

**GOVERNMENT ROLE IN PROMOTING THE FUTURE
OF THE TELECOMMUNICATIONS INDUSTRY AND
BROADBAND DEPLOYMENT**

HEARING

BEFORE THE

**COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE**

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

OCTOBER 1, 2002

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

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CONTENTS

	Page
Hearing held on October 1, 2002	1
Statement of Senator Allen	59
Statement of Senator Burns	7
Prepared statement	8
Statement of Senator Breaux	12
Statement of Senator Dorgan	9
Statement of Senator Hollings	1
Article from BusinessWeek/online, dated October 7, 2002, entitled: When Will the Telecom Depression End?	3
Statement of Senator McCain	6
Statement of Senator Smith	10
Prepared statement	11

WITNESSES

Huber, Peter W., Senior Fellow, Manhattan Institute for Policy Research; Partner, Kellogg, Huber, Hansen, Todd and Evans, PLLC	41
Prepared statement	43
Hundt, Hon. Reed E., Former Chairman, Federal Communications Commis- sion	12
Prepared statement	14
Lessig, Lawrence, Professor of Law, Stanford Law School	31
Prepared statement	33
Article from the November/December 2001 Foreign Policy magazine, enti- tled The Internet Under Siege	34
Mundie, Craig J., Senior Vice President and Chief Technical Officer, Ad- vanced Strategies and Policy, Microsoft Corporation	24
Prepared statement	26
Price, Michael J., Vice Chairman, Evercore Partners, Inc.	17
Prepared statement	20

GOVERNMENT ROLE IN PROMOTING THE FUTURE OF THE TELECOMMUNICATIONS INDUSTRY AND BROADBAND DEPLOYMENT

TUESDAY, OCTOBER 1, 2002

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

The Committee met, pursuant to notice, at 9:35 a.m. in room SR-253, Russell Senate Office Building, Hon. Ernest F. Hollings, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. ERNEST F. HOLLINGS, U.S. SENATOR FROM SOUTH CAROLINA

The CHAIRMAN. The Committee will come to order. Today we examine the depression in the telecommunications industry and again consider policy to help revive the sector. What perplexes me was that this industry was destined to ensure America's economic superiority in the 21st century. It was the motor of growth, we were told. Instead, the telecom depression dragged our economy into a recession and now threatens our global competitiveness as critical equipment makers like Corning and Lucent are staring bankruptcy in the face.

Our telecommunications industry has always been unmatched in its preeminence. In 1996, we sought to extend that supremacy with the Telecommunications Act. Six years later, most of the dazzling promises that led us to pass that legislation remain unfulfilled. Only now are some promises coming true.

The Bells are suddenly making progress opening their local markets. Cable is finally offering voice competition in more markets. There is real competition in the business market. Millions of residential customers have a choice for local phone service. Rates are lower than ever in the long distance and wireless sectors. Broadband is available to 80 percent of Americans. But just as customers are enjoying the fruits of the competition, times have never been worse for the companies, their shareholders, and their employees, over ½ million of whom have lost their jobs. Bankruptcies, accounting scandals, overcapacity, and dozens of bad business plans have destroyed confidence in the industry.

This is not how it was supposed to be. While there is a lot of finger-pointing going on among the companies and here in Congress, we need to move beyond that. We need to move beyond the intramurals up here over Tauzin-Dingell and parity—that crowd went from the constitutionality—I have never seen such a group.

They wrote the law, and then they immediately went to court and said it was unconstitutional. Then, the next thing they said, there was not data. It was not considered.

When we went through the record and found it mentioned 438 times, I think it was, they got off of that and they said, ooh, we could go rural, we could go rural. We looked at the business practices as they came to Washington, swearing they could go rural—they were selling rural just as fast as they could. More recently it has been broadband, broadband, and then parity.

They have tried every gimmick in the book. If the market demonstrates anything, it is that competition, not deregulation, drives the Bells to invest in their networks and comply with section 271, open markets. That is the record in the business market, where the Bells responded with cheaper, newer offerings to combat the CLECs. It is true in the residential market, where the UNIFI lines lost to competitors, forcing the Bells to hurry up and comply with the Act, where they have yet to do so.

Deregulation will not rescue this sector from depression. What ails telecom goes far beyond the regulations governing the Bell companies. Any policy solution must recognize that. Lincoln said years ago, “the dogmas of the quiet past are inadequate to the stormy present. The occasion was filled with difficulty, and he said, we must rise above the occasion. As our case is new, so must we think anew and act anew.

And so, if we politically can get off of this standoff of working against each other for the past few years and see what we can work together on, we might help in saving this telecommunications economy, and then the Nation’s economy. This is what we have in mind with today’s telecommunications hearing. The wireless companies may need to consolidate and obtain more spectrum. What we call broadband may not actually be fast enough. The government may need to subsidize demand and/or infrastructure to promote the highest speeds needed to jump-start the industry.

We can consider new technologies like Wi-Fi and unlicensed spectrum as high speed alternatives, and while I tend to doubt Bell claims that wholesale pricing regimes discourage investment, perhaps we should examine that also. With everybody going broke and declaring bankruptcy, we will take a look at the revenue margin trends of the wire line operating margins of Verizon, SBC, Bell South, Sprint, Alltel, Century Tel, Citizens TDS over the last eight quarters, an average, I would say, of 24 percent for Verizon, 28 percent for Bell South, 31 percent for Sprint, 36 percent—I used to be in these hearings at the Public Service Commission back in Columbia, South Carolina, when we fussed around to make sure they got 12 percent on the rate of return. As the public interest monopoly guaranteed no competition, they were guaranteed at least 12 percent on the rate of return.

The Federal Government does have a history of assisting industries to preserve America’s global competitiveness in the Seventies with the aerospace industry and Lockheed Martin, in the Eighties with the auto industry and Chrysler, and with the semiconductor industry and Sematech.

America also invested in the infrastructure to benefit the economy as a whole, as with the canals and railroads in the 19th cen-

ture, the REA, rural electrification, and federal interstate highway programs in the 20th century, all of which expanded interstate trade. Investments in higher speed broadband infrastructure could pay similar dividends.

I welcome the panel that we have today, the most outstanding panel that we have had in many a year up here. We left off our Bell friends and our long distance friends to get away from the yin and the yang of who was right and who was wrong, and trying to see with some real minds here that maybe something can be done.

