paid for it, the power company doesn't pick winners and losers. In the same regard, network operators should be able to charge varying amounts for bandwidth, as they already do. However, it would be a disaster for future innovation to hand them the power to pick technology winners and losers.

What would happen if tomorrow one of these network operators decided to block Google, Vonage, Yahoo!, or Amazon? What would be the legal recourse of applications that are being blocked or degraded by a network provider?

The regulatory landscape has changed. If network operators chose to block these Internet applications, there does not appear to be any legal recourse. Innovation and competition would be left behind with no possibility of due process.

Let me underscore this point, there is nothing in statute or regulation today to protect consumers or Internet application providers from potential network discrimination. I believe providing marketplace certainty to prevent network discrimination is as important as taking action once a problem occurs.

Network operators maintain they will never engage in this behavior. If indeed that is the case, why can't we work towards a solution that ensures flexibility for network operators while preserving openness for applications providers?

The Internet gives tremendous freedom to individual users and innovators. It has given consumers access to an unprecedented variety of content, services, applications, and devices. As an entrepreneur that has used the Internet to change the way people communicate and conduct business, I am increasingly concerned that the inherent economic incentives of network operators will put the creativity from the Internet in serious jeopardy.

I look forward to working with this Committee to ensure that the Internet remains an open and competitive foundation for innovation.

Thank you Mr. Chairman.

The CHAIRMAN. Our next witness is Kyle McSlarrow, President and Chief Executive Officer of National Cable and Telecommunications Association.

Kyle?

STATEMENT OF KYLE MCSLARROW, PRESIDENT/CEO, NATIONAL CABLE AND TELECOMMUNICATIONS ASSOCIATION

Mr. MCSLARROW. Mr. Chairman, thank you very much for having me here this morning.

Lost in this debate sometimes is a simple reality, which is that Internet service is a relatively immature marketplace. Ten years ago, most of us had not even heard of an Internet browser. Five years ago, the phenomenon of peer-to-peer networking, with its huge implications for bandwidth consumption, was an unknown. It was only last year that the—for the first time, more American households had broadband than dial-up. Thus, the business models that are developing right now are really in their infancy.

Given the explosion of the Internet and its importance to our competitiveness, the creation of jobs, indeed, our quality of life, the

right call, I believe, is to let the marketplace develop, as it has, without government regulation. A very heavy burden should be placed on those who would have the government intervene for the first time.

I think we can all agree that consumers should have reasonable expectations from the companies that deliver high-speed Internet service to them. So, let me be clear, NCTA's members have not, and will not, block the ability of their high-speed Internet service customers to access any lawful content, application, or services available over the public Internet. As the FCC and Chairman Martin have noted, this commitment should be consistent with tiers, in terms of a customer-service agreement, and subject to an operator's ability to manage its network. As an association that includes programmers, as well as operators, we are also mindful that lawful access includes respect for the rights of content owners.

As the industry which largely created the residential broadband market with $100 billion of investment over 10 years, we fully embrace, and will seek to protect, a vibrant Internet. The world described by Senator Dorgan and others this morning, the goals of being able to pay for access and to get on Internet and go anyplace you want, that is the world we live in today, and that is the cable business model. So, we share the goals that have been set forth today. The issue is whether or not we should do something in statute to constrain how the marketplace develops.

Putting so-called "net-neutrality principles" into law may sound warm and fuzzy, but they are not neutral, in any real sense. They represent a choice and a departure, with serious consequences.

Mr. Chairman, in 2002 this Committee held a hearing in which proponents, including some who are here today, pushed the concept of net neutrality. And, at that time, some of those proponents were saying unless we did something, the Internet, as we know it, will end. And where are we 4 years later? Companies like Google have come out of nowhere to build a global empire with a market cap of over $100 billion or something close to the entire cable industry's market capitalization. And if you consider other companies which push net neutrality, like Yahoo! and Amazon.com, you're talking about some of the most successful companies on Earth. It is obvious that they were wrong 4 years ago. All of them have flourished. And the irony is that they have flourished, in part, because cable companies, telephone companies, wireless broadband providers have built a broadband infrastructure that supports their business model.

Right now, innovation is exploding down the broadband highway, and, perhaps unwittingly, proponents of net neutrality have chosen the right phrase: they would risk throwing all of that into neutral and freezing innovation and investment. And one has to ask why.

The large Internet companies have succeeded with the current network architecture, and have made an undeniably great contribution to our Nation. But who is to say what the next network architecture might look like? With net neutrality and little or no incentive to invest in capital-intensive networks, we will likely never find out. As some have noted, by not allowing experimentation you force all networks to compete only on size and price, and

that benefits only the larger players, limiting the types of competition and innovations that are emerging today.

Just as Google and Yahoo! have an incentive to invest, as they are now, in new broadband platforms like broadband over power lines or Wi–Fi, broadband providers have incentives to invest in entrepreneurs who have a new application which might compete successfully with today's Internet market leaders in order to bring more customers to the network.

What is really going on here is that companies that started as entrepreneurs and innovators are now so invested in the status quo that they fear not cable or telephone broadband providers, but that next idea, that next search engine that takes off. What they are asking you to do is freeze the Internet in place with their position in the marketplace locked in. There are many possible outcomes of doing so, but the one thing I am confident of is that it would not be the consumer who benefits.

Mr. Chairman, thank you. I look forward to answering any questions you have.

[The prepared statement of Mr. McSlarrow follows:]

PREPARED STATEMENT OF KYLE MCSLARROW, PRESIDENT/CEO, NATIONAL CABLE AND TELECOMMUNICATIONS ASSOCIATION

Good morning, Mr. Chairman and Members of the Committee. My name is Kyle McSlarrow and I serve as the President and Chief Executive Officer of the National Cable & Telecommunications Association. NCTA is the principal trade association for the cable industry, representing cable operators serving more than 90 percent of the Nation's cable television households and more than 200 cable program networks. The cable industry is also the Nation's largest broadband provider of high speed Internet access after investing $100 billion over ten years to build out a two-way interactive network with fiber optic technology.

I would like to focus this morning on three main points.

First, Congress's policy of leaving the Internet unregulated has been a resounding success. The resulting *network flexibility* has encouraged billions of dollars in investment. Companies that include high speed Internet services among their offerings have the freedom to experiment with multiple business models, producing more choices and competition in content and providers for consumers, and more innovation than ever before.

Second, any change to this policy could have serious repercussions to continued network innovation and investment. Government, by its nature, is ill-equipped to make judgments about the best business models for an industry. This is especially true for a business as dynamic as the provision of high speed Internet services. It is clear that how those business models develop will directly affect the level of investment and innovation we can expect over the next few decades, but no one today can predict which business models will most effectively promote those goals.

Finally, in the absence of any problem calling for a legislative solution—and since the broadband services marketplace is characterized by robust competition—Congress should refrain from premature legislative action and allow the marketplace to continue to grow and change so network and applications providers can offer consumers the fullest range of innovative service options.

Congress's Decision to Leave the Internet Unregulated is an Unquestioned Success

Keeping the Internet free of regulation has helped to spur tremendous investment and competition in broadband networks and services. Left free to create new business opportunities and services, broadband providers (including cable operators, DSL, satellite and wireless operators) have invested billions of dollars to bring high-speed Internet access services to consumers across the nation. With bandwidth usage growing at a rapid pace, continued investment will be needed to keep broadband services robust.

If broadband providers are to continue to make these investments, and if consumers are going to be given the levels of services and innovative new products and features they desire, all at prices they can afford, broadband providers need to have

continuing flexibility to innovate in the business models and pricing plans they employ. Likewise, websites and content providers also need the flexibility to experiment with business models, and to partner with broadband providers in doing so.

Many so called "net neutrality" proposals, however, would seek to specify today which business models are permissible, and which ones are not, both for broadband providers and for website owners and content providers. They would impose by government fiat outcomes that are better left to the marketplace. This is especially so where that marketplace is highly competitive, where no real world problems needing a solution have been identified, and where the pace of technological development is breathtaking. There can be no better circumstances than these to leave it to the marketplace rather than government to be the regulator.

It is far too early for us—or you—to predict which business approaches will succeed in the long run. Any attempt to do so runs the unintended, but high, risk of promoting an approach that fails in the market. By the time the law catches up to the market, it will be too late to recapture the momentum that characterizes broadband today. The hands-off policy has given us the flexibility to innovate and respond to consumer demand. Abandonment of that policy will undermine—not promote—consumer choice.

Internet Regulation Will Direct Resources to Litigation, Not Innovation

Attempts to impose such requirements on broadband network providers also would lead to endless and expensive litigation. Even assuming appropriate regulations could be written—and because this is an area of rapid technological change, we do not think that assumption is warranted—they would still lead to uncertainty as to their actual application. They would also lead to the creation of a new bureaucracy to apply such rules and add layers of additional costs for dealing with the regulations and bureaucracy.

Such costs might be undertaken were there real world problems that needed government intervention to remedy. But again, where no one has yet identified such problems, where such regulations would likely increase costs and stifle innovation, and where there is a vigorously competitive marketplace, one has to ask the question, why take such an enormous risk?

Thank you again for inviting me here today. I would be pleased to answer any questions you may have.

The CHAIRMAN. The next witness is Earl Comstock, President and Chief Executive Officer of COMPTEL.

Earl?

STATEMENT OF EARL W. COMSTOCK, PRESIDENT/CEO, COMPTEL

Mr. COMSTOCK. Thank you, Mr. Chairman and Members of the Committee. It's a pleasure to be here today.

I think it's quite fitting that it is almost 10 years, to the day—tomorrow will be the 10th anniversary of the 1996 Act, which many of you spent a lot of time on, and I did, as a staffer. And I think it's quite fascinating to hear the views that are being expressed today. What no one has mentioned is that the Internet today succeeded because of decisions that Congress made in 1996.

And I think it would be very instructive for the Committee to go back and review two reports that the General Accounting Office, at the time, now the General Accountability Office, put out and sent to every Member of Congress, one in September 1994, one in January 1995. What's fascinating in reading those reports—and I just reread them over the weekend—is that much of what's being discussed today was being discussed then.

With all respect to the other witnesses, we did talk about Voice-over–IP. We did talk about the Internet. Many people forget there were was an entire title of the 1996 Act having to do with Internet pornography, so it's fascinating to me that we knew nothing about

the Internet, yet the members were prescient enough to look at Internet pornography.

So, clearly, people did know about the Internet. We called it the "Information Superhighway," back then. And the only thing that wasn't really firmly planted was whether or not TCP/IP was going to be the victor in the marketplace, or whether it would be, what the Bells were pushing, which was called ISDN, integrated services digital network.

But that same fight, the ISDN fight versus the TCP/IP fight, is instructive for today. What the Bells are doing, and what the cable companies have already done, is engineer their networks to create scarcity so that they can then manage the network in a way that favors their content and services.

Today, the Internet2, which you'll hear from later on today, they are building the next-generation network. They have been since 1995. And what they discovered, through their own research, looking at this question of quality of service which you hear a lot about, is that the answer to quality of service is bandwidth. And the reality is that you don't need quality of service, that what you want is an Internet that does precisely what Mr. Cerf said, it's very simple, it's very robust, in that sense, it doesn't favor one service over the other, it's all best efforts. And as long as you have the bandwidth, that's not a problem. Other countries today—consumers in other countries today can get 100 megabits-a-second. Millions of university students today can get 100 megabits-a-second. And all of you know universities are not rolling in cash, yet they're able to come up with the ability to get to the desktop in dormitories, just like a small community, 10 megabits, 100 megabits, and sometimes more.

So, it's just fascinating to me that we're reinventing the wheel here, and once again you're being presented with promises. I will say, the Bell companies seem to be the best at making the promises, and the worst at keeping them. If you review many of your States, if you look back, they promised to build out a broadband network 12 years ago. In California, for example, they committed to building out a network by 2005 that was going to get 45 megabits to every consumer. They haven't met that promise, not by a long shot. I think there's something in Senator Boxer's front office, a press clipping about that. So, we've heard these promises before.

I think you should take credit, too, for the success of the 1996 Act. Cable was deregulated on price in the upper tier in exchange for building out a broadband network. They have largely succeeded. According to their own statistics, now more than 105 million homes are capable of receiving broadband—or, rather, they pass 105 million homes, and 88 percent of those are capable of receiving broadband.

Now, the question—you know, somebody made the statement that we're 16th in broadband deployment. We're not 16th in broadband deployment by that statistic. We're far ahead of most nations of the world. We're 16th in broadband penetration. And so, the point that you need to keep in mind here is, the Internet was built on a framework called "common carriage." It assured interconnection, reasonable access to service, attachment of devices.

These are all critical elements that are not being addressed by the FCC today in their net-neutrality program.

And so, we have been successful. There was a framework in 1996. Is it time for a few changes? Absolutely. Things like the cable section could probably be gotten rid of if we had bandwidth in the home. You could do cable a la carte. We can do telemedicine. And this is about the future. But all I can say, looking back from the 1996 Act and that experience is, we still don't know, today, until some various court cases are settled, what the final shape is of that Act, based on the FCC and the court's interpretations. So, whatever you do now, it's not going to be about 2007 or 2010. It's going to be about 2015 or 2025. So, you really have to look down the pike. And I do think you should look back very carefully over the promises and commitments that have been made by the network operators, particularly the Bell companies, and how they've done it. And this is a fight about who's going to control innovation. Is it going to be controlled by a few network operators, the gatekeepers on the Internet, or is it going to be controlled by the devices at the edge, and, therefore, allow innovation throughout the country?

Thank you.

[The prepared statement of Mr. Comstock follows:]

PREPARED STATEMENT OF EARL W. COMSTOCK, PRESIDENT/CEO, COMPTEL

Mr. Chairman and members of the Committee: My name is Earl Comstock and I am the President and CEO of COMPTEL. COMPTEL is a non-profit trade association that was formed by the merger of three trade associations, each of which represented segments of the competitive communications industry. Today COMPTEL has 180 voting member companies and stands as the only trade association representing a broad cross section of the competitive industry. Our members are taking action to advance communications through innovation and open networks, and are responsible for introducing many of the innovative services that consumers and businesses take for granted today.

Introduction

It is a pleasure to be here to testify about the concept of "net neutrality" and its role in any potential rewrite of our Nation's communications laws. As a former staff member I worked for the Chairman and this Committee on the last major rewrite effort, the Telecommunications Act of 1996. Tomorrow marks the 10th Anniversary of the enactment of that Act, and it is instructive to reflect back on that effort as the Committee considers once again an overhaul of our Nation's communications laws.

What the history of the 1996 Act tells us is that this new rewrite should be concerned with what the legal landscape will look like in 2015 or 2025, and not in 2007. It is 10 years since the 1996 Act was enacted, and we are only now seeing the final shape of how the FCC and courts interpret what Congress crafted. As a result, the Committee needs to look well into the future as it drafts any rewrite.

The key to a successful rewrite will be how well Congress articulates what it wants our Nation's communications infrastructure to look like 10 or 20 years hence. Does Congress want an even better Internet, two competing cable systems, or something else? Much of what that vision looks like will be decided by how Congress approaches the issue of net neutrality. The challenges presented are immense, but there also great opportunity. The convergence of technologies that was much anticipated in 1996 is finally happening, and that gives Congress a real opportunity to consider significant changes in our communications laws.

For example, fiber optic networks have almost unlimited capacity. If consumers are given access to the kind of broadband speeds fiber and coaxial cable allow, Congress could eventually eliminate the cable provisions of the current law almost entirely. Must carry and program access requirements, for example, would no longer be needed if consumers can get 100 megabits per second, as Internet2 now delivers to desktops at universities around the country and consumers in Stockholm and Tokyo can already purchase. With that kind of capacity consumers could go directly to Disney.com and download whatever movie or HDTV program they want. Like-

wise, consumers who wish to watch the Olympics could go to NBC.com or could watch in a foreign language by going to the website of a local TV station that is covering the event. Basically, consumers could get content a la carte by going to the website of the content producer.

Computers and high-speed networks can allow America to stay at the cutting edge of the Information Age. Our economy is increasingly service oriented, and new information services based on computer applications are a critical driver of our future growth. If businesses and consumers have access to reasonably priced transmission capacity, then any person can invent the next Google, Amazon, eBay, or Yahoo! and hope to succeed. If rural areas can get access to adequate transmission capacity, then rural States and communities can share in that economic opportunity and growth.

Whether or not America will continue to be a world leader in the 21st century's Information Age economy will depend in large measure on how Congress rewrites the law. The Federal Communications Commission has recently made significant changes to the structure of our Nation's communications laws through its interpretation of the 1996 Act. As a result, Congress has a basic choice to make. In rewriting the law it can reaffirm the common carrier policies that led to the creation of the Internet and the tremendous explosion of innovation and growth that accompanied the Internet, or it can reaffirm the FCC's recent decision to abandon those policies and trust that the private business interests of a few network operators—namely the Bells and the cable companies—will protect consumers, provide access to competing content and service providers, and enable the next generation Internet to be built. If history and basic business behavior are any guides, the approach taken by the FCC will prove catastrophic.

The Internet Depends on a Common Carrier Framework

The FCC's new approach will prove catastrophic precisely because the Internet depends on basic common carrier rules to ensure the availability of an essential ingredient, namely the transmission capacity over which Internet applications reach businesses and consumers. Those basic rules required all common carriers—incumbents and competitors alike, to provide non-discriminatory service upon reasonable request, to permit attachment of devices to the network, and to interconnect their networks with other operators on a non-discriminatory basis. Without these basic requirements, the net neutrality principles that the FCC has articulated to protect the Internet fall well short of that goal, and the robust competition in information services that has been the hallmark of the past 25 years will soon diminish to a shadow of its former grandeur.

This rewrite will in many senses determine America's economic future. Communications is increasingly at the heart of America's economy. Companies depend on communications networks to offer content and services to consumers, advertise, manage inventory, and transmit voice and data between locations. Today everyone takes for granted that they will be able to buy transmission services and use those services without interference. That is no longer the case under the FCC's new approach, and will not be the case if the similar approaches taken by S. 1504 or S. 2113 are enacted. Under all three approaches, no longer will AT&T, BellSouth, or other companies that use public resources be required to act as common carriers with an obligation to offer non-discriminatory service upon reasonable request.

Without that obligation, network operators like AT&T will be able to refuse service to, or discriminate against, anyone offering competing content or services, just as the cable operators do today. The CEOs of the various Bell companies have already been saying publicly how they intend to do just that—namely that the Bell companies will decide who can get content or service delivered via the Bells' "higher" quality "private" networks.

This will cause a radical change to the Internet and the information services market. Information services—the content and services made possible by computer applications—all depend on transmission networks to reach consumers. The information services market has been robustly competitive—with tremendous innovation as a result—because the FCC in 1980 required all public network operators (incumbents and competitors) to provide their transmission services on non-discriminatory terms and conditions. By regulating the much smaller class of transmission networks—which everyone needed to compete—the FCC did not have to regulate anyone's provision of information services. By reversing that decision the FCC now makes it possible for the small class of network operators to become gatekeepers on the Internet and dominate the larger information service market.

The FCC's Reliance on Inter-Modal Competition is Not Well Founded

The FCC's reversal is predicated on a flawed assumption, namely that the barriers to entry for transmission networks are so low that anyone who wants to compete can build their own network. Nothing is further from the truth. The truth is that all three of the ubiquitous wired networks—telephone, cable, and power—were built in a monopoly environment. The builder was protected from competition by law, and could build their networks with the assurance that they would get every customer. Each of those entities is now entrenched in their market with ubiquitous facilities and more than 80 percent of the customers, and therefore a substantial revenue stream. Further, to improve their transmission capability incumbents merely have to upgrade existing infrastructure using ongoing customer revenue. In contrast, in the absence of any rules requiring sharing of existing infrastructure, a new entrant has to build new facilities with no customers and no revenue, and then has to win its customers from the incumbent. That is a very high barrier to entry.

The FCC points to wireless and powerline operators (both of which have significant facilities) as potential competitors. But an examination of the facts regarding broadband over powerline (BPL) and wireless make clear they are not real competitive threats for the foreseeable future. First and foremost, there is the empirical evidence. The U.S. is not the only testing ground for new technology. Nowhere in the world are BPL or wireless being commercially used as the primary means for data or video communications. In the U.S., the latest FCC report on broadband shows that wireless, BPL, and satellite account for less than 3 percent of the market, and that their share of the market is actually declining. The reality is that there are significant technical difficulties that remain to be resolved with BPL, and you also need significant investment to deploy the needed facilities.