They have the Telecom Depression, when will it end. Without objection, I will include that article in the record here at this time. After reading that, I am discouraged. I do not know that you can get there from here, but we have got five folks who can tell us if we can. I really am grateful for their appearance today.

[The information referred to follows:]

BusinessWeek/online, October 7, 2002

SPECIAL REPORT—THE TELECOM DEPRESSION

By Steve Rosenbush, with: Roger O. Crockett, Charles Haddad, Jack Ewing, and bureau reports

WHEN WILL THE TELECOM DEPRESSION END?

The ongoing disaster in telecommunications girds the globe, growing in one place just when it shows signs of abating elsewhere

The telecom crisis is reminiscent of a classic scene in *The African Queen*. Humphrey Bogart and Katharine Hepburn, desperate and lost on the Ulonga-Bora River, rip pieces of wood off the little steamer and use them to fuel the vessel's engine. Today's telecom companies, struggling to survive one of the greatest busts in business history, are slashing prices below cost and selling precious assets. "Neither one is a long-term survival strategy," says Stephan Beckert, research director at Tele-Geography Inc., a Washington consultant. Hepburn and Bogart were rescued by a last-moment stroke of good fortune, but today's telecom titans won't escape catastrophe so easily. More than a cyclical downturn, what they're experiencing is a full-blown industrial depression, one that has wiped out half a million jobs and \$2 trillion in U.S. market value. That's about as much as the savings and loan crisis of the early 1990s. And turmoil in the \$2.3 trillion global industry shows few signs of abating. In September, Lucent Technologies Inc. (LU) and French equipment maker Alcatel (ALA) issued dire revenue warnings and new layoffs. Throughout telecom, frenzied cost-cutters come up short again and again. They can't catch up to collapsing revenue or predict the timing of a recovery. "This is an unprecedented period," says Lucent Chief Executive Pat Russo.

How long will the bloodletting go on? *BusinessWeek* spent a month examining the capacity for each type of telecom service, from long-distance to wireless, and comparing it to worldwide demand. The results show that capacity continues to dwarf demand. Prices in America and Europe remain under pressure. Meanwhile, rollouts of new cables promise to extend excess capacity to regions such as Asia that have been spared much of the pain to date. "We're not seeing any turnaround," says BellSouth Corp. CEO Duane Ackerman.

The upshot is that the crisis could last until at least 2004. In the U.S., traffic at the core of the networks is leaping ahead at 85 percent a year, with Europe and Asia at similar paces. Within two years, that should soak up excess capacity of networks in operation, which are running at 35 percent of capacity in the U.S. and Europe and at higher rates in Asia. An economic upturn, expected by the end of 2003, could spell recovery for U.S. telecom carriers six months later. Europe is expected to follow suit in late 2004.

But things could get worse. If the world economy continues to struggle or if telecom companies fail to lop off capacity and come up with lucrative new data services, this depression could continue through 2006. Even when recovery arrives, most of the once-robust telecom players are likely to perform, at best, like stolid, slow-growing utilities through the end of this decade. Growth is likely to be 2 percent or 3 percent a year, predicts Lawrence Kenny, head of the telecom practice at PricewaterhouseCoopers.

The road to recovery for the beleaguered industry involves a three-stage process. The first stage, happening now, is managing the glut. This involves slashing costs and struggling to come to terms with massive debt. This period, which should last another two years, will continue to drive many companies to the brink of insolvency or beyond. But relief won't arrive until stage two, consolidation. That's not likely to come until mid-decade, when the surviving companies have cleaned up their balance sheets and can afford to snap up rivals who have been driven to rock-bottom prices—pennies on the dollar.

Far-sighted companies are already at work on the third stage, transformation. The idea: Players that survive this turmoil will emerge with new business models. Instead of selling old-fashioned access to a network, they'll offer a host of value-added services, from encryption and wireless teleconferencing to management of huge video, music, and game programs.

They'll need loads of these products to fill up today's empty pipelines. Much of the build-out was based on dreams for revenue and traffic growth that fell far short. Internet traffic was supposed to double every three months, but it's growing at just a quarter of that pace. Today, only 1 percent to 2 percent of potential long-distance capacity in North America and Europe is in use. The vast majority is dormant cable in the ground. No wonder the price of a speedy business connection between New York and London has fallen 95 percent during the past three years, to \$6,000 a month.

Much of the problem comes from technology itself. Dazzled by the engineering prowess of optical systems that can download the entire Library of Congress in a flash, few gave any serious thought to the economic consequences of wiring the world with these marvels. Now, super-high-speed technology is out of the lab, and capacity growth is out of control. This winter, British carrier Cable & Wireless (CWP) and Alcatel will begin operating a \$443 million transatlantic cable called Apollo. Loaded with the latest in optical and Internet Protocol communications equipment, the cable's four pairs of hair-thin fibers will be able to carry 3.2 terabits of data—30 percent more than all current transatlantic capacity combined.

And just try trimming back that capacity. Gap Inc. can pull last season's unsold sweaters off the shelves and sell them at discount prices, and then stock the shelves with a new lineup of higher-priced goods. But telecom companies can't pull fiber out of the ground. The result: Capacity, the root of the telecom depression, doesn't go away.

In the midst of this depression, certain sectors, however, remain healthy. Data from Internet services and network management are growing 10 percent to 20 percent a year for many companies. Trouble is, those sectors represent only a fraction of telecom revenue. The biggest sectors, local and long-distance voice, are in decline and are unlikely ever to grow again. In fact, many companies can see the day when voice calls will be offered as a complimentary service to accompany lucrative data subscriptions. "In our projections, voice will be free," says Ilkka Raiskinen, Nokia Corp.'s vice-president of mobile applications & services.

Even in wireless, the booming growth business of the past decade, revenues are flattening out as the wave of new subscribers subsides. The wireless Internet, the great hope from the bubble years, is trudging along behind expectations. Says Lawrence T. Babbio Jr., vice-chairman of Verizon Communications: "We don't see any growth trends."