Likewise, a review of the empirical evidence shows that wireless is a complement to wired services, and not a replacement. First and foremost, wireless services are more expensive on per-minute (in the case of voice) or per-byte (in the case of data) basis. People are willing to pay more for wireless because of the mobility, but almost no one uses wireless to replace wired service where wired service is an option. The number of business users that rely entirely on wireless is limited to those that can only get service by satellite, and in the residential market fewer than 5 percent have chosen wireless only.

The FCC also likes to cite WiMax (a wide area wireless network standard) as a potential wireless competitor providing broadband service. Again, the facts don't support their enthusiasm. WiMax, which like BPL and fixed wireless many of COMPTEL's members are seeking to use, has numerous barriers to entry that must be crossed. First, a final standard needs to be agreed to. Second, any competitor needs to obtain spectrum rights, which must be acquired at auction. Third, they would need to build out a network. Fourth, any customers they gain must be won over from a Bell company or a cable company. And finally, this must be done in the face of competition from incumbent wireless companies owned by the Bells.

Put simply, the FCC is betting America's future on the good will of the Bell companies and large cable operators. Counting on companies to act in the public good against their own financial interest has been tried before, and it has never worked. The FCC believes that robust competition between these two entrenched incumbents will ensure that unaffiliated content and service providers will continue to get access to consumers. Yet in the 10 years since the passage of the 1996 Act not one large cable company has voluntarily let any competitor offer competing service over its network, and not one Bell has voluntarily negotiated an interconnection agreement with a cable company or competitor. The reason is understandable—no CEO is going to voluntarily help a competitor. It is only laws that can make that happen.

Net Neutrality is Fundamental to Preservation of the Internet

The need for laws is where the concept of net neutrality comes in. "Net neutrality" is short for network neutrality, and is a concept that is much debated these days in connection with communications law reform. However, it is often not clear exactly what is meant by net neutrality. Depending upon who is speaking, views of net neutrality range from the cable and Regional Bell companies view of the concept as "a solution in search of a problem" to the view of many consumer groups, competitors, and content providers (companies like Google, Amazon, and eBay) that net neutrality is the key to preserving the future of the Internet.

So, precisely what is net neutrality? Net neutrality is generally discussed in two basic ways. One approach, the one taken by the FCC and S. 1504, focuses on a consumer's ability to access any lawful content and services. Under this approach, a retail end user is entitled to access any lawful content and services using their own devices, and the debate is generally focused on what steps, if any, need to be taken to ensure that consumers can in fact access whatever content and services they

chose. A fundamental limitation of this approach is that it only addresses consumer rights, and not the rights of the content and service providers. As a result, a fundamental assumption built into this approach to net neutrality is that there are no issues associated with the ability of content or service providers to get on the network to offer their services.

The other approach, the one taken by network engineers and academics since the Internet was first being developed in the 1980s, focuses on the role of the transmission network. The key concept of the neutral network approach is whether or not the network is "neutral" with respect to the content or services being sent over the network; i.e., is the network simply a "dumb" pipe that carries information controlled by end users or does the network operator play an "active" role in controlling content and services through "intelligence" (equipment) that interacts with the content and services sent over the network. At the heart of this view of net neutrality is a debate over where innovation will occur with respect to the content and services provided over the network. Does innovation occur at the "edge" of the network through devices attached by both business and residential end users, or does it occur through devices controlled by the network operator in the "core" of the network? A fundamental advantage of this approach is that it looks both the ability of consumers to access content and services and the ability of persons to offer content and services. By doing so, this approach also brings in the fundamental common carrier elements that ensure access to the network for both consumers and providers.

How Congress chooses to address net neutrality will greatly influence the shape of broadband networks and services in America. If Congress looks at the problem narrowly, as the FCC and S. 1504 have done, then they likely will fail to prevent discrimination if that is their goal. The reason is because the consumer approach deals only with prevention of discrimination once a network operator has agreed to provide service to that consumer. If the network operator is under no obligation to provide service (as is the case with the FCC approach and that taken by S. 1504), then the operator can legally discriminate by simply refusing service. Further, this narrow consumer approach fails entirely to deal with the much more likely, and historically more prevalent, forms of discrimination, namely discrimination against competitors or potential competitors.

A network operator that is under no obligation to interconnect their network with other networks or allow attachment of devices on reasonable terms and conditions has every incentive to refuse interconnection or attachment if by such refusal the network operator can thwart a competitor. The network operator can also discriminate in more subtle ways than outright refusal, for example by using bandwidth starvation. Indeed, several different Bell company officials have already suggested in the press that they intend to create a two-tier Internet using bandwidth allocation in which their network will be given priority through the use of Quality of Service management techniques. If Congress allows network operators to take these steps, history will have reversed itself. The common carrier open network requirements that led to the Internet will no longer be in place, and innovation will depend on having the cooperation of the network operator. As a result, the potential to have a world in which consumers can access any content, including HDTV and other high bandwidth services, will disappear.

There Are Many Ways Network Operators Can Discriminate

There are many ways in which a network operator can discriminate. As a result, the concept of net neutrality must deal with each of them. Some, like bit discrimination and port blocking, are addressed by both the narrow FCC approach and the broader neutral network approach. However, the FCC approach stops there, far short of what is needed. To ensure that the Internet we have today continues to grow and flourish, there are several other discriminatory tactics that need to be addressed. These include:

Attachment of devices is a concept that refers to the ability to attach devices to a transmission network. Telephone network users generally have the right to attach any device to the network without obtaining the network operator's permission so long as the device will not harm the network or other users of the network and conforms to certain minimal specifications. In contrast, cable network operators can control what kind of devices are allowed to attach to their network, and that is the reason there is limited competition in set top boxes and cable modems and why many cable users still rent their devices. The ability to attach devices without approval or interference from the network operator is essential for continued innovation.

Bit discrimination is a term used to describe actions by the network operator to either favor its own content and services or to degrade the content or services of

other providers by using information conveyed in the individual bits of a message to identify which messages to favor or degrade. Bit discrimination can be accomplished in any one of several ways. A network operator could, for example, instruct its routers (machines which direct the flow of information to its destination) to delay all traffic bound for Google.com by sending it to another network operator rather than carrying it directly to the address. In the alternative, the network operator could use the sender's address to favor its own services by instructing its routers to give priority to all packets that originate from a Verizon.net address.

Port blocking is a term used to describe a specific form of discrimination in which the network operator uses information in the message header which tells the receiving computer which software application to use to open the information. The computer knows which software to use by the "port" through which the message enters the computer's communications hardware. If a network operator wishes to block a particular application, for example a Voice over Internet Protocol (VoIP) telephone call, it can do so by blocking messages destined for the port used by that application.

Quality of service is a term that is generally used to describe service offerings in which the transmission component is managed with respect to bandwidth, latency, jitter, priority, or other technical aspects of the transmission in order to ensure the quality of a particular service offering. Quality of service (QoS) is used to differentiate service offerings from the baseline standard for Internet transmissions, which operate on a "best-efforts" basis. In cases where bandwidth constraints or other factors result in congestion in the transmission network, QoS can be used to prioritize the delivery of certain types of services (for example VoIP or video services).

Many network operators are attempting to market QoS as an alternative to the "best efforts" approach of the Internet. Best efforts means that all traffic has the same priority, and the network uses its best efforts to deliver all of the traffic. The problem created by QoS is that it requires additional protocols and network management software in order to provide it, thus increasing the cost and complexity of the network.

Perhaps more importantly, QoS negates one of the key benefits of the Internet, which is the use of a common protocol (IP) to allow unimpeded transmission across multiple networks. When QoS is added, it helps balkanize the Internet because transmissions across multiple networks require cooperation among the network operators to ensure that each is using the same QoS protocols. Six years ago Internet2 (an organization tasked with designing and testing next generation Internet technologies) took a close look at QoS technology, and concluded that the cheaper solution to congestion problems was to add bandwidth and continue to use best efforts.

Bandwidth starvation is a term used to describe actions by a network operator to degrade or block applications or services by limiting the bandwidth (capacity) available to provide those services. One way to think of bandwidth starvation is in terms of trying to drink through a straw instead of a garden hose. Bandwidth starvation can be accomplished in a number of ways. At the consumer end, network operators can limit the upstream (sending) capability of user equipment in order to prevent consumers from providing content to other users, or can limit the bandwidth available for downstream content in order to prevent consumers from being able to access competing content. Examples of this would be limiting upstream transmission so that large bandwidth transmissions like digital video content takes much longer to send, thus limiting consumers ability to send movies, or limiting downstream transmission so that video streaming can't compete with the network operator's cable offerings. On the network end, the network operator can create bandwidth starvation by limiting the capacity of its interconnection points, so that content coming from a competing network provider has to squeeze through a narrow choke point, or by creating a two-tier network (as some Bell company officials have proposed) where the bulk of the bandwidth is reserved for the network operator's "private" network and remainder is allocated to the "public" network.

Interconnection is a term used to describe the physical linking of two transmission networks. The Internet is a series of interconnected transmission networks that all use a common addressing protocol (the Internet Protocol or IP) to facilitate seamless transmission across the disparate networks. The primary issues with respect to interconnection are the bandwidth (capacity) of the interconnection and where the interconnection will occur. If the connection between the two networks is too small for the amount of traffic being sent from one network to the other, congestion will occur and transmissions can be degraded or lost. Likewise, if a network operator can only interconnect with another operator at a single location or at distant locations, congestion and/or degradation can occur because of the concentration of traffic across a single point or the additional distance traffic must travel. Historically, if

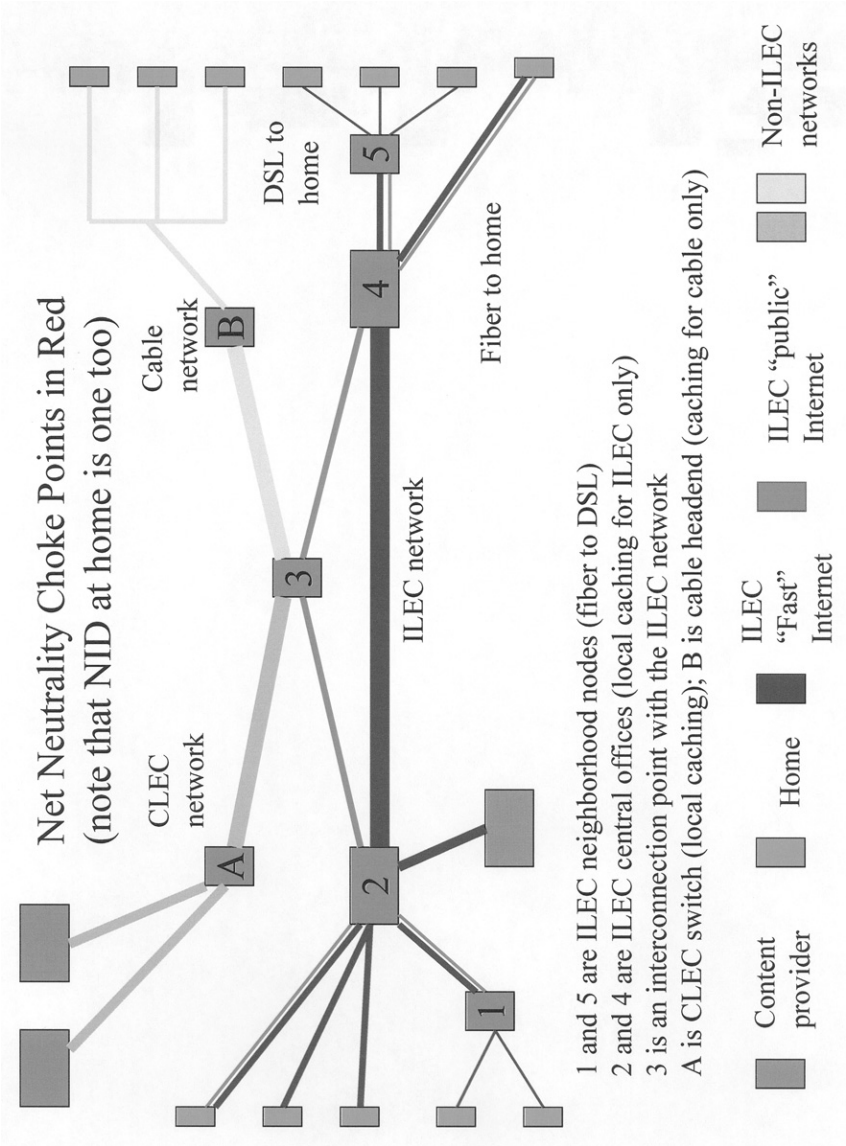
a network operator is under no legal obligation to interconnect its network, voluntary interconnection rarely occurs.

Caching is a term that refers to the local storage of information that is frequently requested by an end user. By storing frequently accessed information, in particular large files like pictures or graphics, at a local storage site near the end user, caching allows the content provider to reduce network congestion (to the extent there is any) and reduce the time needed to run an application (for example, web pages appear faster and file downloads take less time). Caching arises as an issue in net neutrality discussions in two ways. First, because caching must be done on devices located closer to the end user, in general these devices are physically located in a facility under the control of the local network operator (for example in a central office or a cable head end). In the alternative, if the caching is done at a physical location not under the network operator's control, then the local storage device needs to be interconnected with the local network. As a result, in the absence of a right for competitors to physically collocate equipment or to interconnect with a local network, a network operator could use local caching to favor their own content and services.

Each of these potential discriminatory actions by themselves would be sufficient to seriously inhibit, if not prevent entirely, competition in the provision of information services. The *attached diagram* illustrates the many different potential choke points that can come into play in the absence of strong net neutrality requirements. Interconnection issues occur at the incumbent local exchange carrier (ILEC) central offices (numbers 2 and 4) and at the interconnection point with the ILEC network (number 3). Bandwidth starvation is illustrated by the narrow red "ILEC public Internet" lines connecting homes to the central offices and the central offices to the interconnect point. The broader blue pipes of the ILEC illustrate how the ILEC reserves more capacity for itself and its service offerings.

Conclusion

To prevent the discrimination that is at the heart of net neutrality concerns, Congress should maintain the basic legal framework that made the Internet possible. Under that framework any network operator that built transmission facilities used to provide service to the public was obligated to provide non-discriminatory transmission service upon reasonable request, to allow attachment of devices, to interconnect their network with others on reasonable terms and conditions, and could not interfere with content or services sent over their networks. Congress needs to affirmatively overturn the FCC and require that this framework stay in place. If and when competitive markets in fact develop for transmission services, then there will be no need to remove the requirements because the market will dictate similar behavior. As history has repeatedly demonstrated, it is only those who can discriminate who object to a requirement that they not do so. Net neutrality is no exception. In the interests of preserving America's leading role in the Information economy, Congress should include net neutrality requirements that preserve access and prohibit interference in any rewrite.



The CHAIRMAN. Thank you very much.

I've got to say, the five of you have given us statements that I think I personally could sit here and ask you questions for 2 hours, and still not be finished. But we do thank you all for coming, and thank you for the times that you've spent with us in trying to really figure out what to do about this proposal to change the 1996 Act.

If there's no disagreement, we'll limit ourselves to 5 minutes. We've got another panel coming. And I would urge members to stay within the time frame.

Mr. Cerf, why doesn't it make sense for a company like Google to invest in broadband pipes to ensure delivery of content?

Mr. CERF. I'm sorry, "When does it make sense for Google to"—I wasn't hearing you, Senator.

The CHAIRMAN.—invest in their own——

Mr. CERF. Oh, to invest.

The CHAIRMAN.—pipes for delivery of content, broadband pipes. Why wouldn't you do that?

Mr. CERF. In fact, Google does invest in broadband facilities, but it does so to build its own internal network in order to connect all of its computer centers together. We interconnect to the rest of the Internet in order to interact with consumers, people who use the Google services. We've been relying on the telcos, the cable companies, and others all around the world to service those customers. Despite the market cap, we're not in a position to build broadband throughout the world, but our constituencies, our users, a billion of them, are everywhere. So, it doesn't make sense for us to try to build the entire broadband network for the whole world. What we're trying to do is to build the system that will service those people through others who already are making money out of access—building access to the Internet.

The CHAIRMAN. You've got a magnificent search engine out there. There's no question about that.

Mr. McCormick, we've got some testimony that suggests that network providers could offer more capacity if they wanted to. Are any of your companies limiting capacity just to restrict access?

Mr. MCCORMICK. Absolutely not. We are not, in any intentional way, limiting capacity to restrict access. Just the opposite. We're looking to build new networks and to capitalize the investment that will allow us to build those new networks. And the question that we constantly get from investors is, "Well, why in the world would you build a network?" Are you able to offer movies? Google's going to—talking about offering movies. Vonage is talking about offering voice without a network. In fact, Google could offer movies without a franchise. But woe unto our companies if they build a network and want to offer video. Then you have to get a franchise, or subject yourself to other regulations.

So, the question we constantly get is, "If you're going to expand to these networks, how are you going to earn a return on that investment?" And with America being 13th in the world in broadband deployment, one of the big public-policy questions that faces this Congress is, how do we incentivize, how do we reward, investment in networks? How do we encourage investment in networks?

Our companies, as you know, are investing. Verizon is spending over $20 billion to build out the FiOS network. So, we are investing, and we are looking for new ways of being able to capitalize that investment.

The CHAIRMAN. Well, that wasn't quite my question, but I, again, say, Are you attempting, in any way, to limit, artificially, the capacity to prevent others from having access?

Mr. MCCORMICK. No, Mr. Chairman, and we will not artificially limit capacity, nor will we block or impair or degrade any content, any service, or any application.

The CHAIRMAN. Thank you.

Mr. Citron, I have been told that there was one company that blocked the ability of end users to subscribe to VoIP. And there was a consent decree that said that that could no longer take place. Are any U.S. providers, other than that one, blocking the ability of end users to subscribe to VoIP?

Mr. CITRON. Sure, Chairman. First, on the case of the provider who blocked us, Madison River, that occurred prior to the deregulation of DSL services. So, should Madison River re-engage in blocking, today, the FCC may not be able to act appropriately to stop them from doing so.

As it relates to other providers blocking our services, yes, we do come, from time to time, across small providers who do block or degrade our services purposely, either explicitly or implicitly, and we do contact those network providers to try to provide workaround solutions for our customers. In some cases, there's no workaround, and the customer cannot subscribe to our service.

The CHAIRMAN. I really don't have time to ask another question. I'm sort of reminded of my own history, when we, up our way, in the oil patch, had people build pipelines, and some other companies came along and made discoveries and wanted access to pipelines. We're—aren't we entering the same situation here, in terms of your industry now, that there has to be someone, FCC probably, that has greater power to be the umpire, rather than a gatekeeper?

Earl?

Mr. COMSTOCK. Well, Mr. Chairman, I just want to comment. I think you heard testimony from Mr. McSlarrow talking about the $95 billion—he called it $100 billion—that the cable industry has spent since 1996 upgrading their networks. And to respond to your question on Google, the point is, no one is going to build new ubiquitous broadband infrastructure in this country when there are already two wireline infrastructures reaching every home.

And, you know, you've heard mention by Mr. McCormick that Verizon's spending $25 billion. Well, the interesting thing is, this—these are evolutionary expenditures. They're not building a new network, they're upgrading an existing network with an existing revenue base from their customers.

And just to give you an idea, in the case of Verizon this is not a risky investment. They keep talking about Wall Street. They claimed more in depreciation for every year in the past 5 years than they're planning on spending in 2005. They're actually disinvesting, as an accounting matter, relative to their wirelines facilities, including fiber. So, they claim more in the depreciation in the value of their asset——

The CHAIRMAN. I'm over my own time. Sorry about that.

[Laughter.]

The CHAIRMAN. Senator Burns is gone. Senator Dorgan?

Senator DORGAN. Mr. Chairman, first of all, I was on this Committee in 1996, with you and others, when we wrote the legislation. And, Mr. Comstock, I think you're right, I think that there are things that we ought to legitimately take credit for in the 1996 Act. Some things have worked the way we expected, some not, perhaps. But we did, in fact, anticipate advanced telecommunications services—i.e., broadband—in fact, we wrote the provisions dealing with

universal service, not just for basic service, but for advanced services, identical services at comparable prices through universal service to bring the charge down. But I—5 minutes is hardly justice. I understand why you have to do that, Mr. Chairman, but these witnesses have provided just, I think, excellent testimony giving us an excellent sample of what the issues are.

Mr. Cerf, you talked about other countries. And I think Mr. Comstock also described this issue of us ranking 16th. You know, we're 41st in life expectancy, by the way, in the United States. But we're 16th in——

[Laughter.]

Senator DORGAN.—we're 16th in broadband—penetration. Is that right?