And they don't need much convincing these days to slash capital spending. SBC Communications Inc. (SBC) Chief Technology Officer Ross Ireland says he used to buy gear to meet multiyear forecasts. Now SBC saves money with a just-in-time approach. "Before the downturn, it didn't matter if you guessed wrong because you'd just grow into it," he says. But current penny-pinching is leaving equipment makers such as Nortel Networks (NT) and Lucent Technologies struggling to survive. To make it, they and the rest of the telecom industry face a three-step recovery program:

WORK OUT THE GLUT. The first period of the recovery, the glut, entails unremitting pain and apparent paralysis. Even bankrupt carriers struggle to eke out sales, which means that capacity does not disappear. Consolidation promises relief. But that's still a ways off. Carriers are shouldering far too much debt for acquisitions. For this nasty stage to end, the markets have to work their malicious miracles: Survivors must clean up their balance sheets, usually at the expense of investors and creditors. Meanwhile, losers must be ground down mercilessly, until they are cheap enough to buy.

North America has been wrestling with overcapacity for two years and is about halfway through the process. A survey of 20 major long-distance and local trunks shows that networks are running at about half of ideal capacity, according to telecom researchers RHK Inc. Local and long-distance carriers generally expand ca-

capacity on a route when capacity utilization reaches 70 percent to 75 percent. The telcos are slashing their capital spending by up to two-thirds—which puts recovery at two years away.

A few signs of stabilization are finally emerging in the depressed market. The price of a high-speed circuit between Los Angeles and New York, which fell 50 percent, to \$13,000, between the summers of 2001 and 2002, has inched up in recent weeks. Sprint (FON) cancelled a high-speed Internet service called ION, which would have added more capacity. “I won’t predict when growth will resume, but the market is cleaning itself up right now,” says David Dorman, president of AT&T.

One wild card: Some creditors of bankrupt WorldCom Inc. tell BusinessWeek they want to swap debt for equity in a new company. They are pushing other creditors to allow WorldCom to emerge from bankruptcy debt-free, which could spark a price war a year or two from now. Other carriers might start sooner. “I’m a low-cost share taker,” says John J. Legere, CEO of Global Crossing Ltd., which is expected to emerge from bankruptcy this year with just \$200 million in debt, down from original liabilities of \$12 billion.

In some markets, conditions may get worse before they get better. Catapulting demand in Asia, for example, has buffered the region from much of the nastiness to date. Wireline phone revenues in Asia have fallen 10 percent over the past two years, vs. a 50 percent decline in North America and a 33 percent fall in Europe. Yet despite a strong economy, a rising population, and soaring demand for telecom, worrisome signs are emerging. Later this year, Tyco’s telecommunications unit will begin operating a new undersea cable that will double transpacific capacity.

The glut grows relentlessly in other markets as well. Last year, the price of a high-speed circuit between Tokyo and Hong Kong fell 27 percent, to \$62,000 a month. But four new cables have begun service in the region during the past eight months, raising the risk of a price war.

One big variable is the economy. In the U.S., consumers are both yakking on the phone and surfing the Net more than ever. This makes up for falling prices and keeps spending flat. But with corporations slashing costs and laying off workers, businesses have cut phone bills by about 6 percent, paring \$9 billion from a \$141 billion market.

And telecom isn’t likely to see a surge in business demand soon. An uptick in usage should lag economic recovery by six months. That means relief could arrive in 2004. This could trickle down to the equipment makers some six months later, producing modest growth in the second half of 2004.

CONSOLIDATION. It’s waiting to happen in Europe as well as North America—but it will keep waiting for at least another year. If markets permitted, wireless giants Verizon (VZ), Deutsche Telekom (DT), Vodafone (VOD), and perhaps Japan’s NTT DoCoMo (DCM), would be gobbling up smaller competitors, driving down costs, and jacking up prices. Local and long-distance carriers like AT&T (T) and BellSouth (BLS) might have signed long ago. But debt-wary markets will not tolerate such maneuvering today. Even the whisper of new equity or debt offerings provokes warnings of downgrades from rating agencies and investor stampedes.

For a consolidator on a holding pattern, look no further than Verizon. The largest of the Bells, Verizon could take a large step toward dominance by buying a national long-distance carrier, either WorldCom or AT&T. And it could tighten its grip on the U.S. wireless market by gobbling up Sprint PCS (PCS). The total outlay for AT&T and Sprint PCS: perhaps \$25 billion—peanuts back in the bubble.

But that bubble has popped, and Verizon, with \$45 billion in long-term debt, is busy cleaning its balance sheet. The company is slashing investments and paying down debt with its \$2.7 billion in net income. Analysts say that Verizon won’t be out shopping for more than a year.

This is where the passage between phases one and two—glut and consolidation—gets tricky. When one carrier lines up the first big acquisition, competitive pressure could push others into the hunt. That would punish balance sheets while hastening a necessary consolidation.

In the next year, though, look for a slew of buyouts on the cheap. Consolidators like IDT Corp., a Net voice company, are prowling the littered landscape for bargains. Last year, it acquired bankrupt carrier WinStar, for \$42 million, a small fraction of its book value. And if WorldCom fails to emerge from bankruptcy as an independent company, look for IDT and the Bells to buy it in pieces.

Deutsche Telekom, which paid \$26 billion to buy upstart wireless carrier VoiceStream at the height of the market, is now ready to sell the U.S. carrier for much less so it can pay down its massive debt. So far, no buyers. When the German company finds one, perhaps within the next year, the consolidation period will be under way.

TRANSFORMATION. Even while wrestling with capacity and cost issues, phone companies must focus on the longer term. To survive, many must undergo a fundamental transformation. In a competitive environment, the century-old practice of charging customers for access to a network has produced a punishing, low-margin business.

To make money in an age of plentiful networks, carriers must market new content and value-added services that flow through their pipes. The companies already have billing relationships with customers—a huge advantage—but have to come up with services to sell. “It’s really about transforming telecom from a transport industry into a services industry,” says Microsoft Corp.’s Pieter Knook, corporate vice-president for network services providers and mobile devices.

This is already happening. Over the past decade, AT&T has grown its service arm into a \$4 billion enterprise that competes with consulting and service companies. In time, services may become the heart of AT&T and the carrier division may be spun off.

The signs of change are clearest in wireless. In Japan, wireless data pioneer NTT DoCoMo has let thousands of other companies offer an endless array of services, from games to music, on its network. DoCoMo gets a small fee for every transaction. “DoCoMo has created a new model of the telecom as marketplace,” says consultant Andrei Jezierski of telecom researcher i2 Partners. AT&T Wireless, a DoCoMo partner, plans to import the model to the U.S.