Mr. CERF. Yes, penetration——

Senator DORGAN. Penetration. Sixteenth——

Mr. CERF.—it may pass many homes, but not everybody is taking it.

Senator DORGAN. All right. So, a number of other—16 other countries have done better than we have. Tell me about the record with respect to those countries and the preservation of net neutrality.

Mr. CERF. My impression is that all of those countries have very open networks. There are no constraints with regard to who is allowed to put content onto the network or implement applications.

I might point out that we could learn something from the United Kingdom. There is a comparable agency—it's called Ofcom, which is like the FCC—they've taken a very strong position that the underlying broadband system is a transport medium and should be distinguished from any of the applications that run on top.

British Telecom, for example, offers wholesale access to their broadband facilities, with no constraints, and then they also offer advanced services on top of that, through which they compete with others for customers. But the underlying transport system is open. Every one of those systems, as far as I am aware, is financially sound.

Now, I'm just an engineer, so I suppose asking accounting questions of an engineer is—you get the answer you deserve. But to be quite honest with you, my impression is that these organizations have found a way to make this a going concern.

Senator DORGAN. Well, Mr. Cerf——

Mr. CERF. So, I am a little confused why we can't do it here.

Senator DORGAN. I'm sorry, I didn't—just didn't want you to take the entire 5 minutes.

[Laughter.]

Senator DORGAN. Let me say, the—Mr. McCormick and Mr. McSlarrow and others have talked about encouraging the investment in the networks. Now, I'm—I understand that point, because I believe, from the last information that we had from the FCC, 49 percent of North Dakotans, my home State, have access to only one broadband provider.

Mr. CERF. Right.

Senator DORGAN. So, half of the people don't have any choices, no competition with respect to—so, I'm sympathetic to the notion of investments in network; however, I'm not sympathetic to that

issue, relative to destroying what I think is basic uninhibited freedom on the Internet—freedom of content, freedom of choice.

And I mentioned earlier that I have had both DSL and also cable broadband, and I paid for both, on a monthly basis—still do—paid on a monthly basis. So, that—I might ask both of you to comment. "A Verizon executive says Google is freeloading." No, no, I'm calling up Google as a search engine, because I happen to like Google, and I pay a monthly fee in order to be able to do that over an Internet service provider. What's wrong with that?

Mr. MCCORMICK. There's absolutely nothing the matter with that. And, as I said in our testimony, we will not block, impair, or degrade any content, service, or application. The High-Tech Broadband Coalition, several years ago at the FCC, espoused principles that say any consumer should be able to access lawful content of their choice, there should be no impairment of competition among providers on the networks, they should be able to connect any devices of their choice, they should be able to run applications of their choice. We absolutely agree with that.

I wasn't privy to those comments, so I don't know what context that Verizon official's comments were made, but I do note that an awful lot of this debate occurs in hypotheticals. What if Google wants to offer movie services that use up enormous bandwidth? What if the telephone companies want to start blocking? How will people capitalize the deployment of networks? What are you up to? I mean, the questions that you see fired back and forth constantly is, "What are you up to?" And it's very difficult to set policy or to legislate in hypotheticals.

So, I come back to the commitment that we have made, which is, we will not block, we will not impair, we will not degrade any content, any service, or any application. And the Internet that you know today is the Internet that we want to see you have tomorrow, and, in fact, our investments will allow you to have a faster, more robust Internet tomorrow than you have today.

Senator DORGAN. Mr. Chairman, if I might just observe, as I relinquish my time here in a moment, the decision by the Federal Communications Commission to decide that this is an information service rather than a telephone service—or telecommunications service is the reason we're here. If they had made the decision this was a telecommunications service, the common-carrier rules would apply and we wouldn't have these basic questions, because the issue of neutrality and content and so on would not be before us.

So, let me, again, say, I come down on the side of freedom on the Internet. And my hope is that when we finish these hearings, Mr. Chairman, we can address a range of these issues. And I do think the testimony given us is very instructive, from all the five witnesses. I appreciate very much their being here.

The CHAIRMAN. Well, you're right, Senator. That's why I mentioned the question that—comparison to pipelines. You know? Where is that line on common carriers? I think we have to explore that.

Senator Ensign?

Senator ENSIGN. Thank you, Mr. Chairman.

An interesting debate going back and forth, and it, I think, indicates the difficulty of this issue. And when we try to compare our-

selves sometimes with other countries, Japan and Great Britain both have monopoly phone companies, and it's difficult, sometimes you're comparing apples to oranges. And that's why I mentioned in my opening statement that we are much more of a free-market-type country, and our Government, first of all, couldn't afford to build that network out, you know, all across the country, or maybe we're just choosing not to do it. And so, it gets back to what Senator Dorgan was talking about, is—and I think this is the fundamental question—we would all like to see what, Mr. Cerf, you have talked about. I mean, everybody—that would be the ideal situation if there was the financial incentive to build the networks. If those financial incentives were there, if the networks were being built—and I think that the problem that we see today is that we don't have 100 megabits per second—or maybe in Sweden, where I've heard that it's a gigabit per second——

Mr. CERF. A gigabit, that's right.

Senator ENSIGN.—that we don't have that here in the United States, you know, being built quickly enough. The Bell companies have talked about it. And I talked with some of the cable folks this morning, saying that I want the Bell companies—one of the reasons I believe in deregulating as much as we possibly can is, I want the cable companies to be forced by the Bell companies to upgrade their networks, you know, to fiber as close to the home as possible, and then Bell companies have to get a little better, and the cable companies have to get a little better, and whoever else is out there, just like Yahoo! makes Google better, and Google makes Yahoo! better. I think the competition—it mentioned the promises, you know, that Bell companies are making today. I don't trust the Bell companies. I don't trust any of 'em. I want competition, to force those promises to be kept, because competition is the best way. I don't—you know, we can't afford to take anybody's word.

So, Mr. Cerf, if you could—or, Mr. Citron—if you could try to help me understand how the financial incentives would be there to build the networks without doing some of the things that cable and the phone companies want to do, as far as guaranteeing, at least the services they want to have, have access on their networks.

Mr. CERF. Senator Ensign, it seems to me that—and remember, now, this is the engineer trying to answer an economic question, but it seems to me that these other companies who have managed to build, in some cases, full duplex—in other words, symmetric—100-megabit-per-second service, apparently recover the cost of that from the consumers. And they do so at what sounds to me like reasonable consumer rates, $50 a month. So, what puzzles me is why we aren't——

Senator ENSIGN. Aren't those monopoly situations, though, the ones that you're talking about, the——

Mr. CERF. No, actually——

Senator ENSIGN.—100 megabit-per-second——

Mr. CERF.—my understanding is that there is competition in Japan, and there is competition in the U.K. So, perhaps I have—you and I have a different understanding of that.

Senator ENSIGN. Mr. Citron?

Mr. CITRON. Sure. Well, I think, yes, there is competition in the countries that are specified. But I think Vinton has, sort of, gotten

it right, consumers pay, and that's the investment that occurs. You look at a company like Verizon, Verizon throws off billions of dollars per year in cash-flow after it makes its investment in its broadband networks. It returns a great return to its investors, and its stock is worth, you know, $88 billion today. The Bell companies, at large—just the Bell companies—throw off tens of billions of dollars of cash after the investments in—that they make to upgrade their networks. Wall Street is financially sound and pleased. Matter of fact, people are now quoting that AT&T stock might rise to above $30, post-merger.

We've seen consolidation with—inside the industry. The real question is, What creates the proper economic incentives to make those investments? Charging consumers for higher speeds is always clearly the best way to go. I roll out a faster-speed product at a lower price, my competitor rolls out another faster product at a even lower potential price, continually benefiting the consumer.

Well, what happens if we make that commodity, the commodity of bandwidth, incredibly scarce, like oil becomes incredibly scarce? Only thing—one thing happens. Prices rise. Prices for access. And so, I think by creating the incentive system that allows people to go ahead and incentivize the scarcity, or to sort of cut the taps off a little bit, you will cause prices to rise very, very quickly. And whether those prices are subsidized by governments or subsidized by content providers or, of course, borne by the customer, ultimately the customer will pay a higher fee.

Senator ENSIGN. Just—I only have a couple of seconds left, but, Mr. McCormick or Mr. McSlarrow, would you care to comment?

Mr. MCCORMICK. Yes, I think that the free market has brought us the greatest innovation, the greatest social progress, and the highest standard of living the world has ever known. And what we have is that we have a marketplace today that is not characterized by any bottlenecks with regard to access to the Internet. There are a variety of last-mile technologies and services, and the barriers of entry can't get any lower once you make available unlicensed spectrum. So, not only do we have a competitive market, but we have a market that is contestable. And if companies are going to be expected to upgrade their networks to invest greatly in their networks, they have to have the freedom to develop business plans that will convince investors that it's a good investment to invest in those companies that are building out networks.

So, public policy has to allow for a recoupment of your investment in networks.

Senator ENSIGN. My time's expired. I didn't know if you wanted to let Mr. McSlarrow answer. It's up to you, you're the Chairman.

The CHAIRMAN. Go ahead, Kyle.

Mr. MCSLARROW. I'll be real quick.

I think the answer is, we can get the investment with the model we have today. Just taking the cable industry, we invested $100 billion to put fiberoptic technology into the ground over the last 10 years, and all of these services—Google—I use Google every day; I'm sure Dr. Cerf will be happy with that—I mean, all of these services exploded over the last 10 years. So, this model works. Why change it, in the face of hypothetical fears?

The CHAIRMAN. Thank you.

A little aside here. Mr. Cerf, I notice that you're listed as an Internet evangelist. If an engineer can be an evangelist, an engineer can be an economist, too, so——

[Laughter.]

Mr. CERF. I'm sorry I'm not wearing my ecclesiastical robes this morning.

[Laughter.]

The CHAIRMAN. Thank you.

Senator Pryor?

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

Senator PRYOR. Thank you, Mr. Chairman.

I want to follow up, just for a moment, on what Senator Ensign said a moment ago about competition. And I agree that competition is very, very good for the marketplace, and that's the way Adam Smith, you know, figured that out, back a long time ago, that if we have real competition, that is very, very good for the consumer and good for the marketplace, good for the country. But, also, I think that real competition is fair competition. And that's where I'm trying to—that's where I'm searching, is trying to make sure that whatever system we set up, like they did back in 1996, that the system we set up is fair, that we don't give an advantage, or don't place a disadvantage on any one company or one technology or one whatever it may be. So, I appreciate the panelists being here today and talking to us about your perspectives on this.

Let me start with Vonage, if I may. And I have a question about Vonage and the Universal Service Fund. You all pay into the USF?

Mr. CITRON. Yes, we do.

Senator PRYOR. And how do you do that?

Mr. CITRON. When we need to connect our network to the existing PSTN to get calls on that network, we are charged a universal-service fee. We, today, do not have a statutory right to gain access to the underlying network, and are forced to use third-party providers.

Senator PRYOR. OK. And you pay both Federal and State USF?

Mr. CITRON. Yes, we do.

Senator PRYOR. So, whenever you're in a State, you're paying the State portion and the Federal portion.

Mr. CITRON. The underlying telecommunications provider who provides us our services has an obligation to charge us universal service for the calls that we transmit over their networks.

Senator PRYOR. And is that true with all the VoIP providers?

Mr. CITRON. As far as I'm aware, if a VoIP provider is purchasing services from an underlying licensed telecommunications provider, it would be true for them, as well.

Senator PRYOR. I want to ask you about USF and your company's position on USF. Do you all support USF? Do you want to see it continue? Do you want to see it changed? What—tell me about Vonage and USF.

Mr. CITRON. I think USF is an incredibly difficult topic. I do believe our company should be supportive of USF, along with all companies, on an equal and fair basis. But what USF should be sup-

porting is really the question, and how, of course, you go about recouping those funds from individual stakeholders.

Today, consumers are charged via a variety of methods, both on the State and Federal level. There are a number of proposals today that would shift the burden to be on a number basis or shift the burden to a revenued-based basis. And each of these have their pros and cons. I believe that Congress should really hold hearings to establish the best methods of establishing a vibrant Universal Service Fund, and then dictate what that fund should be used for. But, clearly, it should be used for not just existing telecommunications services, but for new and advanced communications, maybe ones that are not even deployed yet.

Senator PRYOR. But do you have—does Vonage have a specific proposal, or a specific set of ideas, on USF? And do you have a wish list, basically, of what you'd like to see Congress do on USF?

Mr. CITRON. Our only wish list is that, as you said in your opening remarks, it be fair, that it treat all providers equally, so that if we are chosen to pay into the fund for deploying and supporting universal services in rural markets where we have deployed rural markets, we should be able to draw from the fund, as well. That level of fairness is about the only thing that we're seriously concerned with.

As for legislative policy around the social agenda, we'd really leave that up to the people in this room to make that decision.

Senator PRYOR. So, in other words, what you want to do is, you want to make sure it's fair for people paying in and fair for people drawing out.

Mr. CITRON. Exactly. One who pays in should also have the ability to draw out of the fund if they're willing to take on the obligations and provide services. We provide services throughout the entire United States in many very rural markets, yet we have no subsidy provided to us for delivering those services. The market has created competition that has incentivized our company to deploy services without the need for a subsidy. So, the question that comes, Is the subsidy still needed? And, if so, what is it really supporting? And that's a question for Congress.

Senator PRYOR. All right. If I may ask you, because you were involved in the 1996 Act, and apparently, as I understand it, spent hours and hours, days and days, months and months, years and years working through that, so let me ask you about the USF. Your view of the USF? Should we change that, given the realities of today's marketplace? And what should that look like?

Mr. COMSTOCK. You're absolutely right. It does need to change—and I think Senator Dorgan mentioned it earlier, the FCC's decision to treat Internet access as entirely an information service—in other words, remove the transmission element out—does have dynamics for the Universal Service Fund. And I think that's the real challenge in front of the Committee, is the fact that all of these services ride over networks, as we've been discussing. There's a cable network and a telephone network that eventually get you to the customer, and so you need to find a mechanism for all services that ride over those to pay. And I would agree with Mr. Citron, I mean, the point is to make it fair. So everything that uses the network pays, and you distribute that cost fairly to the customer.

Senator PRYOR. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much. I appreciate the questions.

Our next—Senator Allen?

STATEMENT OF HON. GEORGE ALLEN, U.S. SENATOR FROM VIRGINIA

Senator ALLEN. Thank you, Mr. Chairman. And thank you to all the witnesses here, including an actual father of the Internet, Mr. Cerf, who was really one of them.

Everyone's throwing around the word "freedom," which they hear a lot from me. And it's freedom on the Internet, and it's freedom of enterprise. Each and every one of you is very articulate and touched strings and strains of my philosophy. And the policy of this country on the Internet has been that it was invented by DARPA, it was given out to the private sector. The private sector has operated it. People, obviously, are getting and using different methods and delivery. And competition does help a great deal. The competition presently, as a practical matter for broadband, is cable or DSL.

The question I would ask Mr. Cerf and others, as far as in the future with Wi-Fi, something that Senator Boxer and I actually worked together on, but we're going to get even better wireless and WiMax in the future, which I think will be very helpful for out in the country where there is a lot of dirt between light bulbs. And it's one of the reasons cable isn't out in the country, you know, rural areas; there's not many customers for all that investment, to recoup it.

Now, how do you see WiMax, or even potentially satellite or broadband over power lines, ultimately getting to those faster speeds and thereby creating the competition, which, of course, is good for the consumer, but also meaning that there doesn't have to be the heavy hand of government, or the hand of government involved at all?

Mr. CERF. Let me distinguish, Senator Allen, between the technology and its current deployment. I mentioned earlier that there are very modest statistics for the deployment of broadband over power lines or alternative wireless access, compared to DSL and cable. In the long run, I think there's a high probability that broadband over power lines might actually work well. There are still things in the lab, so to speak, that are not yet productized, that suggest to me that hundreds of megabits per second, or a hundred megabits per second perhaps, could be reasonably delivered through the power lines. However, that has not yet entered the marketplace in a serious way.

With regard to radio access, Wi–Fi, in the 2.4 gigahertz band, is getting very cluttered. That's because it's a band which doesn't require any kind of registration or payment.

Senator ALLEN. It's unlicensed.

Mr. CERF. Pardon me?

Senator ALLEN. Unlicensed.

Mr. CERF. Unlicensed.

Senator ALLEN. Right.

Mr. CERF. There are higher-frequency bands, up in the 95 gigahertz range, which some companies, like GigaBeam are looking

at, which could deliver on the order of hundreds of megabits per second of capacity over short distances, a mile or so. Those are all potential alternatives to——

Senator ALLEN. What about the—once we get from—the transition to digital from analog, how would—what are the distances on that unused analog spectrum—could be used for wireless?

Mr. CERF. Are you thinking of the 700 megahertz spectrum, for example, or television channels that are——

Senator ALLEN. Right.

Mr. CERF.—currently occupying——

Senator ALLEN. Exactly.

Mr. CERF. That spectrum has the benefit that it will penetrate better than some of the higher frequencies will, so that you could reach into a home with a 700 megahertz transmitter. In terms of data rates, depending on what the bandwidths that are available, one could see tens of megabits per second, potentially, being accessible by that means.

Senator ALLEN. All right. Well, it seems like there is a—the possibility for some competition.

Mr. COMSTOCK. Senator, if I might just comment on that briefly. COMPTEL represents companies that have basically tried every single method of possibly getting around the last-mile facilities owned by other companies. And, unfortunately, the success rate is really low. I think the thing the Committee needs to keep in mind is, whether you're talking about wireless or BPL, these are people that have to build out networks against an entrenched incumbent. This is not a case of going to fertile fields, where there's a customer available if you can serve them. You have to actually take somebody from someone who's already being served by someone who already has a network that's built and partially depreciated. So, it's still a tremendous obstacle. It may come in the future, and we all hope it will, but I do think there are some real practical realities that you need to address, in terms of that.

Senator ALLEN. Understood, thank you. But the point is, right now we don't have a problem. The Googles, the Vonages, the Yahoos!, and others are doing well. The question is, do you pass a law, presently, as Mr. McSlarrow cautioned against? And, in the event, though, that there is this—restrictions, then do you pass a law, retroactively, trying to put—let the genie back out of the bottle? That is, to me, the way I see this arising. And I do think we also ought to understand better—and we don't have time—a concept of this tiered service and tiers of services, have that understood. Mr. Citron mentioned it, but my time's expired.

This debate and discussion will go on much longer, and I thank all our witnesses for really outstanding testimony. And we're going to have to work this through.

Thank you.

The CHAIRMAN. Thank you, Senator.

Senator Boxer?

STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM CALIFORNIA

Senator BOXER. Thanks, Mr. Chairman, for this hearing. I want to welcome the panel. You're all really good spokespeople for your perspective.

Mr. Chairman, I'd like to place in the record a BusinessWeek article that appeared online February 2nd, if I might, on this subject, just one page.

The CHAIRMAN. Without objection.

Senator BOXER. Good.

[The information referred to follows:]

BusinessWeek online, February 2, 2006

IS VERIZON A NETWORK HOG?

By Catherine Yang

THE TELECOMMUNICATIONS GIANT WANTS TO DEVOTE MOST OF ITS CAPACITY TO ITS OWN TRAFFIC, TO INTERNET COMPANIES' DISMAY

Last November, Vinton G. Cerf wrote a letter of warning to Congress. The legendary computer scientist, now a vice-president at Google (GOOG), argued that major telecom companies could take actions to jeopardize the future of the Internet. The phone companies' networks that carry net traffic around the U.S. are much like the highway system. Cerf wrote that they may begin setting up the equivalent of tollbooths and express lanes, potentially discriminating against the traffic of other companies. Such moves, Cerf warned, "would do great damage to the Internet as we know it."

Now, Cerf and his net compatriots have new ammunition to back up their fears. Documents filed with the Federal Communications Commission show that Verizon Communications (VZ) is setting aside a wide lane on its fiber-optic network for delivering its own television service. According to Marvin Sirbu, an engineering professor at Carnegie Mellon University who examined the documents, more than 80 percent of Verizon's current capacity is earmarked for carrying its service, while all other traffic jostles in the remainder.

Paying for Priority. Leading net companies say that Verizon's actions could keep some rivals off the road. As consumers try to search Google, buy books on Amazon.com (AMZN), or watch videos on Yahoo! (YHOO), they'll all be trying to squeeze into the leftover lanes on Verizon's network. On Feb. 7 the net companies plan to take their complaints about Verizon's plans to the Senate during a hearing on telecom reform. "The Bells have designed a broadband system that squeezes out the public Internet in favor of services or content they want to provide," says Paul Misener, vice-president for global policy at Amazon.com.