In the end, telecom companies may eventually even spin off their networks and concentrate on services. The first signs of this fragmentation are evident. Across Europe, so-called virtual phone companies such as Virgin Mobile are selling wireless subscriptions and simply renting network capacity from incumbents.

Even in the midst of this industrial depression, the elements of telecom’s recovery, from consolidation to new business models, are coming into focus. The industry that emerges from this will be humbler and, yes, poorer, than it was in the bubble. But even in these dark days, which are every bit as treacherous as the Ulonga-Bora River, the shape of a new industry is in sight.

Senator McCain.

**STATEMENT OF HON. JOHN McCAIN,
U.S. SENATOR FROM ARIZONA**

Senator McCAIN. Thank you, Mr. Chairman. I also read that article in Business Week, and it starts out by saying the telecom crisis is reminiscent of a classic scene in the African Queen. Humphrey Bogart and Katherine Hepburn, desperate and lost on the Ulonga Bora River ripped pieces of wood off the little steamer and used them to fuel the vessel’s engine. Today’s telecom companies, struggling to survive one of the greatest busts in business history, are slicing prices below cost and selling precious assets.

So when we discuss broadband, I do not see how we can discuss it without the background and absolute criticality of the depression that we are seeing now in the telecommunications business. If we had had this hearing, Mr. Chairman, just a year or so ago, we probably would be talking in very different terms than we are today, and as much as I respect and admire the experts before us, I would be curious when each of you predicted that we would be in the situation that we are in today. I have always believed the Telecom Act of 1996 contributed to this failure, but we will not continue that debate again today.

I thank the witnesses. Broadband is a crucial issue. Obviously, all of us want as many Americans as quickly as possible to acquire broadband services. Starting some massive multibillion central planning effort to do so is not what I believe in or support. As you said, Mr. Chairman, we continue to be gridlocked on this issue here in the Senate and in the Congress, and clearly we will not act this year. I hope that perhaps with less campaign contributions maybe

it will free some of us up to be more conducive to negotiations and agreement. We are gridlocked by the special interests.

We just mentioned the yin and the yang. None of those special interests will let us move when you give million-dollar contributions either directly to the candidates or to institutions that they would set up in their various states named after them, so I hope, Mr. Chairman, in the coming year we will be able to work on this issue from the broadest perspective, the telecom depression, but also on the specific issue of broadband access. Both of those issues are indivisible.

I thank you, Mr. Chairman.

The CHAIRMAN. Thank you. Senator Burns.

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

Senator BURNS. Welcome to production agriculture. We have been going through this for a long time, folks. It is nothing new.

Thank you, Mr. Chairman. I have a statement here, and I will paraphrase some of it, but I want it to be put in the record.

I quit reading those things because they are depressing, and so we will go on with the business at hand of moving America ahead.

Last year, we requested a comprehensive GAO report on spectrum management along with my colleagues Senator Hollings and Senator Inouye and Senator Kerry. This report, which was unprecedented in its scope, was released yesterday. We have not had all the time to go through it yet, but I will tell you that there were some very glaring findings in that report. They are nothing short of alarming, and I think they beg our immediate attention.

The report indicates that the U.S. currently lacks a national spectrum policy, in large part because it is a divided structure on spectrum management. I should add that both the FCC and the NTIA has done tremendous work recently in coordinating their actions due in large part to the efforts of Chairman Powell and Secretary Victory, since I am concerned that the split in authority over spectrum authority has bred a longstanding institutional turf battle between the two agencies.

Another troubling finding in that report is the direct state-of-affairs regarding the lack of preparation for the all-important World Radiocommunication Conference that is upcoming. The GAO report states that the U.S., and I will quote, "the U.S. position on some items has remained unresolved until the eve of the conference, leaving the U.S. little time to build preconference support." Furthermore, the head of the delegation, who bears a huge responsibility of negotiating a unified U.S. position at the conference, typically bears the rank of Ambassador for only 6 months, and that's not very long.

We could cite numerous other examples found in the report that faults the U.S. spectrum policy, including severe lack of accountability and, concerning efficient spectrum use by federal agencies, I have fundamental reservations about the very auction method itself, which views spectrum as some sort of a national resource to be exploited for maximum budgetary impact. We have seen the results of this sort of thinking in both Europe and here at home, which, instead of maximizing revenue, has often resulted in bank-

ruptcies and lawsuits. Rather, spectrum should be viewed as a technology, which is a key to the future of the new generation of services for American consumers and American companies.

Given the stark nature of the GAO findings, I will begin immediately working on draft spectrum reform legislation. I look forward to working with my colleagues on the Commerce Committee that share those concerns. We will also look forward to the GAO's upcoming early 2003 report on spectrum allocation practices of other countries, and will incorporate those findings in the final bill.

I have become convinced of the need for comprehensive reform after traveling. We made a trip to Asia over the Memorial Day recess. During my trip to Korea and Japan I met with top legislators and telecommunications CEOs, and was quite impressed with the products and services they are making available to their consumers. Making innovative wireless services available to consumers is seen as a national priority in each one of those countries, and I believe the key goal should also be a national priority for this country, also.

And then there are some new things that are coming down. We hope to talk to some witnesses today about Wi-Fi and other unlicensed wireless technologies. It is amazing to see new entrepreneurs coming up with new ideas, and just using a small slice of spectrum, unlicensed spectrum I would say for commercial innovation.

So Mr. Chairman, I appreciate this hearing today. It will be interesting to hear what our witnesses have to say, but we are wounded in this industry a little bit, but we are along way from being dead, or counted among the dying. So we think there is a great future, and I appreciate the witnesses coming, and I appreciate your having this hearing today.

Thank you very much.

[The prepared statement of Senator Burns follows:]

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

Thank you, Mr. Chairman. Today's hearing concerns a topic of crucial importance to the nation's future: how best to accelerate the pace of broadband deployment. I would like to focus my remarks on the need for wholesale reform in our nation's spectrum allocation policy.

Last year I requested a comprehensive GAO report on spectrum management along with my colleagues Senator Hollings, Senator Inouye and Senator Kerry. This report, which was unprecedented in its scope, was released yesterday. The GAO's findings are nothing short of alarming and call for immediate action. The report indicates that the U.S. currently lacks a national spectrum policy, in large part because of the divided structure of U.S. spectrum management. I should add that both the FCC and the NTIA have done tremendous work recently in coordinating their actions, due in large part to the efforts of Chairman Powell and Secretary Victory. Still, I am concerned that the split in authority over spectrum policy has bred longstanding institutional turf battles between the two agencies.