Verizon argues that it needs to take such measures to earn a return on its network investments. The New York giant is seeing steep declines in its traditional telephone market, so it is spending an estimated $10 billion over seven years on new fiber lines to diversify into the TV business. Unless it can deliver seamless, high-quality TV service—a real bandwidth hog—Verizon says it won't be able to compete against Comcast (CMCSA) and other cable rivals. We "give consumers choice for video services," says Verizon Executive Vice-President Thomas J. Tauke.

At issue is what the Internet of the future will offer. Critics of the phone industry say the net has flourished because innovators anywhere could reach consumers just as easily as deep-pocketed corporations. But if Verizon and AT&T (T) set up tolls and express lanes, upstarts may not be able to afford the fees. "If you deliver video the way Verizon does now, that makes it very hard for others to compete," says Carnegie Mellon's Sirbu.

Legislative Strategy. The net companies are trying to persuade Congress to pass a law ensuring that broadband providers, such as the Bells, don't discriminate against rivals when they charge tolls or prioritize traffic, an idea called "network neutrality."

Verizon says there's plenty of room on its network for everyone. Still, the growing controversy is giving the company second thoughts about its legislative strategy. Last year it was pushing Congress for comprehensive telecom reform. But now Verizon is paring back its ambitions. At a Jan. 27 press conference, Verizon's Tauke said it was time for lawmakers to switch gears and pick off piecemeal issues. Top

on the list is a bill on local franchise approvals that would allow phone companies to offer TV service across the country more quickly.

Meanwhile, net neutrality faces more debate in both the Senate and the House. Cerf & Co. certainly have a difficult task. After all, the phone companies employ armies of lobbyists and donate millions to Congress. Google hired its first lobbyist just last year.

Senator BOXER. I want to read some of it. "Last November, Vinton Cerf wrote a letter of warning to Congress. The legendary computer scientist argued that major telecom companies could take actions to jeopardize the future of the Internet. The phone companies' networks that carry net traffic around the U.S. are much like a highway system. Cerf wrote that they may begin setting up the equivalent of toll booths and express lanes, potentially discriminating against the traffic of other companies. Such moves, Cerf warned," "would do great damage to the Internet as we know it. Now Cerf and his net compatriots have new ammunition to back up their fears. Documents filed with the FCC show that Verizon is setting aside a wide lane in its fiberoptic network for delivering its own TV service. According to Marvin Sirbu, an engineering professor at Carnegie Mellon who examined the documents, more than 80 percent of Verizon's current capacity is earmarked for carrying this service, while all other traffic jostles in the remainder. Leading net companies say Verizon's actions could keep some rivals off the road. As consumers try to search Google, buy books on Amazon, or watch videos on Yahoo!, they'll all be trying to squeeze into the leftover lanes on Verizon's network. On Feb 7, the net companies plan to take their complaints about Verizon's plans to the Senate during a hearing on telecom reform. 'The Bells have designated a broadband system that squeezes out the public Internet in favor of services or content they want to provide,' says Paul Misener, vice president for global policy at Amazon."

The reason I'm reading this is, I think it's a very good explanation of where we are. Sadly, the story ends with the following: "Net neutrality faces more debate in both the Senate and the House. Cerf and Company"—that's you, sir—"certainly have a difficult task. After all, the phone companies employ armies of lobbyists and donate millions to Congress. Google hired its first lobbyist just last year."

Well, let me tell you, I think this Committee is going to get above the fray on who's lobbying for what. I think, under the leadership of our chairman, we are trying to figure this thing out.

And so, I guess what I'm confused about, Mr. McCormick, Mr. Comstock, and Mr. McSlarrow, is, Can you not admit this is an issue? Because, as I heard you and read what you wrote, you're acting as if this is a nonissue.

Mr. MCCORMICK. Well, I think that there is an issue.

Senator BOXER. OK.

Mr. MCCORMICK. I think there is an issue. The issue is that the United States, in the information century, is behind. The United States needs to deploy new broadband networks. The United States desperately needs investment in broadband networks.

Senator BOXER. OK.

Senator BOXER. I hear you. But you don't think it's an issue for consumers to worry about, that some of them could get squeezed out?

Mr. MCCORMICK. I think, Senator, that what-ifs are always issues. Here's a what-if issue. Google, which is a company talking about net neutrality, has absolutely abandoned the concept of Internet freedom with regard to its customers in China. Google controls half of all Internet searches.

Senator BOXER. OK, just a second. That's another hearing and another topic. I'm talking about this issue of net neutrality. I want to make just one point, because, gosh, that 5 minutes goes so fast.

There's a new policy by a lot of physicians in California. This is what it is. Physicians take insurance, and they're not doing as well as they want to do, so what a lot of them are doing—I pass no judgment on this—is say to their patients, "If you give me $2,500 a year, on top of what your insurance gives to me, and on top of your copayments, you get first in line." And a lot of patients are signing up. Now, what happens, at the end of the day? The patients that pay that extra money get terrific service, they're first in line, and the people left out of this system get the leftover time of the physician. Now, if the people who pay the $2,500 don't get that sick, everybody's OK, they're all going to get the physician's time, but if they get sick and the physician has no more time, the other patients will get a lot of help from the nurses in the office. That may be OK, but it's not the same quality.

I think what some of us are worried about—I think all of us are trying to balance what you say about "let the market do its thing" with what happens at the end of the day to the people that we represent. Will they not be able to use—utilize the Internet, except in ways that Mr. McCormick, Verizon, decides is good, or Mr. McSlarrow, the cable companies, or the smaller telecom companies? And so, freedom is an issue here, you're right. It depends on how you look at what freedom is.

So, all I can say, because my time is almost up, is that I am very worried. I, personally, am very worried about this. That's why I did join with Senator Dorgan in 2002. And I think we ought to, Mr. Chairman, listen to everyone. But the voices that brought us this great revolution, I think we should really hear them, because I think at this stage we don't want to do anything to stifle them. And so, that's very important to me.

Thank you.

The CHAIRMAN. Thank you very much. And we thank you very much. The reason for the time limit is obvious, we have four other witnesses, and we——

Senator BOXER. Yes, I'm not complaining——

The CHAIRMAN.—expect to be done by——

Senator BOXER.—about it, I'm just saying it's hard.

The CHAIRMAN.—by 11:30.

Mr. Cerf, you mentioned the problem of—I think, inferentially—of distance, in terms of the speed. I'm sort of at a loss over the comment that we're in the gigabits in other countries, 100 megabits are common, and yet we're still in the engineering phase. Now, I don't have time to ask you to answer that, but we have asked the engineers from all parties to brief our staff on the reasons for the abil-

ity of universities to deliver 100 megabits to 4 million college students, but the highest we're getting, in terms of the average range, as I understand it, is about 15 megabits on other systems. Now, somehow or other that question's going to come up again and again, so if any of you want to make any comments about that to us, we would appreciate it in writing. All right?

Mr. CERF. Oh, in writing?

The CHAIRMAN. Yes.

Mr. CERF. Yes, certainly. I'll be happy to respond.

The CHAIRMAN. Thank you very much.

We do appreciate your courtesy in coming, and your contribution. You certainly leave us a lot to think about.

Senator BOXER. Mr. Chairman, would it be possible for us to send you some questions in writing for this panel?

The CHAIRMAN. I think within some limitation, yes, because we have a time limit, in terms of when we're going to get around to try to deal with all these bills. But, yes, I——

Senator BOXER. Just about four questions, if I could submit them for the record.

The CHAIRMAN. That's up to the—we hope the witnesses will respond to Senator Boxer.

Senator BOXER. Thank you very much, everybody.

The CHAIRMAN. Our next panel—and we thank you very much. We'll take about a 5-minute station break so people can shift, here.

[Pause.]

The CHAIRMAN. Thank you very much. We'll turn to our second panel now—and we thank you for coming—Kyle Dixon, Senior Fellow and Director of the Federal Institute of Regulatory Law and Economics, The Progress & Freedom Foundation, of Washington; Lawrence Lessig, the professor of law at Stanford Law School; J. Gregory Sidak, professor of law at Georgetown University Law Center; and Gary Bachula—and I hope I pronounced that right—Vice President for External Affairs at Internet2, in Washington.

Gentlemen, we thank you very much for coming, and we'll proceed with the statements. As I indicated, your statements you've submitted will be printed in the record in full.

And we'll turn first to Mr. Dixon.

STATEMENT OF KYLE D. DIXON, SENIOR FELLOW/DIRECTOR, FEDERAL INSTITUTE FOR REGULATORY LAW AND ECONOMICS, THE PROGRESS AND FREEDOM FOUNDATION

Mr. DIXON. Good morning, Chairman Stevens and Members of the Committee.

As Chairman Stevens said, I am a Senior Fellow with The Progress and Freedom Foundation, and I direct its Federal Institute for Regulatory Law and Economics. But before joining PFF in 2004, I worked for 7 years at the Federal Communications Commission, most recently as special counsel to Chairman Michael Powell for broadband policy.

As a former regulator, I'm always careful to evaluate policy issues in terms of their prospects for implementation, the goal being to avoid rules that may do more harm than good. Proponents of network neutrality hope to convince you that regulating these

issues would be simple and harmless, but imposing a network-neutrality mandate would be neither simple nor harmless.

For all its flexibility, the Internet has some technical shortcomings. For example, the Internet suffers from a variety of security and safety vulnerabilities—worms and viruses, authentication problems, inappropriate content, and the like. The Internet also tends to transmit data in short bursts. This approach works well for things like e-mail, but does not work well for applications that require a steady flow of information over the network, like videostreaming.

To address problems this pressing, consumers need help from all aspects of the Internet, including network providers. *The Wall Street Journal* just reported that AOL and Yahoo! will combat junk mail and identity theft using a new service that gives preferred treatment to certain e-mails for an additional charge. Suppose, instead, that a company like AOL seeks to buy services from Verizon or Comcast to address some of the same technical shortcomings. A network-neutrality mandate could prohibit Verizon or Comcast from doing that deal, based on the notion that the deal would discriminate in favor of AOL. In that case, a network-neutrality mandate harms consumers by denying them the opportunity to get more out of the Internet with less frustration. Essentially, a mandate could force broadband networks to disarm unilaterally when the battle against security and other technical limitations has hardly begun. It also harms consumers by denying them the benefit of additional investment in broadband networks that revenues from the service might have supported.

Now, certainly Congress could attempt to craft a more flexible standard for network neutrality that allows network owners to contract with content and applications companies, at least in some cases, but such flexibility would generate more ambiguity and litigation and push consumers and the industry down a slippery slope toward further regulation and consumer harm.

Ironically, most network-neutrality proposals presume that cable modem and DSL providers will use their supposed market dominance or power to undermine robust competition to develop Internet content applications and devices. But even if presumptions of market power were valid, which they are not, it is clear that a network-neutrality mandate will do nothing to increase broadband competition beyond current levels. Rather, by imposing costs, uncertainties, and constraints on how network owners address security and other technical limitations, a network-neutrality mandate likely would undermine incentives to invest in competing broadband networks. It also may delay the rollout of new content and applications that are disfavored by the current Internet.

All that said, the goal of maximizing consumer welfare suggests that the best answer to the question of network neutrality is not always "yes" or always "no," but "maybe," under certain circumstances. Specifically, if broadband providers were to obtain and abuse market power in the future, some sort of network neutrality might prove beneficial to remedy consumer harm. Congress could accomplish this either by relying on existing antitrust enforcement or by giving the FCC a rigorous competitive standard by which it could identify and remedy abuses of market power in specific mar-

kets. The latter approach tracks recent proposals by Senator DeMint, of this Committee, as well as by The Progress and Freedom Foundation, in collaboration with several university scholars from across the country.

In closing, I would just urge Congress to remain cautious about imposing network-neutrality mandate at this early stage of the broadband Internet. Imposing neutrality where it is not necessary to remedy abuses of market power could be far more damaging than endorsing a problem in search of a solution. Doing so could make network neutrality itself the problem.

I thank the Committee for this opportunity, and I ask that my remarks be added to the record.

Thank you.

[The prepared statement of Mr. Dixon follows:]

PREPARED STATEMENT OF KYLE D. DIXON, SENIOR FELLOW/DIRECTOR, FEDERAL INSTITUTE FOR REGULATORY LAW AND ECONOMICS, THE PROGRESS AND FREEDOM FOUNDATION

Good morning, Chairman Stevens, Co-Chairman Inouye and Members of the Committee. My name is Kyle Dixon. I am a senior fellow with The Progress and Freedom Foundation (PFF), and I direct its Federal Institute for Regulatory Law and Economics. Before joining PFF in 2004, I spent seven years working at the Federal Communications Commission, most recently as special counsel to former Chairman Michael Powell for broadband policy.*

Thank you for the opportunity to speak with you about whether Congress should mandate so-called "network neutrality." Such a mandate would constrain the ability of Internet access providers to make private arrangements with other companies that would differentiate among Internet applications, content or devices that rely on broadband network connections to consumers.

This issue confronts Congress with the most crucial regulatory decision for the broadband age. Remedies like a network neutrality mandate may be beneficial where evidence demonstrates that market power has been abused. But the more likely effect of a network neutrality mandate under current competitive conditions would be to reduce consumer welfare by undermining investment and innovation.

I. Consumer Welfare as the Touchstone for Resolving the Network Neutrality Debate

Network neutrality is hotly debated because it is so central to the economy and to our society. The Internet and broadband networks are permitting virtually any service or application—voice, video or data—to reach consumers over multi-purpose digital networks. Thus, if Congress decides to regulate how broadband providers work with content and other companies, it will affect the evolution of the converged communications and information technology industries dramatically.

Much ink already has been spilled in this debate, primarily by companies hoping to use the presence or absence of network neutrality mandates to their advantage in commercial negotiations. Yet too often the sound and fury of this rhetoric signifies little that cuts through to resolve this complex issue. As a former regulator, I recall being faced with this dilemma frequently. I learned then that the best way to resolve issues like this coherently and effectively was to return to first principles.

The touchstone for resolving network neutrality or any other regulatory debate is *consumer welfare.* Specifically, policymakers must balance many (and, inevitably, competing) interests to maximize benefits to consumers in the form of competition, investment and innovation. With this as a starting point, it becomes immediately clear what is known or apparent about the current status quo for consumer welfare, and what questions remain.

*The views expressed here are my own and may not reflect those of The Progress and Freedom Foundation, its Board, or its supporters.

II. What We Know: The Status Quo for Consumer Welfare

A. Broadband Networks, Content, Applications and Devices Are All Critical to Maximizing Consumer Welfare

A quick Google search reveals that the Internet often is described as an ecosystem. Like nature, the Internet is highly *interdependent,* involving myriad collaborations among end users, broadband network providers, content and applications developers and so on. The Internet also resembles nature because it is constantly *changing and growing,* adding new users and uses continuously. This interdependence and dynamism account for the many benefits consumers already receive from the Internet, as well as the expectation that these benefits will expand. Conversely, this expansion of consumer benefits depends on maintaining healthy prospects for each of the Internet's components.

B. Content, Applications and Devices Are Thriving on the Broadband Internet

One need only consult advertisements, the news or most anyone with children to assess the vibrancy of the content, applications and device components of the broadband Internet. Consumers use "voice over Internet Protocol" services like Vonage to call cheaply across the country and around the globe. Virtual communities spring up daily as users create and share web logs, instant messages and other media, and as they compete in online video games. Companies fuel American productivity using business-to-business and business-to-consumer applications. Music and video programming lovers increasingly download or "stream" this content to iPods, TiVo boxes and other devices. The evolution of these components of the Internet continues unabated even in the absence of a network neutrality mandate.

C. Broadband Networks, Although Increasingly Ubiquitous and Competitive, Have not Reached Their Full Potential

Despite claims by network neutrality proponents that the market for "last mile" broadband connections is not competitive enough, this aspect of the Internet also shows promising signs:

- The FCC reports that nearly all zip codes are served by at least one broadband provider, and a solid majority is served by several.[1]
- Wi-Fi, WiMax, satellite and other emerging technologies continue to continue to add customers, hoping to compete on a niche or wider basis with existing cable and DSL offerings.[2] Effective spectrum reform would dramatically improve these prospects, thus making such reform a top priority in bringing consumers the benefits of the broadband Internet.
- Industry analysts estimate that most Internet users have defected from "dial-up" Internet access to broadband and that this trend is accelerating.[3]
- Cable modem, DSL and, increasingly, wireless and optical fiber-based networks compete on several bases, including price, speed and technology.[4]

That said, neither the proponents nor opponents of network neutrality want the broadband market to stall at its current level of development. They agree that additional broadband deployment would bring consumers more of the benefits of competition and, hopefully, narrow the gap between the United States and other countries with respect to broadband usage.[5] And although providers continue to make their networks faster, far more of this investment will be needed before high-value uses like streaming video can become commonplace. This, in turn, would initiate a "virtuous cycle" whereby bringing consumers more value would intensify demand for broadband investment.

III. Narrowing the Network Neutrality Debate

Given the importance and relative health of the broadband network, application, content and device components of the Internet, Congress can narrow the network neutrality debate to the following question:

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[1] Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division, *High-Speed Services for Internet Access: Status as of December 31, 2004* (Ind. An. and Tech. Div., rel. July 2005), at 1–5.

[2] *Id.* at 2.

[3] *See, e.g.,* Bernstein Research Call, *Broadband Update: The Biggest Gains for the Biggest Players* (Oct. 14, 2005), at 1.

[4] *Id.*

[5] Federal Communications Commission, *Availability of Advanced Telecommunications Capability in the United States: Fourth Report to Congress* (Sept. 9, 2004), at 40–43.

Would enacting a network neutrality mandate add to the benefits consumers *already enjoy,* or undermine those benefits?

In the continued absence of demonstrated market power abuses by broadband providers, I contend that network neutrality mandates would do more harm than good.

A. Network Neutrality Mandates Would Not Improve (and Could Worsen) Conditions for Content and Applications Development

The broadband Internet already affords consumers unprecedented freedom in how they obtain, share and manipulate information. Other than a few incidents,[6] broadband providers have not blocked or impaired consumers' use of the content, applications or devices of their choice. These incidents often alleged legitimate concerns about protecting consumers' Internet service quality from erosion by their neighbors' high intensive use of shared network capacity. In any event, these incidents generally were abandoned for business reasons or in response to FCC action.

Even as they experiment with business models to support their expensive network investments, broadband providers are not likely to change course in any way that reduces overall consumer welfare. This results from the current level of competition among broadband networks. There is no single, dominant broadband network provider and none seems likely to emerge in the immediate future. Instead, cable and phone companies vie to expand their respective, substantial market shares and to defend against wireless and other firms who hope to use less established technologies to enter new markets and expand existing footholds.

Nor does it seem likely that broadband providers will extract economically prohibitive terms from other firms any time soon. Companies hoping to earn a return on the billions of dollars they have invested or hope to invest in broadband networks understand that consumers pay a premium over dial-up service so they can access the diverse and exciting content and applications that the Internet offers. Although network owners may wish to bargain with other companies to share the revenues generated by this increased consumer value, they are unlikely to draw hard lines in the sand that risk losing existing or future customers to other networks.

Similarly, no broadband network owner is likely to acquire an "essential facility" without which rivals are effectively barred from the market. Whether a facility denied to a competitor is "essential" for competitive analysis largely turns on whether the competitor is unable, practically or reasonably, to duplicate the essential facility. In most cases, however, at least two firms already compete in the local broadband market, and consumers continue to sign up for additional technologies, such as wireless. Moreover, consumers have accelerated their switch from dial-up to broadband, raising the possibility that network owners entering the market can gain customers without having to entice them away from other broadband providers.

Finally, it seems unlikely that broadband providers can parlay their position in the market as leverage to constrain the market for complementary or "vertical" products, such as content, applications and devices. Leveraging and attempted monopolization theories, at a minimum, require that a company has a monopoly or is likely to be capable of acquiring one. Broadband providers probably will not satisfy this prerequisite anytime soon, for the reasons already stated. And to the extent broadband providers take actions that arguably might fit this theory in the future, attention to the goal of maximizing consumer welfare would need to make sure those actions were not justified as pro-competitive. This seems especially true to the extent providers act to preserve incentives for them (and thus others) to invest in broadband infrastructure.

Note that there is reason to expect that a network neutrality mandate actually might *weaken* the competitive vibrancy of the content, applications and device components of the Internet. For all its flexibility, the Internet cannot be all things to all uses. For example, Internet protocols (e.g., TCP/IP) route packets of digitized data over the Internet anonymously on "first come, first served" and "best effort" bases. This approach has worked well for applications or related devices that are not time-sensitive. This approach works poorly, however, for uses that depend on a steady transfer of data of networks, such as streaming media, online gaming and even voice over IP.[7] An example of this type of application would include Internet delivery of high definition television programming. If Congress enacted a network neutrality mandate, it might prevent network owners from using private networks

[6] *See, e.g., Madison River LLC and Affiliated Companies,* File No. EB–05-IH–0110, Order, 20 FCC Rcd 4295 (Enf. Bur. 2005).

[7] Christopher S. Yoo, *Beyond Network Neutrality,* Vanderbilt University Law School, Public Law and Legal Theory (Working Paper No. 05–20), Law & Economics (Working Paper No. 05–16), available at *http://ssrn.com/abstract=742404* (visited Feb. 1, 2006), at 5. The information referred to has also been retained in Committee files.

to work around this inherent shortcoming of the Internet. This, in turn, would discourage the offering of services that consumers want but that are disfavored by the Internet's current architecture.

By enacting a network neutrality mandate, Congress also might complicate efforts to keep the Internet safe and reliable. As recent events have shown, the phenomenal growth of the Internet also has made it more crowded and vulnerable to security risks, such as viruses and spam. Companies hoping to recoup or expand their investment in broadband networks will be eager to help solve such problems by offering content and applications developers new services that work around the Internet's technical limitations, at least until broader refinements can be made to the global Internet ecosystem. Broadband providers may not be free to offer such services if Congress enacts a network neutrality mandate.

Thus, a network neutrality mandate likely would not improve and could worsen conditions currently faced by developers of content, applications and devices. That some content and applications companies vigorously lobby Congress to enact such a mandate may be explained best by "public choice" theory. Public choice predicts that companies will lobby the government for rules that help them in the marketplace, thereby saving them the trouble of achieving the same results through competition and negotiation.[8] Companies supporting network neutrality may see their greatest advantage in having a rule that frees them from negotiating with broadband providers, but such a rule is not likely to make consumers better off. Broadband providers already face strong pressures to add as many customers as possible, both to keep customers from signing up with competitors and to recoup providers' significant investments in network infrastructure. The facts speak for themselves; there is no persuasive evidence that broadband providers systematically have prevented or discouraged consumers from using any legal content, applications or devices. As such, Congress can accord little weight to companies' pleas for help in avoiding commercial negotiations as irrelevant to the main goal of regulation: maximizing consumer welfare.

B. A Network Neutrality Mandate Likely Would Undermine Investment and Innovation in Broadband Networks

Most significantly, a network neutrality mandate would discourage investment and innovation in broadband networks.

1. Ambiguities Regarding What "Network Neutrality" Actually Means Would Burden and Delay New Broadband Services and Networks

Perhaps the simplest definition of "network neutrality" would be "nondiscrimination," i.e., a requirement that broadband network owners serve all potential customers equally. As I have suggested, this kind of mandate could preclude broadband providers from offering services that address the Internet's inherent reliability and security limitations and thereby make it more difficult to offer or purchase valuable new Internet services.

A naked nondiscrimination requirement also could hamstring efforts by content and applications providers to develop sustainable business models. It is only very recently that companies began to trade the "virtual" profits that inflated the Internet bubble for real profits, largely based on targeted Internet advertisements. I suspect that even some proponents of regulation in this area would not want Congress to bar broadband providers from agreeing to feature content or links on consumers' Internet "home pages" or, as some companies have done, agree to make Yahoo!, AOL or others preferred Internet service providers on their networks.[9] But these arrangements, which seem to benefit consumers, are difficult to square with the concept of nondiscrimination.

Further, more sophisticated notions of network neutrality—notions that allow companies to improve reliability or security, or develop pro-competitive business models—are likely to be more ambiguous than nondiscrimination. This added ambiguity would invite costly litigation before the FCC or the courts as to what Congress meant when it enacted a particular network neutrality mandate. The challenge of writing nuanced network neutrality rules also could result in unanticipated consequences.

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[8] See James M. Buchanan, *Public Choice: Politics Without Romance,* Policy Quarterly (Spring 2003), available at *http://www.cis.org.au/Policy/spr03/polspr03–2.htm* (visited Feb. 1, 2006).

[9] *See, e.g.,* Burt Helm, *SBC's Gambit, Yahoo's Tidy Gain,* BusinessWeek Online (June 2, 2005), available at *http://www.businessweek.com/technology/content/jun2005/tc2005062*__8479__tc024.htm (visited Feb. 1, 2006).

2. Enacting a Network Neutrality Mandate Would Push Consumers and the Industry Down a "Slippery Slope" Towards More Burdensome Regulation

Fears that a network neutrality mandate would usher in subsequent regulation are not merely speculative; they are supported by the FCC's experience in regulating "enhanced" services and attachments to the narrowband, telephone network in its *Computer Inquiry* and *Part 68* proceedings.

The *Computer Inquiry* requirements were adopted over many years beginning in the 1970s and, at base, were designed to allow telephone companies to participate in the emerging data processing industry on the condition that they afford competing "enhanced" or information service providers (e.g., third-party voicemail providers) the same access to the transmission capability of the phone network. Phone companies had to file the terms and conditions of these "basic" services with tariff reviewers at the FCC, subject to regulation that the prices for these services be "just and reasonable." The *Computer Inquiry* spawned a vast maze of requirements so Byzantine that few attorneys at the FCC or elsewhere claimed to understand it fully. Many of the requirements were rejected in a series of court appeals.

Not surprisingly, the FCC last year honored Congress' demand that it eliminate barriers to broadband investment by affording DSL providers the flexibility to opt out of the *Computer Inquiry* requirements along with other aspects of "common carrier" regulation.[10] Likewise, in 2000, the FCC eliminated 125 pages of Part 68 rules governing the attachment of devices to the telephone network, that time responding to Congress' mandate that the agency eliminate unnecessary, and thus burdensome, regulation.[11]

The risk that a network neutrality mandate would lead to further regulation is illustrated more generally by the FCC's implementation of the provisions in the Telecommunications Act of 1996 intended to open local telephone networks to competition. As that experience suggests, mandates that one company share its network with competitors almost always lead competitors to call for more regulation regarding how that sharing is done, especially with respect to price.[12] Brushing aside any incentives network owners have to carry as much traffic over their networks as possible (to spread heavy fixed costs as widely as possible), competitors' argument is that it does no good to mandate access to a network if its owner can request price or other terms that make the access uneconomical for competitors.

By analogy to the broadband context, it seems likely that any network neutrality mandate that Congress adopts (and that survives implementation and judicial review) will be met with calls for additional regulation of the price and other terms of this "neutral" access. This additional regulation would heighten the burden imposed by a network neutrality mandate itself, thereby further discouraging investment in broadband networks.

3. A Network Neutrality Mandate Would Undermine Broadband Deployment by Deterring Providers From Addressing Internet Reliability and Security Concerns

I mentioned earlier the benefits of allowing broadband providers to develop services to address some of the Internet's inherent technical limitations. The flip side of the value that those services could offer content and applications developers (and, ultimately, consumers) is that such services create new revenue opportunities for network owners. These revenues then can be used to fund the network upgrades and expansions that are necessary to support wider availability of valuable, bandwidth-intensive services, such as video and tele-medicine. A network neutrality mandate risks blocking this flow of money, thereby reducing consumer welfare.

In sum, the most significant likely effect of a network neutrality mandate would be to weaken investment and innovation in broadband networks when they have not yet reached their full potential. Also, it is worth noting that a network neutrality mandate that denied broadband providers the value of the billions of dollars they have invested in their networks could raise issues as to whether the mandate amounted to an unconstitutional "taking" of property. Taken together with the likelihood that such mandates (at best) will merely free content and applications developers from having to negotiate with broadband providers, this explains why Congress need not enact a network neutrality to promote consumer welfare at this time.

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[10] Federal Communications Commission, *Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities,* CC Docket Nos. 02–33 *et al.,* Report and Order and Notice of Proposed Rulemaking (rel. Sept. 23, 2005), at 40–46.

[11] Federal Communications Commission, *FCC Privatizes Standard-Setting and Certification Process for Telephone Equipment,* CC Docket No. 99–216, News Release (rel. Nov. 9, 2000).

[12] *See generally* Federal Communications Commission, *Unbundled Access to Network Elements,* WC Docket Nos. 04–313 et al., Order on Remand (rel. Feb 4, 2005), at 1–5.

IV. The Market Power Alternative: A Superior Solution to Protecting Consumer Welfare

If Congress decides it must assume the risk of harm to which an across-the-board network neutrality mandate would subject the Internet ecosystem, it should consider alternatives that reserve such mandates for situations in which they are needed to remedy abuses of market power.

Arguments in favor of network neutrality rely largely on the assumption that broadband providers have market power that they will use to deny consumers the freedom to use the content, applications and devices of their choice. Leave aside, for the moment, broadband providers' incentives to maximize the value of their networks by keeping the floodgates of content and applications open. It is clear that a provider cannot extract "monopoly rents" (as opposed to market-constrained fees) *unless* the provider has market power. Thus, imposing network neutrality only where a broadband provider has abused market power should limit that remedy to situations in which the provider truly is harming consumer welfare.

There are likely multiple options for limiting network neutrality remedies to abuses of market power. One option would be for Congress to rely on traditional antitrust enforcement; for example, in the face of demonstrable evidence that it had abused market power, a broadband provider could avoid an antitrust suit by agreeing to "neutrality" remedies.

Alternatively, Congress could specify a competitive standard according to which the FCC could identify and remedy market power abuses. This tracks the approaches recently proposed by Senator DeMint in S. 2113, and by the Progress and Freedom Foundation in our Digital Age Communications Act project.[13] The Foundation developed its proposal in conjunction with dozens of legal, engineering and economic scholars and practitioners representing a range of viewpoints. Nonetheless, these scholars share a passion to updating regulation to comport with the evolving demands of digital technology.

However Congress crafts a "market power alternative" to network neutrality concerns, it should satisfy at least two prerequisites. First, the alternative should be *narrowly targeted* to specific instances of market power, in terms of both the geographic scope and behavioral requirements of the remedy.

Second, the alternative should incorporate a *rigorous competitive standard and evidentiary* showing to ensure that neutrality mandates are imposed only to remedy demonstrable cases of market power abuse. A competitive standard that fails to satisfy these prerequisites likewise will fail to avoid many of the potential risks to consumer welfare that "one-size-fits-all" network neutrality mandates pose.

V. Conclusion

The debate over whether to enact a "network neutrality" mandate is no mere regulatory squabble; it confronts Congress with momentous decisions that will affect generations of Americans. We know that all the components of the broadband Internet—from networks to applications, content and devices—are critical to maximizing consumer welfare. In order to further this central goal of communications regulation, I urge Congress to remain cautious about imposing network a neutrality mandate at this early stage in the development of the broadband Internet. Imposing "neutrality" where it is not necessary to remedy abuses of market power could be far more damaging than endorsing a "solution in search of a problem." Doing so could make a network neutrality mandate *itself* the problem.

I thank the Committee for this opportunity, and I ask that my written remarks be made part of the record. I am happy to answer any questions you may have.

The CHAIRMAN. Thank you very much.

Our next witness, Lawrence Lessig, professor of law, Stanford Law School.

STATEMENT OF LAWRENCE LESSIG, C. WENDELL AND EDITH M. CARLSMITH PROFESSOR OF LAW, STANFORD LAW SCHOOL

Mr. LESSIG. Thank you, Mr. Chairman. You have my testimony. I worked very hard to prepare it. I want to put it aside and address four points which the testimony this morning seems to leave vague

[13] Randolph J. May and James B. Speta, Co-Chairs, *Digital Age Communications Act: Proposal of the Regulatory Framework Working Group* (Release 1.0), The Progress and Freedom Foundation (June 2005).

in the minds, I'd suggest, of this Committee—two points, or two principles, no one should disagree about, and two points, or two facts, that I don't think anybody, with a straight face, can deny.

The two principles are, first, that Congress should be conservative in whatever regulation it adopts, or whatever policy it adopts, about networks, especially the Internet, meaning Congress should learn from the past. And, second, Congress should promote competition. It should promote competition not just in broadband service, but also in applications and content that run on top of the broadband network.

Now, against the background of those two principles, I suggest there are two facts that make the issue that this Committee is considering today extraordinarily important. The first fact is that the proposal that is being promoted right now to deregulate in this context is a radical change in the regulatory environment governing telecommunications for at least the past 40 years. In one of the submissions that's before this Committee, someone credits me with the term "network neutrality." It's crazy to suggest the ideas that we're talking about today are new. These are extraordinarily old principles. They've been part of telecommunications law for the last 40 years, at least. And it's under these principles that the Internet itself was originally created. It's under these principles that the most important competition in applications occurred. It's under these principles that Internet2 asks that you continue to produce an environment that will encourage innovation.

And when we look to foreign countries—in particular, Japan, Korea, and France—it is under these old principles that those countries have architected a broadband network that has produced broadband networks that are much more efficient and cost effective than what we have. As *The Wall Street Journal* reported last fall, France offers its citizens broadband at $1.80 per megabyte—megabit per second. That's about 11 times cheaper than the service offered by Verizon in the United States.

So, this new—so these old ideas are now being replaced by new principles, new principles that are backed by theory, by theory offered by a bunch of academics and a bunch of economists that have nothing more than the hand-waving of theories before them.

Now, I'm an academic, but I feel a little bit like the stableboy who spends his whole life shoveling—I guess I can't use that word here, right?—but shoveling whatever, and I'm surrounded by a bunch of academics offering a bunch of theories about how we should remake telecommunications law to get to the grand new age. And I say, you should look to the past and learn the lessons from the past before you radically change the infrastructure within which innovation has occurred.

And the fourth point that I don't think anybody can really deny, the changes that are being described, not by the very reasonable people who testified in the earlier panel, but by the leaders of Verizon and the leaders of AT&T, the changes that are being described would radically reduce competition in applications and content on the Internet, radically reduce that competition because as they set up fast lanes on the Internet, the only companies that could afford to buy access to the fast lanes on the Internet are companies like Google and Yahoo! and Microsoft and the content com-

panies that already have succeeded in the marketplace. The next-generation Yahoos! and Googles cannot buy access to the fast lane, because they would face a barrier to entry that would restrict competition. This restriction in competition would fundamentally weaken the growth of the Internet.

Now, you have a bunch of theories before you, and I want to just end with a frame to think about these theories.

I was criticized many years ago for using a quote from one of my favorite musicians, Jill Sobule. She has a fantastic song in which the slogan is "sold my soul, and nothing happened." And I'd suggest, 10 years from now, if we follow the regulatory strategy that we're going right now, which says "Give up the framework of regulation that has governed telecommunications for the last 40 years, give up the principles of neutrality that has governed telecommunications for the last 40 years," then, 10 years from now, we will look back, and we will say, "In order to get what the broadband providers promised, we sold our soul, the soul of neutrality that has governed the Internet since its birth, and we got nothing in return."

Thank you very much.

[The prepared statement of Mr. Lessig follows:]

PREPARED STATEMENT OF LAWRENCE LESSIG, C. WENDELL AND EDITH M. CARLSMITH PROFESSOR OF LAW, STANFORD LAW SCHOOL

Introduction

Mr. Chairman, and Members of the Committee, my name is Lawrence Lessig, and I am a professor of law at Stanford Law School. For the past decade I have been researching the relationship between technology and Internet policy, and in particular, the relationship between the architecture of the Internet and innovation. I am therefore happy to have the opportunity to address the question that this Committee is now considering—whether Congress should enact rules to protect network neutrality.

To answer that question, this Committee must keep in view a fundamental fact about the Internet: as scholars and network theorists have extensively documented, the innovation and explosive growth of the Internet is directly linked to its particular architectural design. It was in large part because the network respected what Saltzer, Clark and Reed called "the 'end-to-end' principle" that the explosive growth of the Internet happened. If this Committee wants to preserve that growth and innovation, it should take steps to protect this fundamental design.

In my view, the most important action that this government has taken to preserve the Internet's end-to-end design was the decision by Chairman Michael Powell to commit the FCC to enforce what he referred to as the Internet's four "Internet Freedoms." Building upon an idea first presented to this committee by Microsoft's Craig Mundie in 2002, these "Internet Freedoms" established for the first time a Federal policy to assure that network owners don't deploy technologies that weaken the environment for innovation that the Internet initially created. Those principles were relied upon by the FCC when it stopped DSL provider Madison River Communications from blocking Voice-over-IP services. That enforcement action sent a clear message to network providers that the Internet that they could offer must continue to respect the innovation-promoting design of end-to-end.

It is my view that Congress should ratify Powell's "Internet Freedoms," making them a part of the FCC's basic law. However, in the time since Chairman Powell announced these principles, it has become clear that they are missing one important requirement. The now openly-stated intentions of AT&T and others to introduce access-tiering to the Internet threatens to undermine application competition on the Internet.[1] Congress should act to avoid that result.

[1] See *Telcos Propose Web Tiers,* Red Herring (January 31, 2006).

Access-tiering[2] will create an obvious incentive among the effective duopoly that now provides broadband service to most Americans. By effectively auctioning off lanes of broadband service, this form of tiering will restrict the opportunity of many to compete in providing new Internet service. For example, there are many new user generated video services on the Internet, such as Google Video, YouAre.TV, and youTube.com. The incentives in a world of access-tiering would be to auction to the highest bidders the quality of service necessary to support video service, and leave to the rest insufficient bandwidth to compete. That may benefit established companies, but it will only burden new innovators.

To oppose access-tiering, however, is not to oppose all tiering. I believe, for example, that consumer-tiering should be encouraged. Network providers need incentives to build better broadband services. Consumer-tiering would provide those incentives.

Consumer-tiering, however, should not discriminate among content or application providers. There's nothing wrong with network owners saying "we'll guarantee fast video service on your broadband account." There is something wrong with network owners saying "we'll guarantee fast video service from NBC on your broadband account." And there is something especially wrong with network owners telling content or service providers that they can't access a meaningful broadband network unless they pay an access-tax.

I don't mean "wrong" in the sense of immoral, or even unfair. My argument is not about the social justice of Internet access. I mean "wrong" in the sense that such a policy will inevitably weaken application competition on the Internet, and that in turn will weaken Internet growth.

The Internet's growth is a crucial part of the Nation's economic growth. In my view, Congress should take steps to assure that the current concentration in broadband access does not translate into reduced application competition on the Internet. A "network neutrality" policy that combined Chairman Powell's "Internet Freedoms" with a requirement that network providers secure a level of basic Internet service with only consumer-tiering would, in my view, promote that growth.

I. The End-to-End Internet Inspired A Wide Range of Innovation

The Internet has inspired a wide range of innovation. Because of its particular architectural design, that innovation has come primarily from the "edge" or "end" of the network through application competition. As network architects Jerome Saltzer, David Clark, and David Reed describe,[3] the original Internet embraced an "end-to-end" design, meaning the network itself was to be as simple as possible, with intelligence for the network provided by applications that connected at the edge of the network.

One consequence of this design is that early network providers couldn't easily control the application innovation that happened upon their networks. That in turn meant that innovation for these network could come from many who had no real connection to the owners of the physical network itself. Indeed, if you consider some of the most important innovations in this history of the Internet—from the design of its protocols by graduate student Vint Cerf, and Bob Kahn, to the development of the World Wide Web by a Swiss researcher at CERN, to the first peer-to-peer instant messaging chat service, ICQ, developed by a young Israeli, to the first web based (or HTML-based) e-mail, HoTMaiL, developed by an Indian immigrant—these are all innovations by kids or non-Americans: outsiders to the network owners.

This diversity of innovators is no accident. By minimizing the control by the network itself, the "end-to-end" design maximizes the range of competitors who can innovate for the network. Rather than concentrating the right to innovate in a few network owners, the right to innovate is open to anyone, anywhere. That architecture, in turn, has created an astonishing range of important and economically valuable innovation. Here, as in many other contexts, competition has produced growth. And that competition was assured by the network's design.[4]

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[2] By "access-tiering," I mean any policy by network owners to condition content or service providers' right to provide content or service to the network upon the payment of some fee. These fees are independent of basic Internet access fees. No one questions the right of network owners to charge Google for the bandwidth it uses. Instead, "access-tiering" adds an additional tax on network innovators based upon the particular service being offered.