Another troubling finding by the GAO is the dire state of affairs regarding the lack of preparation for the all-important World Radiocommunication Conferences. The GAO report states that "the U.S. position on some items has remained unresolved until the eve of the conference, leaving the U.S. little time to build preconference support." Furthermore, the head of the U.S. delegation, who bears the huge responsibility of negotiating a unified U.S. position at the conference, typically bears the rank of ambassador for only six months.

I could cite numerous other examples found in the report about the faults in current U.S. spectrum policy, including the severe lack of accountability concerning efficient spectrum use by federal agencies. I also have fundamental reservations about

the very auction model itself, which views spectrum as some sort of national resource to be exploited for maximum budgetary impact. We have seen the results of this sort of thinking in both Europe and here at home, which instead of maximizing revenue has often resulted in bankruptcies and lawsuits. Rather, spectrum should be viewed as a technology which is key to the future of a new generation of services for American companies and consumers.

Given the stark nature of the GAO's findings, I will begin immediately working on draft spectrum reform legislation. I look forward to working with many of my colleagues on the Commerce Committee who share these concerns. I will also look forward to the GAO's upcoming early 2003 report on the spectrum allocation practices of other countries and will incorporate these findings into the final bill. I became more convinced than ever of the need for comprehensive spectrum reform after traveling to Asia over Memorial Day recess. During my trip to Korea and Japan, I met with top legislators and telecommunications CEOs and was quite impressed at the products and services available to consumers. Making innovative wireless services available to consumers is seen as a national priority in each country. I believe this key goal should also be a national priority in the U.S.

Finally, I want to touch on a topic that could yield tremendous benefits for businesses and consumers—opening up additional spectrum for unlicensed wireless broadband technologies. Wireless technologies, with their ability to transfer data over vast distances instantly, offer an immediate solution for areas of low population density such as my home State of Montana. I hope that some of our witnesses today will talk about Wi-Fi and other unlicensed wireless technologies. It is amazing to see what entrepreneurs have been able to do when this small slice of spectrum was opened up for commercial innovation. So-called “hot spots” of wireless Wi-Fi broadband access are springing up across the nation. The Wi-Fi innovation and deployment happened in spite of, not because of, government involvement. We need to see, Mr. Chairman, what we can do to remove the interference of government and let such innovations take place.

Right now, Wi-Fi is capable—like DSL and cable—of working only over limited distances. But market innovators are already moving to extend its reach. There have been stories in the press recently about new Wi-Fi equipment that is capable of creating broadband zones of up to 12 miles. During a recent briefing before the Internet Caucus, MIT professor Andy Lippman talked about extending the reach of Wi-Fi even further, up to a radius of 30 miles.

In short, comprehensive spectrum reform has the potential to create numerous high-tech jobs and jump-start the currently ailing technology sector of the U.S. economy. We need to create a spectrum plan that will focus on managing spectrum in a rational way, balancing the needs of industry and federal agencies. The emphasis of this plan must focus on developing innovative new wireless technologies.

I look forward to the testimony of the witnesses. Thank you.

The CHAIRMAN. Thank you. Senator Dorgan.

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

Senator DORGAN. Mr. Chairman, thank you very much. Let me start just by saying, I know there are people who are pushing to have the FCC make decisions right now on some very important issues. We have a nomination for an FCC Commissioner that is pending here. It has been pending for a good long while. It is someone who I care a great deal about, because that person is, in my judgment, going to bring a rural voice to the Federal Communications Commission. As has been the case with too many nominations on key issues, this nomination languishes. I am not quite sure when we can expect some action on it, but I guess I would say, I would like the FCC to have a full complement of commissioners and the input from all the commissioners before they make some of these decisions.

So we can talk about these things a little later, but I do not quite know what we do about this. I mean, how on earth can anybody hold up Jonathan Adelstein's nomination at this point? This ought

to go to the floor for a vote. It ought to be there today. It is just unforgivable that we have a commission that has so many important decisions in front of it, we have a nomination that has been here, as I said, a long while ago, this Committee has acted on it, and so there it sits on the floor of the Senate.

Well, I will say more about that on the floor in the next couple of days, but let me thank the Chairman for holding this hearing. The issue of broadband is very important. I carry a Blackberry, which is probably both a blessing and a curse. My Blackberry that I have with me works just fine in Washington, D.C., but when you get off the airplane in the Dakotas, you might as well turn it off, because there is no service at all. Yet this company would advertise they serve, I think, 90, 94 percent of America.

I have seen ads about these kinds of devices where they say, we cover 90-some percent of the country. That is true. It is just the major cities. You gather up all the folks who live in the major cities, and you have got 90 percent of the country, but if you take a look at the geography of the country, devices like this do not work over a large part of the country.

The reason I mention this is that people tell us that by 2002, 90 percent of the people in this country will have access to broadband. Well, that is probably true as well, but take a look at the map and you will find a large portion of the rural areas of this country that will not have access. In order to exercise and maximize the full potential of the Internet, you do need high speed connections. When we wrote the telecommunications bill, we talked about advanced services, providing advanced services with Universal Service Fund support. We were explicit in that as we started in 1996.

So we have a lot to talk about, Mr. Chairman. I know there is—once again, I say this often, as I was shaving this morning and getting ready for work, I saw more ads on television by both sides lobbying back and forth. It is like advertising foot powder to hear these ads by both sides on the telecommunications industry, but frankly, we need an FCC that makes good decisions. We need a Congress that is proactive and aggressive in setting goals on the buildout of broadband, enhancing broadband capability for all Americans, and comporting with the law.

We wrote the law in a very simple way. We said that Universal Service Fund shall support advanced telecommunications services. Some people seem to forget that, Mr. Chairman.

I look forward to the witnesses' testimony.

The CHAIRMAN. Thank you. Senator Smith.

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

Senator SMITH. Thank you, Mr. Chairman. If I may, I have a longer statement that I would like to include in the record.

The CHAIRMAN. It will be included.

Senator SMITH. In the interests of time and hearing from our witnesses I will not read it, but just simply say that I think broadband deployment can be a significant part of economic development, particularly in rural places. There are places in my state where they have in one case, Le Grande, Oregon, a deployment. A tremendous amount of medical services are given there through

this technology that I think is very, very promising. I think we need to structure policies and tax policies in particular to incentivize the deployment of broadband all over the place, but there are some other questions I hope to ask when we get to the witnesses.