[3] 29 See J. H. Saltzer, David Clark, and David Reed, "End-to-End Arguments in System Design," available at *<http://web.mit.edu/Saltzer/www/publications/endtoend/endtoend.pdf>;* David P. Reed et al., "Active Networking in End-to-End Arguments," available at *<http://Web.mit.edu/Saltzer/www/publications/endtoend/ANe2ecomment.html>.*

[4] The best work describing this interaction is Barbara van Schewick, *Architecture and Innovation: The Role of the End-to-End Arguments in the Original Internet,* PhD dissertation, Technical University, Berlin (2005), and Tim Wu, *Network Neutrality, Broadband Discrimination,* 2 J.

Continued

II. Concentrations in Broadband Access Threaten That End-to-End Neutrality

It was the assumption of many (including me)[5] that competition in broadband access would prevent any compromise in end-to-end neutrality. That was the premise of the "open access" requirement imposed upon telecom providers. The assumption was that in a competitive market, no individual ISP would have the market power to successfully restrict the range of Internet applications. "Open access" thus sought to establish a competitive ISP market, which in turn was thought would protect network neutrality.[6]

This assumption about competition protecting end-to-end neutrality has been drawn into doubt by recent scholarship.[7] But given the increasing concentration in broadband provision, the question whether ISP competition could protect end-to-end neutrality is now effectively moot. Whether or not competition among ISPs is enough, America no longer has sufficient broadband ISP competition. In most markets, an effective duopoly controls access to high speed Internet.[8]

This concentration has now led network owners to openly advocate changes in network policy designed to vest new control in the network owner over the applications and content that flow over their network. In the United States, there have been isolated incidents, for example, of DSL providers blocking Voice-Over-IP (VoIP) services.[9] That policy has become the rule in a number of foreign jurisdictions. And as recently reported, network owners in the United States and Canada are now discussing adding access-tiering to their networks.[10]

These changes, if allowed, would fundamentally alter the environment for innovation on the Internet. With a network that embeds the principle of end-to-end, there is no danger that an innovator's application or content will be blocked by the network owner. Consumers might not like the innovation. That risk is unavoidable. But an end-to-end network removes the risk that the network owner will interfere with an innovation, either because it competes with the network owners own business (e.g., VoIP), or because the owner wants to extract payment from the innovator. This threat-free environment induces more application innovation.

If the principle of end-to-end is abandoned, however, then innovators must now include in their calculation of risk the threat that the network owner might either block or tax a particular application. That increased risk will reduce application investment.

III. Powell's "Internet Freedoms" Are A Critical, Though Incomplete, Defense of Network Neutrality

This concern about the costs to innovation caused by network owners is not new. Since the 1996 Telecom Act, the FCC had been struggling to formulate policy that balanced both the need for new broadband investment against the risk that broadband operators would exercise too much control over network innovation. Former FCC Chairman Michael Powell finally resolved that policy struggle in February, 2004. In a speech given in Boulder, he outlined four principles that he promised would guide FCC policy. As Chairman Powell described, these "Internet Freedoms" were:

> (1) Freedom to Access Content. First, consumers should have access to their choice of legal content.
>
> Consumers have come to expect to be able to go where they want on high-speed connections, and those who have migrated from dial-up would presumably object to paying a premium for broadband if certain content were blocked. Thus, I challenge all facets of the industry to commit to allowing consumers to reach the content of their choice. I recognize that network operators have a legitimate need to manage their networks and ensure a quality experience, thus reason-

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Telecom. & High Tech 141 (2003). I have also addressed this question in *The Future of Ideas* (2001).

[5] See, e.g., Mark Lemley & Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era,* 48 UCLA Law Review 925 (2001).

[6] As the Wall Street Journal recently reported, France has vigorously enforced "unbundling" requirements for network providers. See Jesse Drucker, *For U.S. Consumers, Broadband Service is Slow and Expensive,* Wall Street Journal, November 16, 2005. Japan has followed a similar policy. See Nobuo Ikeda, *The Unbundling of Network Elements Japan's Experience,* available at *< http://www.rieti.go.jp/jp/publications/summary/03110001.html>.*

[7] See van Schewick, *supra,* § 9.3

[8] FCC, "High-Speed Services for Internet Access," as of 12/31/04, available at *<http://www.fcc.gov/wcb/iatd/comp.html>.*

[9] See *infra* note 12.

[10] See *supra* note 1.

> able limits sometimes must be placed in service contracts. Such restraints, however, should be clearly spelled out and should be as minimal as necessary.
>
> (2) Freedom to Use Applications. [C]onsumers should be able to run applications of their choice.
>
> As with access to content, consumers have come to expect that they can generally run whatever applications they want. Again, such applications are critical to continuing the digital broadband migration because they can drive the demand that fuels deployment. Applications developers must remain confident that their products will continue to work without interference from other companies. No one can know for sure which "killer" applications will emerge to drive deployment of the next generation high-speed technologies. Thus, I challenge all facets of the industry to let the market work and allow consumers to run applications unless they exceed service plan limitations or harm the provider's network.
>
> (3) Freedom to Attach Personal Devices. [C]onsumers should be permitted to attach any devices they choose to the connection in their homes.
>
> Because devices give consumers more choice, value and personalization with respect to how they use their high-speed connections, they are critical to the future of broadband. Thus, I challenge all facets of the industry to permit consumers to attach any devices they choose to their broadband connection, so long as the devices operate within service plan limitations and do not harm the provider's network or enable theft of service.
>
> (4) Freedom to Obtain Service Plan Information. [C]onsumers should receive meaningful information regarding their service plans.
>
> Simply put, such information is necessary to ensure that the market is working. Providers have every right to offer a variety of service tiers with varying bandwidth and feature options. Consumers need to know about these choices as well as whether and how their service plans protect them against spam, spyware and other potential invasions of privacy.[11]

Powell's speech was an indication about enforcement strategy. In March, 2005, that strategy was demonstrated. In an extraordinarily swift manner, the FCC succeeded in securing a settlement with a DSL provider, Madison River Communications. That company had allegedly blocked VoIP on their DSL lines. In the settlement, Madison River agreed it would not use its power over the network to block legal applications on the network.[12]

Powell's strategy, in my view, was a perfect mix of carrot and stick. His aim was to signal to network providers the kind of network service they could provide without fear of FCC intervention. But the Madison River case demonstrated that Powell's FCC would not hesitate to intervene when these basic principles were violated. Network providers thus knew the kind of business model that would steer clear of the FCC. That had an important effect upon investment incentives—both of network providers, and of application developers.

There is, however, one important hole in the "Internet Freedoms" that Powell articulated. And that risk is revealed in the recently revealed intentions of major network providers to begin to implement access-tiering for content and service providers on the Internet.

The motivation behind this sort of tiering is perfectly understandable. Network providers now have significant market power in the broadband market. They aim to leverage that power to maximize revenue. No doubt, some of that revenue will support new network provisioning. That provisioning will of course benefit everyone to the extent it increases the spread of broadband service.

But this form of tiering will also have consequences for the market for application and content innovation. That danger can be seen in a simple hypothetical.

Imagine a network owner with the ability to provision a network that is providing 6 Mbps to its customers. Initially, that capacity is the effective space for broadband application competition. Imagine then that the network begins to offer "speed lanes" to particular video providers. These channels effectively reduce the capacity for broadband application competition. In this context, video providers have the incentive both to secure for themselves sufficient bandwidth to guarantee quality service, and the incentive to guarantee that no one else, or at least, no one not paying the access fee, be able to provide that network service. Thus, working with the network

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[11] "Preserving Internet Freedom: Guiding Principles for the Industry," February 8, 2004, *<http://www.fcc.gov/commissioners/previous/powell/speeches.html>*.

[12] "Madison River Communications, LLC Order and Consent Decree," March 3, 2005, *<http://www.fcc.gov/voip/>*.

provider, large video companies could secure sufficient provisioning to enable their content to be served while leaving insufficient bandwidth to other competitors.

Thus, for example, there are many new user-generated video sites appearing on the Internet. Google has one such site—Google Video—but others are being created by traditional Internet startups. Thus, youTube.com and YouAre.tv are two competitors to Google that are developing similar services to the Google Video service.

In a world with access-tiering, companies like Google in this context would have an incentive to secure sufficient bandwidth to enable its services while leaving competitors without enough bandwidth for their own. Access-tiering would thus become another barrier to entry for competitors, reducing application or content competition on the Internet.

This would represent a fundamental change in the environment for innovation on the Internet. For the first time, network owners would have a strategic capability, as well as incentive, to create barriers to entry for new innovators. We should remember that the current leaders in Internet innovation all began with essentially nothing. Google, eBay, Yahoo! and Amazon all started as simple websites providing limited, but fantastic, services. They had to pay no special access-tax to be on the Internet; there was no special channeling by Internet providers that disadvantage these competitors relative to any others. They succeeded because the product they offered was better than others. Competition on the merits thus drove this market.

That competition would be threatened by access-tiering. Existing content providers have an incentive to block competitors; access-tiering would be a means to effect that competitive advantage. And while these actions might not rise to the level of an antitrust violation, it is perfectly appropriate for Congress to select a network policy that it believes would maximize innovation and growth for the Nation. Adding toll booths to the Internet may well benefit those who own the roads; but it won't benefit application and content competition on the Internet, both of which drive economic growth.

To oppose access-tiering, however, is not to oppose all tiering. It is certainly valuable for network providers to offer consumers different tiers of service. Such differentiation will create incentives for network providers to improve network performance. The currently abysmal record of broadband provision in the United States demonstrates that they certainly need more incentives.[13] Consumer-tiering could well provide more incentives.

But consumer-tiering would not create any of the anticompetitive effects that access-tiering would. So long as network owners offered neutral tiering—for example, offering high speed for video content, or simply higher speed for large file transfers—that "discrimination" would not harm application competition. The diversity of consumer wants would produce a general demand for faster, cheaper Internet service. That general demand would benefit application competition generally.

IV. Congress Should Ratify Powell's "Internet Freedoms" Along With A Restriction On Access-Tiering

In light of this emerging threat to application and content innovation, it is my view that Congress should enact legislation that clearly establishes the competitive baseline for broadband service in America. That legislation should first ratify Chairman Powell's "Internet Freedoms." These principles are an essential element to any "network neutrality" policy.

But in addition to these "Internet Freedoms," Congress should act to avoid the competitive costs that access-tiering could produce. There are two ways in which Congress could respond to this threat.

At a minimum, Congress could simply restrict access-tiering by network providers. That would leave network providers free to offer consumer-tiered service. But such tiering should not be allowed to turn upon the particular provider of network content. Instead, such tiering should be limited to either bandwidth guarantees (e.g., guaranteeing at least 10 Mbps) or service guarantees (e.g., guaranteeing fast 'video service' without specifying a particular provider).

A more ambitious regulation would require network providers to provide a "basic Internet service" to all broadband customers. The FCC would define what "basic Internet service" was. And the FCC's definition would turn upon a judgment about the capacity necessary to assure sufficient competition among application and serv-

[13] Comparative broadband infrastructure statistics rank broadband in America somewhere between the 13th and 19th industrialized nation in broadband penetration. See, e.g., *<http://www.clickz.com/stats/sectors/geographics /article.php/3563966>* (15th). As the Wall Street Journal reported last fall, it is not countries such as Japan or Korea that have outflanked the United States. European countries too now offer their citizens vastly superior broadband options. French households, for example, can secure 20 Mbps service at about $1.80/Mbps. The equivalent Verizon entry-level service plan costs almost 11 times that price. See *supra* note 6.

ice providers. In the current context, that could mean sufficient bandwidth to provide reasonable video services. But as the uses of the Internet develop, the scope of this "basic Internet service" could change.

Conclusion

The Internet was the great economic surprise of the 20th century. No one who funded or initially developed the network imagined it would have the economic and social consequences that it has had.

But though the success of the network was a surprise, we have learned a great deal about why it was a success. Built into its basic design was a guarantee of maximum competition. A free market in applications was coded into its architecture. The growth of that network followed from this basic design. The world economy benefited dramatically from this growth.

The threat facing the Internet today is that network owners will convince regulators to go back on that original design. Through regulatory policies that permit broadband providers to act however their private interests dictate, these regulatory policies would threaten the economic potential of the network generally. New innovation always comes from outsiders. If insiders are given both technical and legal control over innovation on the Internet, innovation will be stifled.

Unlike many other industrialized nations, we in the United States have failed to preserve the extraordinary competition among ISPs that characterized early Internet growth. But despite that loss in access competition, the end-to-end principle, supported in part by the FCC, still provided significant opportunity for application and content competition. The changes now being spoken of by the effective duopoly of broadband providers will weaken that application and content competition.

It is my view that any policy that weakens competition is a policy that will weaken the prospects for Internet and economic growth. I therefore urge this Committee to secure and supplement the work of Chairman Powell, by enacting legislation that protects the environment for Internet innovation and competition that the original Internet produced.

The CHAIRMAN. The next witness is J. Gregory Sidak, Professor of Law at Georgetown University.

STATEMENT OF J. GREGORY SIDAK, PROFESSOR OF LAW, GEORGETOWN UNIVERSITY LAW CENTER

Mr. SIDAK. Thank you very much, Mr. Chairman.

Well, I'm tempted, also, to toss aside my prepared remarks after that inspiring testimony by Professor Lessig. I agree with him that there's a lot that we already know about this problem. I have spent the last 20 years working as a lawyer and economist on regulatory and antitrust problems in the telecommunications industry. It's clear to me that economics understands the distinctive cost and demand characteristics of telecommunications networks better than just about any industry that I can think of.

The common problem that we see again and again in telecommunications is, How do you create the incentives to build the network while at the same time making use of the network affordable for as many people as possible? That is the critical issue that this Committee faces.

In my view, there is not a problem of net neutrality that requires legislation. We know, from economics, that there are six essential characteristics of telecommunications networks. If the Committee will take cognizance of those, I think it will see that there are strong market forces that will prevent the harms that are asserted to exist here.

The first unique characteristic of a telecommunications network is that it requires substantial sunk investment. Networks are not build overnight. Sunk investment is made sequentially over time. As soon as it becomes clear, through the imposition of something

like a net-neutrality regime, that the recovery of the sunk investment of the network is in jeopardy, the funds that come forward to build the network will become more expensive, the cost of capital goes up, and the scale of the network is curtailed.

Second, networks display economies of scale. That means that the marginal cost of another user using the network is very low. But if you price on the basis of marginal cost, you can never recover the sunk costs.

A third and related point is that networks have what are known as economies of scope. They have common costs, because they produce multiple products. Those products have costs incurred in common. That means that there should be a contribution from each one of those products to the recovery of the sunk costs of the network. The way that economists have figured out to do this in the least distortionary way—in other words, in the way that affects consumer choice the least—is something known as "Ramsey pricing." It's been known since 1927. Ramsey pricing is one form of differential pricing; in other words, charging prices based on the intensity of demand.

That is important, because a fifth characteristic of telecommunications networks is joint demand. A telecommunications network is an example of a two-sided market. There is value to someone placing a call, and there is value to someone receiving the call. There is value to someone browsing the Internet, and there is value to a Google of providing the search engine, because it sells advertising to customers who value the information that is revealed when the person doing the search reveals that he or she is interested in particular information.

So, there are two sides of the market. Each one has an interest in the product being produced. There are two willingnesses to pay in that situation. There is no basis in economic theory to presume that it would be socially optimal for the end users to pay for all the costs of building a high-speed network, while the companies that deliver content or applications to those same end users over the network, and who therefore derive substantial economic advantage from the use of the network, would pay nothing. But that is the proposition that's been put to us this morning.

A sixth consideration is congestion. Just like highways, telecommunications networks are subject to congestion. That's why pricing signals are very important. We know that if there is differential pricing of products—something, incidentally, that we see in many, many competitive markets, so it's not unique to a monopoly in any way—then the price can be lowered to the consumer who has the most price-sensitive demand. In that sense, the scale of the network can be expanded. It can be made more inclusive. That is a good thing, because we believe that the larger the network—as universal-service policy, for example, illustrates—the greater the social benefit.

So, it's important to realize that we have, already, a toolkit that we have been using for decades in telecommunications to understand these problems of common costs of networks and finding the way to pay for the building of the network in the least distortionary way.

Thank you.

[The prepared statement of Mr. Sidak follows:]

PREPARED STATEMENT OF J. GREGORY SIDAK, PROFESSOR OF LAW, GEORGETOWN UNIVERSITY LAW CENTER

Thank you, Mr. Chairman, for inviting me to testify today. I have worked as a lawyer and economist on regulatory and antitrust proceedings in the telecommunications industry for twenty years. In the interest of disclosure, let me say that I have been a consultant to a number of companies in the telecommunications, content, and software industries.[1] Today, however, I am appearing on my own behalf. I do not represent any company, and no one has paid me to prepare this testimony.[2]

"Net neutrality" obligations would require a telecommunications carrier to operate its broadband network so that no packet of information is treated as inferior to others in terms of its urgency of delivery. Under "net neutrality" I can take comfort in knowing that my son's Internet chatting about what agent Jack Bauer did on last night's episode of *24* will receive the same priority of delivery as my file transfer of this testimony to the Committee's staff. The practical effect of "net neutrality" obligations would be to require a telecommunications carrier to recover the full cost of its broadband network connection through a uniform flat-rate charge imposed on all end users. Companies like Google, eBay, and Yahoo! might believe that such an outcome works to their private economic advantage, but that short-run view would neglect the disincentive that "net neutrality" obligations would create for private investment in the very broadband infrastructure upon which these companies rely to deliver their content and applications to consumers.

Few industries studied by economists have received such intensive theoretical and empirical analysis as telecommunications. Today, regulators in the United States and other OECD nations understand very well how the unique cost characteristics and demand characteristics of telecommunications networks affect market outcomes and the efficacy of regulatory intervention. "Net neutrality" obligations are incompatible with what we know about the economics of telecommunications. To understand the harm that "net neutrality" obligations pose to economic welfare, Congress needs to appreciate six salient economic features of telecommunications networks. These six economic considerations underscore why Congress should not frustrate the ability of a telecommunications company to recover the sunk costs of its broadband network in the manner that least distorts consumer choices.

The first economic consideration is that a broadband network requires substantial sunk investment.[3] Private investors will fund the construction of a broadband network only if there is a reasonable expectation that the company making that investment will recover the cost of its investment, including a competitive return on capital. Sunk investment is not a one-shot deal; sunk investment is made continuously over time. Therefore, as soon as it is understood that a new regulatory obligation or regime like "net neutrality" will jeopardize a firm's recovery of its sunk costs, the capital markets will demand a higher risk-adjusted return. As the cost of capital rises, incremental sunk investment in the network will be more costly for its owner, and the likelihood that the network will be completed according to its originally intended scale will diminish.

The second economic consideration is that a broadband network exhibits economies of scale. The large sunk costs of building a broadband network imply that the marginal cost of providing service to one more consumer is very low. However, marginal cost pricing is insufficient to recover even the average variable cost of the network, much less the average total cost, which would be necessary to recover the sunk costs of building the network. In economic theory, the solution to this problem is to charge consumers a lump sum fee to recover the sunk costs and to price usage at marginal cost. In a regime of regulated pricing, however, this solution is impos-

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[1] Since the early 1990s, they have included Alcatel, AT&T, Bell Atlantic, BellSouth, BT (British Telecom), CanWest Global Communications, Comsat, Deutsche Telekom, Eircom, Ericsson, France Telecom, GTE, Hongkong Telecom, Microsoft, National Association of Broadcasters, Nippon Telegraph and Telephone, NTT West, NTT DoCoMo, Portugal Telecom, Qwest Communications, Recording Industry Association of America, SBC Communications, Siemens, Telecom Italia, Telefónica de España, Telstra, The Walt Disney Company, United States Telecom Association, Verizon Communications, Verizon Wireless, Videsh Sanchar Nigam Limited, and Vodafone. In addition, I advised the Republic of Mexico in the World Trade Organization dispute between the United States and Mexico concerning international telecommunication services, and the Antitrust Division of the U.S. Department of Justice and the Canadian Competition Bureau on antitrust matters concerning telecommunications services.

[2] The views expressed are my own, and not those of Georgetown University.

[3] See, e.g., Jerry A. Hausman & J. Gregory Sidak, *A Consumer-Welfare Approach to the Mandatory Unbundling of Telecommunication Networks,* 109 YALE L.J. 417 (1999).

sible for political reasons because the lump sum fee could be enormous. So firms or regulators attempt to identify what has become known as the "optimal departure from marginal cost pricing."[4]

The third economic consideration is that a broadband network exhibits economies of scope. In other words, there are synergistic "common costs" to producing multiple products over the same network. The products may have substantially different demand characteristics, including different price elasticities of demand. A multi-product firm can earn contributions to the recovery of the sunk costs of its broadband network from each of its services. Economic welfare is maximized when the pricing of each such product makes a contribution to the recovery of sunk costs that is inversely related to its price elasticity of demand. This pricing rule is known as Ramsey pricing.[5]

The fourth economic consideration is that differential pricing, such as Ramsey pricing can increase economic welfare because it enables a firm to lower the price to consumers who would otherwise be priced out of the market if the firm were constrained to charge a higher uniform price. Moreover, differential pricing is commonplace in competitive markets (such as airlines, hotels, retailing, package delivery, personal computers, and book publishing) because competition *compels* firms to adopt rival strategies to lower, to the maximum extent possible, the prices that they charge price-sensitive consumers.[6] It would be perverse to prohibit owners of broadband networks from employing the same differential pricing methodology that is routinely used by firms in competitive markets.

The fifth economic consideration is that telecommunications services have joint demand. For example, a telephone call is valued by both the caller and the recipient, and a visit to a website is valued by both the consumer doing the browsing and the owner of the website. In a "two-sided" market of this sort, the demand that one party has for the product is complementary to the demand that the other party has.[7] Over-the-air television programs are free to the viewer because advertisers pay broadcasters to assemble audiences to receive advertisements. Google searches are free to Internet users because Google sells highly focused advertising that responds to the interests revealed by the Internet user's search request. Each party in a two-sided market can contribute to the recovery of the sunk costs required to build a broadband network. There is no basis in economic theory to presume that it would be socially optimal for end users to pay for all of the cost of building a high-speed broadband network while the companies that deliver content or applications to those same end users over that network—and therefore derive substantial economic advantage from its use—pay nothing.

The sixth economic consideration is that telecommunications networks are susceptible to congestion. For that reason, correct price signals must be used at every possible point in the network so that users who congest the network bear the social cost of their behavior.[8] If, instead, the owner of a broadband network were constrained to charge the same price to every end user, regardless of the amount of network congestion that the user created, the result would be excess demand and reduced supply—which is to say, shortages of bandwidth.

These six economic factors counsel Congress not to frustrate the ability of a telecommunications company to recover the sunk costs of its broadband network in the manner that least distorts consumer choices. We know from Ramsey pricing that the least distortionary method is to charge all persons or businesses that use the network, and to do so in inverse relation to their respective price elasticities of demand. In that manner, revenues earned from persons or businesses with the most price-insensitive demand for broadband connections will permit the telecommunication carrier to reduce prices for consumers who are more sensitive to price, including those with limited disposable income. The result is an expansion of the scale and use of the network. Under differential pricing, intense demanders of broadband delivery—like Google or Yahoo! or eBay—probably would pay more for expedited delivery of the advertising that drives their business models. For these users, conven-

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[4] See William J. Baumol & J. Gregory Sidak, Toward Competition in Local Telephony 35–40 (MIT Press & AEI Press 1994); William J. Baumol & David F. Bradford, *Optimal Departures from Marginal Cost Pricing,* 60 Am. Econ. Rev. 265 (1970).

[5] Frank Ramsey, *A Contribution to the Theory of Taxation,* 37 Econ. J. 47 (1927).

[6] See William J. Baumol & Daniel G. Swanson, *The New Economy and Ubiquitous Competitive Price Discrimination: Identifying Defensible Criteria of Market Power,* 70 Antitrust L.J. 661 (2003).

[7] See, e.g., David S. Evans, *The Antitrust Economics of Multi-Sided Platform Markets,* 20 Yale J. on Reg. 3235 (2003).

[8] See Christopher S. Yoo, *Network Neutrality and the Economics of Congestion,* 95 Geo. L.J. (Forthcoming June 2006); J. Gregory Sidak & Daniel F. Spulber, *Cyberjam: the Law and Economics of Internet Congestion of the Telephone Network,* 21 Harv. J.L. & Pub. Pol'y 327 (1998).

tional "best efforts" delivery may be insufficient. In contrast, consumers who are the less intensive users of broadband capacity and who would be satisfied with best-efforts delivery will find it more affordable to subscribe to broadband for Internet access if they do not have to pay for higher network performance than they need. It should come as no surprise that the *New York Times* reported two days ago that America Online and Yahoo! "are about to start using a system that gives preferential treatment to messages from companies that pay from ¼ of a cent to a penny each to have them delivered."[9]

Congress also should not deny telecommunications carriers the freedom to supplement subscriber revenue with their own advertising revenue. Newspapers, cable television operators, and Internet service providers all have business models that rely on revenues from both advertising and subscriptions. Unless Congress prohibits them from doing so, telecommunications carriers will also develop business models that generate advertising revenue. That ancillary revenue will enable these carriers to reduce further the monthly subscription price for broadband access.

In short, the enactment of "net neutrality" obligations would impose social costs. It would reduce consumer welfare by forcing end users to pay more for broadband Internet access or to forgo the service. At the same time, such obligations would not produce benefits in terms of preventing anticompetitive behavior. A telecommunications carrier already lacks the incentive to block a consumer's access to lawful content, because content and carriage are complementary goods, not substitute goods. A telecommunications carrier also lacks the incentive to degrade the quality of packets for VoIP services, because that degradation would be quickly detected and could trigger antitrust or business tort litigation.

Finally, the overarching reason why anticompetitive behavior of any sort is implausible is that competition will constrain the market power of any given carrier. In most geographic markets, four or more separate firms will supply broadband Internet access. It will be supplied over the fixed network of the regional Bell operating company or other local telephone company, over the fixed network of the local cable television operator, and over two (if not three) wireless networks in addition to the wireless network affiliated with the local RBOC.

To conclude, the legislative agenda of the "net neutrality" movement ignores the essential cost and demand characteristics of telecommunications networks. It also posits that the current marketplace will produce implausible competitive harms. Congress faces many important questions as it revises the Communications Act, but the imposition of "net neutrality" obligations is not one of them.

The CHAIRMAN. Thank you very much.

Our next witness is Gary Bachula, Vice President, External Affairs, of Internet2.

Thank you.

STATEMENT OF GARY R. BACHULA, VICE PRESIDENT, EXTERNAL AFFAIRS, INTERNET2

Mr. BACHULA. Thank you, Mr. Chairman and Members of the Committee.

Internet2 consists of over 300 universities, corporations, and government labs working on an advanced Internet. Our Abilene network, a private 10-gigabit research-and-education network, today enables millions of researchers, faculty, and students to live in the future of advanced broadband. Internet2 students and faculty already routinely use technologies like TV-quality videoconferencing and are hard at work at creating more advanced, potentially life-changing technologies in areas such as telemedicine and distance learning.

These innovations are not being developed by telephone or cable companies; they're being developed the way the web browser, the search engine, and instant message were developed the first time around, by end users. That requires an open, standards-based, non-

[9] Saul Hansell, *Postage Is Due for Companies Sending E-Mail,* N.Y. Times, Feb. 5, 2006.

discriminatory Internet. That is why we support net-neutrality provisions in law and regulations.

Now, some argue against net neutrality, saying that they must give priority to certain kinds of Internet bits, such as video, to guarantee quality. Let me tell you about our actual experience at Internet2.

When we first began to deploy our Abilene network, our engineers started with the assumption that we, too, should find technical ways of prioritizing certain bits, such as streaming video, in order to assure that they arrived without delay. We explored various quality-of-service schemes. As it developed, though, all of our research and practical experience supported the conclusion that it was far more cost effective to simply provide more bandwidth. With enough bandwidth, there is no congestion and video bits do not need preferential treatment.

Today, our Abilene network does not give preferential treatment to anyone's bits, but our users routinely experiment with streaming HDTV, hold thousands of high-quality two-way video conferences simultaneously, and transfer huge files of scientific data routinely around the globe without loss of packets.

We would argue that, rather than introduce additional complexity into the network fabric, and additional costs to implement these prioritizing techniques, the telecom providers should focus on providing Americans with an abundance of bandwidth, and the quality problems will take care of themselves.

At Internet2 universities today, we routinely provide 100 to 1,000 megabits per second of connectivity to the desktop, the laboratory, the research lab, the classroom. Today's typical home broadband connection is only 1 to 5 megabits, at best.

We would like to see Congress set a national goal of 100 megabits of symmetrical bandwidth to every home, business, and school in America in 5 years, and a gigabit in 10. This is absolutely doable using coaxial cable and fiber to the home. That would allow plenty of bandwidth for telephone, video, e-mail, and many other new uses, without requiring these costly prioritization and partitioning schemes.

Higher bandwidth will also enable exciting new uses for the Internet. Home medical monitoring, for example, could save billions in healthcare costs, reduce hospital stays, and keep people from needing nursing homes earlier. Education and telework are two other areas where a high-bandwidth Internet could have major impact.

Our foreign competitors get this. They are adopting high-bandwidth, open, simple, low-cost designs for their networks. We are the only nation looking at making the network more, rather than less, complex and expensive. We believe this is the wrong choice.

If we lose the open Internet, the Internet controlled by users, the Internet that allows innovation and entrepreneurial investment, we will lose something very important to our national economic well-being. Keeping network design open, inexpensive and simple is better than costly, complex, and closed.

If you do the right thing, we believe you will be enabling another wave of amazing innovation and economic growth in this country.

We know, because every day in our university campuses we see part of that future.

Thank you for your consideration.

[The prepared statement of Mr. Bachula follows:]

PREPARED STATEMENT OF GARY R. BACHULA, VICE PRESIDENT, EXTERNAL AFFAIRS, INTERNET2

Mr. Chairman, Members of the Committee:

Thank you for the opportunity to testify today. With respect to the issue of net neutrality, some have said that the future of the Internet is at stake. We in Internet2 would agree, but might go further. The future of American innovation and competitiveness is also at stake. To compete in the world, we need a simple, inexpensive, and open network, not a costly, complex, and balkanized one.

Who we are. Internet2 is a not-for-profit partnership of 208 universities, 70 companies, and 51 affiliated organizations, including some Federal agencies and laboratories. Our mission is to advance the state of the Internet, and we do that primarily by operating for our members a very advanced, private, ultra-high-speed research and education network called Abilene that enables millions of researchers, faculty, students and staff to "live in the future" of advanced broadband. By providing very high speed pipes—10,000 times faster than home broadband, in our backbone—we enable our members to try new uses of the network, develop new applications, experiment with new forms of communications, experiencing today what we hope the rest of America will be able to have and use in just a few years.

Today on our campuses students are able to take master music classes with world-renowned musicians via DVD-quality video conferencing technology. Recently, students at Wichita State were able to play and take lessons from the New World Symphony in Miami using Internet2's network. The fidelity of the audio and video is so fine-tuned, it is as if the teacher and the student are in the same room, able to discuss details about playing technique and musical phrasing. Famed oceanographer Bob Ballard is able to take elementary school children on undersea expeditions using Internet2's network. They can have a 2-way video conversation with an underwater diver in real time from any connected school in the country—imagine the lasting impression this must have—especially for those who may never have experienced the ocean firsthand.

We have a very strong interest in the current telecommunications reform discussion that is unfolding here in the Congress: we have seen an Internet future that is possible for this country and we know that the rules and incentives that you are considering could have an enormous and lasting impact upon the kind of Internet we will actually achieve.

Importance of Net Neutrality. If we lose the open Internet, the Internet controlled by users, the Internet that allows innovation and entrepreneurial investment, we will lose something very important to our economic well-being.

Our experience working with advanced networks dictates that we support an open Internet where the network operator does not block or degrade content or applications. Users should be able to decide how much bandwidth to buy from the network operators—a little or a lot—but once they've paid for the bandwidth, they should be able to go to any web page, use any lawful application or service, and send any lawful content. As network managers ourselves, we understand the need to be concerned with security attacks, spam, and overall congestion—but these should not be used as excuses to discriminate.

We also understand that the "net neutrality" issue goes deeper than just blocking a web page or a Voice over IP application. If a network operator starts to give preference to packets from one source (that perhaps pays the operator for preference), what happens to all of the other, ordinary packets? We know that when an ambulance or fire truck comes down a congested highway, everybody else has to pull over and stop. For emergencies, and for public safety, that is accepted, but what if UPS trucks had the same preference? Giving a preference to the packets of some potentially degrades the transport for everyone else.

In addition, if economic toll booths are allowed for content and applications to access the Internet, then soon only the richest content providers will be able to make their material available. What happens to the little guy, the start-up, the entrepreneur? If charging content providers to carry their bits to local customers had existed ten years ago, we would never have seen Amazon, e-Bay, or Google. As start-ups they could never have afforded the tolls that telephone companies today are imagining.

Our experience. Having deployed an advanced broadband network to over five million users for some seven years now, we at Internet2 believe our experience will interest Congress as you consider important telecommunications legislation.

We are aware that some providers argue against net neutrality, saying that they must give priority to certain kinds of Internet bits, such as video, in order to assure a high quality experience for their customer. Others argue that they want to use such discrimination among bits as a basis for a business model. Let me tell you about our experience at Internet2.

When we first began to deploy our Abilene network, our engineers started with the assumption that we should find technical ways of prioritizing certain kinds of bits, such as streaming video, or video conferencing, in order to assure that they arrive without delay. For a number of years, we seriously explored various "quality of service" schemes, including having our engineers convene a Quality of Service Working Group. As it developed, though, all of our research and practical experience supported the conclusion that it was far more cost effective to simply provide more bandwidth. With enough bandwidth in the network, there is no congestion and video bits do not need preferential treatment. All of the bits arrive fast enough, even if intermingled.

Today our Abilene network does not give preferential treatment to anyone's bits, but our users routinely experiment with streaming HDTV, hold thousands of high quality two-way video conferences simultaneously, and transfer huge files of scientific data around the globe without loss of packets.

We would argue that rather than introduce additional complexity into the network fabric, and additional costs to implement these prioritizing techniques, the telecom providers should focus on providing Americans with an abundance of bandwidth—and the quality problems will take care of themselves.

For example, if a provider simply brought a gigabit Ethernet connection to your home, you could connect that to your home computer with only a $15 card. If the provider insists on dividing up that bandwidth into various separate pipes for telephone and video and Internet, the resulting set top box might cost as much as $150. Simple is cheaper. Complex is costly.

A simple design is not only less expensive: it enables and encourages innovation.

The design of the Internet. The original Internet grew so fast, and spurred so many new uses, in part because of the way it was designed. It was designed to have an agnostic, neutral "core" whose job was to pass packets back and forth—and not to discriminate or examine the packets themselves. This allowed the network to be very cost efficient and economical. It also allowed all of the "intelligence" in the network to be at the "edge," that is, in the hands of the user.

This was very important to the evolution of the Internet. The network provider did not have control, the user did. As long as the user utilized the standardized protocols, he could expect to send and receive packets to anyone else on the network in a completely understandable, predictable manner. That allowed the user to experiment with new programs, new applications, slightly tweaked applications, and even new devices—and the user would know that the network would treat the packets all exactly alike.

Innovation was possible and could happen very quickly at "the edge" because you didn't have to re-architect or re-build the entire network in order to make a tweak or improvement in an end-user technology (such as improving a web search engine or developing a new video encoding program).

As a result of this remarkable design, sometimes called "end-to-end architecture," an explosion of new Internet technologies were developed over the past decade, many of them on university campuses or by recent graduates. The World Wide Web, the web browser, the search engine, instant messaging, and many other technologies were innovations by users of the network. Not one of these innovations was developed by telephone or cable companies.

The future of the Internet. The faculty and staff and students at Internet2 universities are experimenting with the next generation of the Internet today. If we do this telecommunications reform right, it could unleash another wave of new uses, new applications, money-saving innovations, and economy-driving benefits.

We believe that Americans are going to need, and want, significant increases in broadband speeds over the next two decades (just as they have experienced increased computer processing speeds and ever-expanding computer memory). At Internet2 universities today, we routinely provide 100 megabits per second to the desktop, and many of our schools offer 1000 megabit (1 gigabit) per second connections to their faculty and students. We have done so using commercially available, open-standards technology and our traffic flows on the very same fiber used by today's Internet service providers. Today's typical home broadband connection—which

admittedly is a big step up from dial-up—is only about 1 megabit. So the goal of broadband legislation should be to encourage ever-increasing bandwidth.

We would like to see Congress set a national goal of 100 megabits of symmetrical bandwidth, meaning the same speed for both uploaded and downloaded content, to every home and business and school in America in five years—and a gigabit (1000 megabits) in ten years. This is absolutely doable using coaxial cable and fiber to the home. That would allow plenty of bandwidth for telephone, video, e-mail, and many other uses—and enable brand new uses that we cannot even imagine today.

It does not cost all that much, relatively, to upgrade a network once the basic wiring is in place—that's the big original cost. For example, a university campus in the Midwest that serves 14,000 students and faculty, recently estimated it would cost about $150 per port (per end user) to replicate their current 100 Mbps network for a five-year period, or about $30 a year per user. To upgrade to 1000 Mbps (1 gigabit) it would cost $250, or about $50 per year. University campuses are like small towns or suburban neighborhoods. Once cable companies and companies like Verizon make their initial fiber investment, the relative cost of upgrading bandwidth to customers is small.

What will that kind of high-speed Internet provide?

You will be able to transfer electronic health records that include X-rays and body scan data in seconds, rather than the hours it takes on today's broadband networks. It will be possible to monitor patients at home, remotely, both improving health care quality and reducing costs: a recent study concluded that we could save over $800 billion over 20 years using home medical monitoring technologies. A Veterans Administration study showed you could cut hospital stays in half for many patients—and yet monitor and watch over them for longer periods of time.

With DVD-quality two-way video-conferencing, patients will be able to consult with their doctors, parents will be able to confer with teachers, rural schools will be able to deliver Advanced Placement courses to their students, and families will be able to stay close no matter how much distance separates them. Students will be able to search the Library of Congress from their homes, and form study groups with friends around the world.

Telework and tele-commuting will finally be realistic for workers who need the ability to see and talk to their colleagues and transfer large quantities of data; this ability to reconstitute work at home will not only save employers money, and reduce oil consumption and traffic congestion, but also make Federal agencies more resilient to disaster or attack.

Our foreign competitors. We believe that these new high-speed networks will unleash a huge new wave of American innovation—new uses, new products, new services, new jobs, and new wealth. But we have to be honest: the first time around, America was alone in developing the Internet and we exported our success to the rest of the world. We were the leaders. This time the rest of the world is aggressively working to be ahead of us—and in many cases is ahead of us. We cannot assume that the next wave of economic benefits, spurred by this technology, will be American. Our international competitors are adopting high bandwidth, open, simple, low cost designs for their networks. We are the only nation looking at making the network more, rather than less, complex and expensive. We at Internet2 feel this is the wrong choice.

For example, just this past week it was announced that Vienna, Austria, plans to bring fiber to all of its 960,000 households and 70,000 small and midsize businesses through a collaboration by the city, a power provider, and a cable company. They will offer their citizens one gigabit of symmetrical bandwidth. They emphasize that the network will be an open access platform for all service providers under equal conditions. Access will not be limited to classic Internet service providers but also offered to other services such as, for example, the health sector.

Already, consumers can now get 100 megabits to their homes in Hong Kong for $49 a month, and a gigabit for $200. Japan has a goal of bringing fiber to every home this year or next. South Korea, Europe and Canada all have ambitious plans that put them and their people on the "path to a gigabit" in the coming decade.

Some critics make the point that many of these places have very dense populations, making it easier to deploy big broadband. That may be true, but why have we not done it in New York, in Chicago, in Boston, in San Francisco?

Again, our research and experience shows that if the broadband pipe is large enough, you do not need to discriminate in favor of some of the bits. A cost-effective, simple network can provide as high a quality experience for the user as a more complex, costly, partitioned network.

MIT is pioneering a move to put all of its course content—written materials, multi-media, videos of lectures and more—onto the Internet for free distribution to the world. It is an experiment, but a bold one that could have transformative impact

upon those who might never be able to see the inside of a college classroom. Stanford University is making the audio from class lectures available on the web. The Library of Congress is working on projects to make rare materials available over the Internet. Should MIT or Stanford or the Library of Congress now have to pay Verizon and AT&T, Comcast and Cox, and all of the other local network providers to allow Americans access to this material? Other nations are not putting up toll booths, why should we?

We in the Internet2 community have a keen interest in this upcoming legislation and we hope that you will protect the integrity of the Internet architecture that has given our Nation so much benefit. Net neutrality is an important component of that design. Keeping network design open, inexpensive, and simple is better than costly, complex, and closed. If you do, we believe you will be enabling another amazing wave of innovation and growth. We know, because we have seen part of that future. Thank you for your consideration.