Thank you, Mr. Chairman.

[The prepared statement of Senator Smith follows:]

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

Thank you Mr. Chairman. Earlier this year, I offered an amendment to the Energy Bill for a broadband deployment tax credit and said that the Federal Government has an obligation to support broadband deployment just as it has supported the construction of highways throughout our nation. It is only with federal support for the construction of broadband networks that all consumers will be given access to the advantages of broadband.

Broadband networks have the power to bring economic development and opportunity to rural areas, but unfortunately, the communities that often have little or no broadband service are rural and low-income areas. We have already seen how the information economy has transformed major cities and other industrial areas. I believe it is critical that we bring that information economy to all consumers.

Recent studies show that cost is the biggest impediment to consumer broadband growth. More than 70 percent of potential broadband consumers said they were not signing up for broadband because it is too expensive. I am very concerned about reports that nearly every major broadband provider *increased* prices in the past two years.

It is now time for the government to act. The legislation I had offered would create a two-tiered tax credit designed to spur broadband deployment around the country. The first tier would provide a 10 percent tax credit to broadband providers for new deployments in rural and low-income areas. The second tier would provide a 20 percent tax credit for next-generation broadband deployments. The rural and low-income credit would be broadly available. For example, in Oregon, 45 percent of the households would be eligible for the first tier of tax credit. The second tier credit would be available for broadband deployments throughout the country.

We know that broadband deployment can benefit consumers. In La Grande, Oregon, which was connected to a nearby fiber optic network in 1999, the community has developed a telemedicine program that makes it possible for doctors to consult with patients remotely and receive needed medical information instantly. Other Oregon towns have seen broadband services help them attract and keep telecommuting residents and improve local services.

The issue I want to explore with the witnesses today is whether the current broadband environment is consumer friendly. Is the offering by telcos and cable operators consumer friendly? Do consumers want more broadband choices than just two carriers, which are cable and DSL? Is wireless or satellite broadband technically feasible?

I firmly believe that even as we talk today about increasing government's role, it is important that our actions are not heavy-handed. Any government action must have—as its first priority—the goal of encouraging private businesses to make a substantial investment in public infrastructure. Making high bandwidth broadband widespread and affordable is going to require tens of billions of dollars of risky investment by any company in the telecommunications industry. The companies who take the risk of deploying last mile broadband facilities should get the benefit if it succeeds.

Our goal is simply to make sure that basic consumer safeguards are in place. The widespread availability of broadband technology is essential to ensuring the United States' technological leadership in the world. We must make a commitment to a national broadband policy.

I look forward to hearing from our witnesses today about what they are doing to develop broadband technologies, and what they think we should do to encourage broadband in the United States. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. Senator Breaux.

**STATEMENT OF HON. JOHN B. BREAUX,
U.S. SENATOR FROM LOUISIANA**

Senator BREAUX. Thank you, Mr. Chairman. I thank you for having the hearing and for our witnesses. I think by any measure that we look at that the telecommunications industry in this country is in a tailspin. Whether you are a manufacturer of telecommunications equipment or whether you are a long distance company, or whether you are a Bell local service company, you have to look very hard to find someone who has really been successful.

I think one of the companies let go another 12,000 employees on Friday. Nearly 500,000 jobs have been lost, \$2 trillion in market value, just in the last 24 months, and it is across the board. You could say that, well, long distance is doing well, and local service is not, but that is not true. The opposite is not true as well.

There is not a segment of the most important, or one of the most important industries in this country, that is not in very serious financial trouble. When this Committee was considering the legislation a couple of years ago to bring the telecommunications industry into the 21st century, legislation which I strongly supported, none of us, I will bet, would have thought that in a short period of time we would be here looking at an industry in the shape that it is in today. The real question is, what do we do to help?

Now, I think there are some things that need to be considered and looked at, but we just cannot sit back and watch one of the most important industries in this country go down the tank. That is what is happening, and I thank you for having the hearings.

The CHAIRMAN. Thank you.

The Committee welcomes our very distinguished panel, Hon. Reed Hundt, Former Chairman of the Federal Communications Commission, Mr. Michael J. Price, vice chairman of Evercore Partners in New York, Mr. Craig Mundie, the senior vice president and chief technical officer of Microsoft, Mr. Lawrence Lessig, professor of law at Stanford University, Mr. Peter Huber, senior fellow of the Manhattan Institute.

Mr. Hundt, Chairman Hundt, glad to see you back.

**STATEMENT OF HON. REED E. HUNDT, FORMER CHAIRMAN,
FEDERAL COMMUNICATIONS COMMISSION**

Mr. HUNDT. Thank you very much, Senator. Thank you all for inviting me back. It is a great privilege. It has been 5 years since I have had the opportunity to appear in front of you, and 5 years since I have left public service, and there certainly has been a lot of water that has gone under the bridge since then, and some bridges have been washed away.

Senator BURNS. Do not worry about the Potomac, though. It comes and goes.

[Laughter.]

Mr. HUNDT. I was trying to think about how to summarize these last 5 years. Unfortunately, my high school senior son showed me the book he has just been assigned, which is "A Tale of Two Cities," and you only have to read the first paragraph to encapsulate the last 5 years. It has been the best of times and it has been the worst of times, it has been the time of hope and it has been the time of despair, and if you will permit me, I would like in a very, very

short period of time to talk to you about the best of times part and the worst of times part in my judgment, and then urge you to take the leadership you have shown so often in the past and take the steps to build America the finest next generation broadband network in the world that will reach absolutely everybody, especially including those of you in your state, Senator Burns, or your state, Senator Dorgan, who are the most expensive and the most in need of the government's help in being part of the network.

So the best of times, actually the telecommunications sector measured by revenue is much bigger now than it was in 1996, when you signed the law. It is much bigger this month than it was 6 months ago, measured by revenue. It is \$277 billion for this year, and was only \$164 billion when the Telecommunications Act was signed. It has been a story of continued growth measured by revenue. One of the main reasons is the spectacular new services that have been introduced all across the country in this time period, the Internet, cell phones, even broadband itself, with 15 million subscribers in homes and small businesses.

These are tremendous growth stories from the perspective of consumers. What lies behind them is the competition has produced better prices for new services than ever before in the history of telecommunications. Since 1996, long distance prices have dropped at a rate of 6 percent per year on a compound basis. Wireless prices have dropped at 19 percent a year on a compound basis since 1996, and long haul data dropped in just 1 year 99 percent in price.

As a result of all of these price drops, consumers have purchased not the same amount for less money, but more for more money, and every time you read a story about how we have a consumer-led economy that is just barely keeping us out of recession, it is in particular, the epitome of that, that the consumers are buying more in the communications sector.

All of this is because of the magic elixir of competition and innovation at the same time. We have never seen so much innovation. We have never seen so much competition. All of this has also produced net job growth in this time period.

Looking at the telecommunications companies alone, we now have 1.6 million jobs. We had 1.2 million 10 years ago. Jobs increased in the telecommunications sector every month from the signing of the Telecommunications Act until May of the year 2001. Since then, they have begun to decline.

Now let us talk about the worst of times. The worst of times is that in the last 2½ years there has been a flight of capital and a retraction of investment in this particular sector. It is true at the startup level, it is true at the big company level, it is true in the public stock markets. We have the longest bear market in 60 years, and it is most dramatically the case that we have a bear market in the telecommunications sector. As investment leaves—we all know that there is a non-virtuous cycle that goes on. As investment leaves, companies begin to lay off people, they reduce the innovation, they do not produce new services, ultimately the dynamic strength of the sector fades away and dissipates because there is not new investment, and as the services are not introduced, and as companies are not trying to market them success-

fully, ultimately the consumers do not buy more, and the whole economy tips into a recession.

That is where we are right now, I would suggest with great respect, and with great humility in terms of predicting the future. We are at the very knife's edge of decision, where it is absolutely imperative that the government play its right role in exercising the leadership to make sure that we build on all these strengths of the real economy and create a new vigor and a new confidence in the market economy and in the capital markets in particular.

There are two choices that have to be made. Here is the first choice, I would say with great respect. Do we adopt a policy of monopoly and try to consolidate industries through a pro-monopoly policy at the government level, thereby building the confidence of investors in those particular industries, or do we stick with the policy of competition?

Here is the choice that was faced in the crash of the market in 1929, and the policy choice made over the 10 years thereafter was to revert to monopoly and have big government come in and regulate those monopolies and make sure that there was not too much capital invested in any of the infrastructures of America. That is why the Federal Communications Commission was created in 1934.

That is the wrong policy, I would say. That is the policy that reduces jobs, shrinks investment, reduces innovation, reduces the number of services, and ultimately will reduce the size of the economy. The right policy is competition, but the essential key—and this is the bottom line that I hope will join in the thoughts already expressed by the Senators and build a momentum, to the degree my testimony can, for a new policy of universal service.

The essential extra ingredient to a competition policy is to have the government look at broadband, look at the new technologies of fiber and upgrades of existing plants and wireless, and decide that the government needs to make an investment of public moneys in jump-starting our broadband industry. There has never been a communications industry or a transportation industry in the history of America that did not benefit from an original government jump start or incentive plan to get going, and this broadband industry needs that help now.

[The prepared statement of Mr. Hundt follows:]

PREPARED STATEMENT OF HON. REED E. HUNDT, FORMER CHAIRMAN, FEDERAL COMMUNICATIONS COMMISSION

Mr. Chairman and Members of the Committee:

Thank you for inviting me to testify today on the government's role in the future of telecommunications and broadband deployment. This is a vital subject and a timely hearing, as the telecommunications sector, which led the economy through extraordinary growth in the 1990s, is now leading the capital markets in the wrong direction in this decade. I am grateful for the opportunity to present my views.

My testimony today reflects only my personal views, and not the views of any company with which I am associated.

My two key points are that (1) competition is the right policy to build broadband networks, but (2) to ensure truly high speed and universal broadband networks, government needs to help pay at least for the early stages. By year-end, about 15 million homes will have broadband at speeds approximately 1 megabit per second ("mbps"). This Committee should vow to get 100 million homes on broadband at speeds never less than 10 mbps by the end of the decade.

I am certain, Mr. Chairman, that you and the other Members of this Committee know well the current state of the telecommunications sector. It is in large part be-

cause of this Committee's leadership that the telecommunications sector became an engine of our dynamic economy of the late 1990s. The 1993 Budget Act opened the airwaves, or spectrum, to competition by making new licenses available through auction. The 1996 Telecommunications Act opened telephone markets to competition, and created the single most successful universal service program in history—the so-called E-Rate, which has put Internet access in 90 percent of all classrooms in less than 5 years. Thanks to your visionary legislation, competition policies and tremendous technological innovation have together lowered prices for communications services. As a result, consumers and businesses have purchased more services than ever before, and aggregate revenues for telecommunications have grown steadily from the beginning of the 1990s to this date. Aggregate employment in the sector also grew steadily from 1992 until the middle of 2001.

However, capital markets and profits in telecommunications have been in decline since mid 2000. Inevitably, the decline for investors has translated to reductions in employment. Net job loss has plagued telecommunications for more than a year now. Ultimately, if firms do not make profits and investment does not begin to grow, instead of shrink, in telecommunications, we will not see the same rate of innovation, new services, competition, and revenue growth that characterized the 1990s.

The good news is that, as a whole, the telecom sector continues to grow rapidly, and consumers are spending a growing percentage of their income on an expanding array of telecommunications and information services, while benefiting from sharply lowered prices. The pace of growth in the U.S. telecommunications industry, including voice and data, wireline and wireless, is enviable. Total U.S. telecommunications revenues grew from \$164 billion in 1996 to \$242 billion in 2000, and current estimates indicate they will reach \$277 billion in 2002, and a staggering \$383 billion in 2006. Although revenues for long distance voice are shrinking and local voice revenues are under pressure, local data, long distance data, and wireless voice revenues are growing rapidly, with the result that revenues for the sector as a whole continue to grow.

Telecommunications, moreover, is posting healthy gains as measured by its share of the gross domestic product (GDP). For example, U.S. telecommunications revenue represents an increasing percentage of GDP—just over 2 percent in 1996, projected to increase to over 3 percent in 2006, which represents a 4 percent compound annual growth rate. Residential telecom spending, as a percent of disposable income, is growing at an even faster rate—at a 5.7 percent compound annual growth rate.