The CHAIRMAN. Thank you very much.

We have a real problem here, in terms of time. And I do want to thank each of you for taking the time to be here. I'd like to ask that you do us one favor, and that is, later, when you—if you have time, give us your feeling about whether the 1996 Act needs replacement, or would some amendments be sufficient—are amendments sufficient? There are some people who think it doesn't really need to be changed at all. I would like your different experience, background—particularly those of you from law school and Mr. Dixon, from the FCC—Mr. Bachula, you've got the Internet2 concepts—the Committee would be very interested to know if you feel that it is really necessary to replace the 1996 Act, or to amend it, and how. What problems really that we're talking about this morning stem from the Act itself?

And, Mr. Lessig, we appreciate your putting the statement aside. I've looked at your statement, but I appreciate what you're saying about looking to the past, and not throwing out the door all of the experience that we've had that has brought us where we are now. I think you and Mr. Dixon are saying somewhat similar—are making similar comments about it.

We'd very much appreciate your advice on the basic problem. Should we replace this Act, or should we amend it, or should we just go on to other subjects, in terms of some of the basic problems we have that are in the general area—911, so many other things, interoperability? The Telecom Act, itself, has been a major problem that we face, as far as this is concerned.

I can tell you that as far as my questions, I'd like to come back just to you, Mr. Bachula, and that is, you've got Internet2, superfast broadband. You serve colleges, research institutions like NIH. Is it possible to expand that to the public? And, if so, what's the future?

Mr. BACHULA. We think the principles that—the design of our networks that we—that serve those constituencies is not based on anything different than what could be provided by the telecom providers or even the cable companies.

The CHAIRMAN. Are there engineering limitations to the existing systems that prevent you from extending out, just generally?

Mr. BACHULA. There are not engineering limitations. We were created to essentially serve the university research community, and that is why—that is what we have been doing. But the kind of Internet that we provide to our universities could be provided to

every American in their homes by the companies that were represented here today if they simply follow the right principles.

The CHAIRMAN. Well, I represent an area that's one-fifth the size of the United States, and it has less than a million people. Is Internet2 ever going to serve Alaska?

Mr. BACHULA. Oh, Internet2 is very active at the University of Alaska, sir.

The CHAIRMAN. That's the university. I'm talking about the consumers in the State.

Mr. BACHULA. Well, the buildout that is required requires investment by the private sector. Internet2 is not in the business of serving everyday home consumers.

The CHAIRMAN. It's not a replacement, then, for the Internet, in terms of the general public.

Mr. BACHULA. No, not the network that we run, but the network we run is an example of the kind of network the public should get in a few years.

The CHAIRMAN. Well, then how about these announcements we're hearing about in other countries, they're getting such enormous speed, enormous content at such lower cost?

Mr. BACHULA. That's exactly right. Vienna, Austria, just announced, last week, that they were going to create a partnership between the city, a power company and a cable company, to provide a gigabit to every household, 960,000 households and 70,000 businesses, and it was going to be a completely open network. You can buy 100 megabits in Hong Kong for $49. And I think you can buy a gigabit for $200. It's available elsewhere. We are operating under a different scenario here, where we have scarcity, we're preserving scarcity, and we seem to be trying to say, "But if you want to pay us more, then we'll get rid of the scarcity."

The CHAIRMAN. But don't we serve a nation that's different—that country will fit in one of the peninsulas south of my house in Girdwood, Alaska.

Mr. BACHULA. That's very true, but we're not even doing it in New York or Chicago or San Francisco these days, here.

The CHAIRMAN. It's density-sensitive, though, isn't it?

Mr. BACHULA. Density affects the cost, that's true, but we're not—we're not even doing it in New York today.

The CHAIRMAN. Well, again, I would urge that you, if you will, give us your judgment about the basic structure of the Act, itself, and whether—what needs to be done to it, if anything.

The CHAIRMAN. Senator Allen?

Senator ALLEN. Thank you, Mr. Chairman, for your questions, and all of these witnesses, as well.

The guiding principles have been, for the Internet, that it—the term is more of common carriage. It's open. What's great about the Internet is—I've always said it's the greatest invention since the Gutenberg press for the dissemination of information and ideas. And no one would have read Martin Luther's "95 Theses" that he nailed onto the church at Wittenberg if it wasn't for the printing press. We're not asking the Internet service providers, though, to print everything that is written. However, the Internet is that printing press, and it's an individualized enterprise zone, or indi-

vidualized system, and an individual makes those decisions. And that's what makes it compelling.

The net neutrality is—saying that net neutrality would harm recovery of sunken costs, that Professor Sidak said, indicates that, OK, well, there are going to be limits now, and there's not going to be that open opportunity for creativity or whatever access to information individuals would want. The open standards that Mr. Bachula was talking about, the net neutrality, the higher bandwidth, for teleworking, which I think is so important for congested areas, for quality of life, for families to actually be able to see their kids, and also reduce congestion and air pollution, is very important. The bandwidth also, though, is for video, primarily; it's not for reading newspapers or reading publications or e-mailing or instant-messaging. It's mostly for that video quality.

I'm one who's very much for competition, as well as standing for freedom. To hear that other countries are further ahead than us is worrisome. Mostly when we hear about foreign countries, they're talking about limiting access to the Internet. You have China limiting discussion of Taiwan or the Falun Gong or Tibet, Tiananmen Square, and so forth. Then you have the other problem with some of the—some of these international or other countries wanting governance of the Internet by governments. And I don't want governments regulating the Internet. Leave it free.

Now, internal organizations may want to limit what their employees are saying, but ultimately we don't want the United Nations or anybody governing the Internet. It should be the private sector and individuals. The only real role of the government is the domain-name registry. It's like a telephone book. Other than that, leave it free.

Now, insofar as France is concerned, how does France—you say France has better and cheaper—less expensive Internet. Now, did—was that built out by the government in France, or was it by Alcatel or a private company?

Mr. LESSIG. Well, Senator, there's a regulatory regime in France, which is very much like the regulatory regime of the 1996 Act, that requires, essentially, unbundling by what was a monopoly telecom company. And it's that unbundling requirement that has facilitated extraordinary competition in providing broadband access in France.

Senator ALLEN. All right. So, in other words, the—was this bandwidth in France built out—now, the universities—the universities doing that, and—or maybe some cities, in some cases. But in France, as a country, was it built out by the private sector, or was this built out by the government?

Mr. LESSIG. I think everything in France is a mix, private sector and government. And I think that's one of the points that this Committee should keep in mind, that regulation, in this context, has always been a mix. Right? We need extraordinary competition, free of regulation, on top of the network. But telecommunications has always had basic principles that have been subject to principles of law. When Chairman Powell announced the four Internet freedoms, those were, in my view, essential principles to how this network should be regulated. And I think they're very good and this Congress should adopt them, because the critical change that's happened between the 1996 Act and today is that telecommuni-

cations, as it exists in broadband service, has moved from Title II to Title I. Title II is the principle of, as you called it, "common carriage." I don't think we have to go that far, but basic principles of——

Senator ALLEN. All right. Under——

Mr. LESSIG.—and by giving that up, we've gone to the complete opposite extreme, where no principles of neutrality get built into the network design. We've never seen that network succeed. Every network that's succeeded, around the world, to produce the kind of Internet that Internet2 would give us, has operated under a different theory; in fact, the theory that's governed telecommunications in America for at least the last 40 years.

Senator ALLEN. Thank you.

Mr. Dixon, you have to be able——

Mr. DIXON. Thank you.

Senator ALLEN.—I have to allow you to respond, since——

Mr. DIXON. Thank you——

Senator ALLEN.—since bringing up——

Mr. DIXON.—for letting me respond.

Senator ALLEN.—Chairman Powell.

Mr. DIXON. I would say, in general, two things have changed. I think the most important thing is that Congress, in the 1996 Act, made a judgment that competition, as opposed to government regulation in the form of common carriage, et cetera, was the preferred way of bringing benefits to consumers. And I am not suggesting that competition should be limited to networks; it should extend to all layers of the network. The other thing that changed is that technology, in fact, changed, and it made it more possible for more competition to exist. So, what we're—we no longer have, as we did have in the original telephone network, is a legal monopoly, where we had to really worry about abuses of market power and other things that would harm consumer welfare. In a competitive environment, where prices for broadband continue to come down to $14.95, now $12.95, et cetera, technology is continuing to be invested.

I think it's probably too early to call the game and say, "We're going to throw our hands up and abandon, in essence, the judgment Congress made in the 1996 Act and go back to a world where we assume there will be a monopoly."

Senator ALLEN. Thank you.

Mr. SIDAK. Senator Allen, could I just add one point to that? I published a book last year, with three economists, called "Broadband in Europe." In the book we asked the following question, What has determined the level of broadband penetration in the different member states in the EU? We found that the most important driver of broadband penetration was platform competition. It was competition between DSL and cable. The role that unbundling played in determining broadband penetration was much less.

With respect to France Telecom, I think one consideration is that it continues to be owned, in substantial part, by the French Government. So, decisions about network investment that are being made by a major shareholder that is, itself, the government, are, in essence, a form of public subsidy of the network.

Senator ALLEN. Right. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Senator Boxer?

Senator BOXER. Thank you, Mr. Chairman.

In one of the discussions that the Chairman was having with Mr. Cerf, he kind of said as an aside, "You really have a—Google really has a magnificent search engine."

Now, my question is to Professor Lessig. Suppose in the 1990s Microsoft was able to pay to get faster service for consumers accessing its search engine. What would the impact have been on the development and expansion of Google?

Mr. LESSIG. Well, it would have been negative. It would have restricted the opportunity for Google or new competitors to enter into this marketplace. Now, whether it would have been enough to stop it or not, who knows? But there's no doubt of the effect. The effect would have been to restrict application competition, which is exactly what we should be encouraging in this context.

Senator BOXER. So, when Mr. Cerf says, "It's the new Google, the new innovation that's—that could come, that could be stymied because you can't get your," "'product' out in this pipe that's been so narrowed," it's a real problem. It's a big problem for anyone who cares about freedom and access and the ability of the American people to learn. I think it's a problem.

And I guess what's confusing to me—and any and all of you could respond to this; because, again, I like to start from a premise that at least we agree on some things. So, I'd like to know, has there been anything in any laws we've passed here, either a long time ago or the recent Act, or any regulations coming out of the FCC, that has fostered net neutrality? Because, on the one hand, I hear some people saying, "Leave it alone. We never had—you know, we got this net neutrality without any laws." So, I'm just wondering if we could have some consensus as to whether anything we did, or the FCC did, brought about a situation of net neutrality. And——

Mr. SIDAK. I think you can point to many things that the FCC has done that do not advance the vision of net neutrality, as it's been presented here this morning, in the sense that——

Senator BOXER. Well, I'm not asking you that.

Mr. SIDAK. No, No, not——

Senator BOXER. Is there anything——

Mr. SIDAK. I realize that, but——

Senator BOXER.—that they've done that has fostered net neutrality?

Mr. SIDAK. But the fact that there is differential pricing with respect to many different services that are subject to tariffs is, itself, evidence of a realization by the FCC that you have to pay for the cost of the network by tapping all people who derive benefit from the use of the network.

Senator BOXER. OK. So, you don't think that we've ever done anything to foster net neutrality.

Professor Lessig, do you agree with that?

Mr. LESSIG. I don't. In fact——

Senator BOXER. Oh. I was afraid of that.

Mr. LESSIG. Yes. In fact, in my view, the Government has done a lot to foster what we now call net neutrality. If it weren't for what we would now call net-neutrality principles applied to the original Bell network, you would never have had the Internet develop. And we know that, because, in countries where those principles didn't occur, the Internet was slowed and stopped by existing telecommunications networks. So, we have always adopted a principle, which is referred to either as the "connectivity principles" or Michael Powell's "four freedom principles" with respect to each technology that encourages new innovation. We have now changed that. As we've gone from Title II to Title I, there is no such principle in telecommunications law anymore.

And so, the question that I asked this Committee is, Why, when it worked so well to produce the Internet and produce the kind of competition we see around the world, why would we abandon it now? Now, I respect Mr. Sidak's academic work, especially his work in economics, but I suggest his testimony was a perfect followup to my charge that what we've got is a history of something working, and now what we're offered is a theory about what might work in the future. And that theory is great academic work, but I think this Committee should be guided by practices that have actually worked.

Mr. SIDAK. Well, Senator, if I——

Senator BOXER. I—OK.

Mr. SIDAK.—could respond to that.

Senator BOXER. I don't want to—I don't want to prolong, because I have one more question, but I would love to hear from you in writing, all of you, on this.

Senator BOXER. But I'm just assuming the two of you, on either end, that Mr. Dixon would probably line up with Mr. Sidak, and Mr. Bachula would line up with Mr. Lessig, basically. Is that correct? OK.

Then let me ask my last question. And this really comes from Senator Inouye, who is the ranking member here. He asked this to Professor Lessig. The point is often made by opponents of network-neutrality rules that if we do not allow network operators to charge Internet application providers for so-called quality-of-service guarantees, then network operators will lack the incentives to build out these networks and make them available to consumers. How would you respond to that?

Mr. LESSIG. There are two kinds of discriminating charges that we've been talking about. One is consumer tiering, where you say to a consumer, "You pay more, you get more." And the other is access tiering, where you say to Google, "You've been getting a free lunch. You've got to pay to get onto our Internet." In my view, there's nothing wrong with consumer tiering. Networks should be able to say, "You pay more, you get more," and they should be encouraged to do that, because that will drive deployment of fast networks.

But the problem that we've identified, in the network-neutrality work that I've been a part of, is the problem with access tiering, where you start saying to large companies like Google, "Here, you can buy the reserved lane, so that the reserved lane serves your content well." And I know Google can afford it. But when Google

then rolls out something called Google Video that tries to compete with the other video services out there, like YouTube TV or YouAreTV. Those competitors will never have the opportunity to compete effectively against Google Video if Google Video can buy the fast lane. So, if you want to preserve the kind of competition that made Google possible, you have to do what Google suggested this morning, in the words of Vint Cerf, you have to preserve the end-to-end neutrality principles that define the Internet and, in my view, define telecommunications law for the last 40 years.

Senator BOXER. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Allen, do you have any further question?

Senator ALLEN. No, I do not. But I do think, Mr. Chairman, that this whole issue on tier pricing didn't get enough of an understanding in the hearing, and it's part of this. There is tier pricing if you have dial-up versus DSL versus broadband over, say, the cable modem, and it's something that is happening already. The whole question, to me, will be, in the event that there are restrictions on this neutrality, whether or not we can let the genius—when I said the "genius"—or the "genie," whether we can let that genie out of the bottle, in the event that something happens and we say, "Why was this ingenuity bottled up?" Can a Government, a Congress, a Senate that moves at the speed of a wounded sea slug——

[Laughter.]

Senator ALLEN.—can—would that thwart innovation, competition, and opportunity? And that's, I think the—for me, as we go through some of the details, will be some of my guiding criteria in listening to evidence on it.

Thank you, Mr. Chairman. Thank you, all our witnesses.

The CHAIRMAN. Senator Boxer, do you have any further question?

Senator BOXER. Just to add my thanks, again, to both panels. This is a very important topic. And I thank you, Mr. Chairman.

The CHAIRMAN. This is just a piece of an important topic, unfortunately.

May I ask the two professors this. You heard Mr. Comstock talk about—and others—talk about the decision of the FCC with regard to the difference between common carrier and the transmission of information. Do you think that—either of you think that decision needs to be re-examined by this Committee in connection with this bill?

Mr. Lessig?

Mr. LESSIG. I think it absolutely does. I think the decision to move everything out of the kind of neutrality regulation principles that Title II created is what will create the problem for application competition. So, whether you go back to common carriage, which I don't think is necessary, or you just simply implement principles consistent with the net-neutrality principles that Chairman Powell articulated, supplemented by one idea—and that is that access tiering is forbidden, and consumer tier should be encouraged—that would be enough, in my view. It's a minimal amount of regulation, but it would reestablish a principle that has been part of telecommunications law forever.

The CHAIRMAN. Well, I'd be happy to have a draft from you of that subject.

The CHAIRMAN. Mr. Sidak, what do you think?

Mr. SIDAK. My view is a little bit different. I think that the larger problem that your question about information services versus common carriage illustrates is that we have an historic pigeonhole view of how the telecommunications industry functions and what services it produces. The challenge that legislators and regulators face today is that firms in telecommunications and content and applications are devising completely new models for revenue generation that do not conform to the old regulatory pigeonholes. So, in a sense, that means that a re-examination of the basic distinction between information service and telecommunications service is what's required.

The CHAIRMAN. We thank you very much. And if you have any further comments, the Committee would be delighted to have them. We thank you for the—taking the time to be with us. I know it's an imposition on you for—to come for such a short period of time, in terms of your individual comments, but we do examine your comments in full, and the statements, and appreciate your willingness to help us. Thank you very much.

The Committee will meet again this afternoon in this room for a series—consideration of a series of nominations to the Department of Transportation at 2:30 p.m this afternoon.

[Whereupon, at 12:10 p.m., the hearing was adjourned.]

A P P E N D I X

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

Tomorrow will mark the 10th anniversary of the Telecommunications Act of 1996. In those brief ten years, the Internet has evolved from a hobby for computer enthusiasts into a central pillar of communications and commerce in the new economy.

Its rapid evolution has spawned applications and services that, even ten years ago, could hardly have been imagined. However, we cannot forget that this innovative explosion was no fortuitous accident. The Internet did not just happen on its own.

It was nurtured by those who built and designed it to allow creative advances at the edges of the network from the maximum number of innovators. It was sustained by a legal framework that allowed consumers to connect to Internet access providers through low cost telecommunications services.

Now, these early successes are met with new challenges. Despite the FCC's efforts to establish Internet freedoms through its recently released policy statement, its classification of broadband services has called into question the FCC's authority to prevent unfair discrimination by broadband network operators.

According to recent press reports, network operators are planning to charge application providers additional fees for access to their broadband networks. This is ample cause for concern.

Almost 10 years to the day after the Telecommunications Act of 1996 was signed into law, we are confronted with new challenges. The question is, how will we respond? Will future generations thank us for preserving and protecting neutrality and nondiscrimination on broadband networks? Or will they condemn us for breaking the Internet?

These are indeed weighty and complex issues. So it is fitting, Mr. Chairman, that we begin to consider them today. I look forward to the testimony from today's witnesses and to working with my colleagues on these issues in the weeks and months ahead.

PREPARED STATEMENT OF HON. JOHN D. ROCKEFELLER IV, U.S. SENATOR FROM WEST VIRGINIA

Mr. Chairman,

In the last few years, both traditional and wireless carriers have concocted line item charges, fees, and surcharges, purporting to recover all manner of "regulatory," "administrative," or "government-mandated" costs, but which do nothing more than charge consumers for the carriers' ordinary operating costs.

Though the carriers' monthly line items differ in terms of what they are called and what the carriers claim to recover through the charges, they are alike in many respects—all are misleading and some are downright deceptive.

These charges frustrate consumers and limit their ability to make reasoned and informed choices among competing carriers.

In 1996, I introduced legislation to prohibit telephone companies from marking up federally mandated charges on consumers bills. My bill spurred the FCC to finally adopt its 1999 Truth-in-Billing order. Unfortunately, the FCC rules have not been sufficient to protect consumers—most notably wireless telephone consumers.

The explosion of the wireless industry and an explosion of consumer complaints over their bills forces policymakers to reexamine this issue. In the first six months of 2005, the FCC received almost 8,000 complaints from consumers about their wireless phone provider—the overwhelming majority, complaints about billing issues.

In 2004, the National Association of State Consumer Advocates tried to get the FCC to address the explosion of misleading and deceptive line items on wireless bills.

Unfortunately, the FCC, rather than adopting stronger consumer protections, actually weakened consumer protection laws, by completely preempting states from

regulating wireless carriers' billing. Instead of protecting consumers from abusive carrier practices in an increasingly complicated marketplace, the Commission instead decided to exempt carriers from basic consumer protection laws.

As disturbing as the policy in the FCC's order preempting state authority, I am troubled that the FCC's top staffer in developing this order was working for the wireless industry's trade association within weeks of the Commission's adoption of this ruling. It certainly raises more questions as to process of this rulemaking.

I plan to introduce legislation strengthening Truth-in-Billing requirements, and to clarify the role of states in setting line item charges. My bill will be both pro-consumer and pro-competitive. Consumers will benefit by being able to shop among carriers for the lowest rates without being subjected to deceptive, misleading, or confusing billing practices.

I look forward to working with my colleagues on this issue as we move communications bills in the months to come.