Customers benefit tremendously from the price reductions that have occurred over the past few years as Congress' national competition policy has begun to take hold in all sectors of this industry. Long distance prices dropped an average of 6 percent per year from 1995 to 2000; wireless prices dropped 19 percent annually; frame relay prices fell 12.6 percent per year; and OC-3 prices fell a staggering 99 percent annually. Prices for local voice and for Internet access have been more or less stable over the past few years.

The effects of the competition policy introduced by this Committee, combined with technological innovation, have been profound. Specifically, that policy has lowered greatly the barriers to entry in all segments of the telecommunications sector; fostered extensive innovation and the deployment of a vast array of new services; and made possible the explosive growth of the most revolutionary communications medium in history—the Internet's network of networks. Moreover, the growth of competition has been largely responsible for both the ongoing reductions in the prices for most telecommunications services, as well as the continuing increases in aggregate revenues for the sector since the early 1990s. The number of jobs in the telecom sector, while down from its peak in 2001, is still much higher in 2002 (1.6 million jobs) than it was in 1992 (1.3 million jobs). Finally, net income for the telecom sector is still positive, although it has shifted away from some firms and some technologies and toward others.

My conclusion from these facts is that competition provides exactly what the economists advertise—tremendous advantages for consumers, opportunities for entrepreneurs and new capital to take risk and introduce new technologies, and continued growth in the nation's economy. It is also clear that a competitive sector means that companies can fail, as they do in every competitive economy, and that has happened to many firms in telecommunications. Some of the failures in this sector are due, it seems, to excessive investing in redundant business models; others to shoddy or even fraudulent practices. Good sense among investors, better corporate governance, and stricter regulation in financial markets are all right and proper remedies for these serious problems. But it is always true that there is some risk of misallocation of capital by the private sector, as we saw in the second half of the 1990s. And it is always true that this risk is the one policy makers should

permit investors to take, in return for a competitive, innovative telecom sector. The potential reward significantly outweighs the risk.

Despite the recent downturn, I am confident that new capital spending will return to this industry. I am also quite sure that there is a right way and a wrong way for government to act during this prolonged period of disinvestments.

The wrong way is to react by repudiating the benefits of competition, and blessing monopoly instead. Down that path lies job loss, price increases, reduced innovation, reduced capital investment in the aggregate, fewer new services, a smaller GDP, and ultimately the loss of the spirit of entrepreneurship and risk-taking that is part of the American spirit.

The right way is to encourage new investment and to foster competition and innovation. And a key part of the right way is to recognize that certain essential elements of a modern telecommunications network are not likely soon to be constructed purely by the operation of competitive private markets. Therefore, to some degree public monies should be spent to provide a base or floor for private sector capital investment. And a final part of the right way is to identify as well the extent to which public money must be spent to make essential communications services available and affordable to all Americans.

All private markets leave some services too expensive to be affordable to all. For most services and goods, there is no good public policy reason to address this issue. But part of maintaining democracy and our uniquely inclusive society is to include everyone in our country—those in distant rural areas and those in high cost demographics and those in nonaffluent income classes and those in classrooms and government buildings and health care facilities—as part of a single fabric of communication. Just as roads link every small town and farm to every big city and business location, so we have long set as a national goal the linking of everyone in America to the most modern conceivable communications networks.

And where private markets do not through the operation of innovation and competition make such networks available and affordable to everyone, the government should step in. At this perilous time for capital markets it is doubly important to reaffirm this traditional universal service goal because the right amount of public money, spent in the right way, can help build essential facilities that are necessary for the further evolution of America's communications networks and industries.

Everyone in the information sector acknowledges that the next technological leap in telecommunications is broadband. Policy and competition has to date built a broadband market of about 15 million households and small businesses now subscribing to high speed connections that deliver data, also known as Internet content and communication, over cable modem or DSL.

But 15 million is not enough, especially when we see that more than 40 percent of households in Korea, for example, have broadband. We need a broader dissemination of broadband than private markets, under today's economic constraints, are likely to provide, if we want to make broadband universally available and affordable. Moreover, if we want a communications network that would serve as a base for advanced data services then we should not be content with the speeds of today's broadband networks.

Our goal should be speeds to all business users that range from 100 megabits per second to 1 gigabit per second, or even 10 gigabits, and to all residential users at speeds from at least 10 megabits per second to 100 megabits. These speeds will require a combination of upgrades of existing facilities, deployment of new wireless technologies, and ultimately installation of fiber. Whether it is in connection with education, business, health care, entertainment, or any other part of our modern life, a robustly networked America will be a productive America.

I would like to describe the best approach to broadband as "Having our cake and eating it too." We should take advantage of competitive market structures to build this broadband network. That's the cake. And every American should have broadband available to them; it should be universal and it should be affordable. That's the eating.

The only way we will get a broadband market that meets these twin goals is if the government provides the leadership and economic stimulus to accomplish it. It took government leadership and some public funding to build a truly national electric system and a truly national highway system, and it will take it here. Unfortunately, as of today private capital simply will not invest to build a universal broadband system. There is capital available to build the current lower speed version of broadband in parts of the country, where the population density and the economics of the families or businesses passed justify the investment, but it is not universal and it is not high speed enough.

I am sure the Members of this Committee know that there are many countries around the world that are ensuring that broadband is universally available, with

networks touching every citizen. If they succeed and we falter, the applications and the hardware for these networks will be developed in those countries, not here. For decades, we have been the world leader in technology and telecom, but there is no guarantee that we will remain the leader.

It would be great if we could sit back and watch private capital build a universal high-speed network. But it won't happen soon enough, nor will it be universal, nor will it provide efficient communications services to all business and residential users and service providers, unless government establishes a plan to make it happen.

Only if the Federal Government provides leadership, and financial incentives, will we have the high-speed networks that ensure our continued world leadership in telecommunications. We can afford it, because these networks will pay for themselves over time, but they will not pay for themselves soon enough to attract private capital today and they will not pay for themselves in important but remote or underserved parts of the country.

There are many ways that the Federal Government could provide the leadership. I don't favor government ownership of a broadband network, but I do favor government assistance to communities that need the help to provide broadband to all their citizens.

Wireless technologies are advancing rapidly, and we should be doing everything we can to make sure that the spectrum is available and the technology is encouraged so wireless can be part of our broadband solution.

A next generation, universal broadband network will cost tens of billions of dollars. But we know consumers will pay for the network over time if the monthly user price is affordable and the applications are attractive, and everyone is on the network. Therefore, to some extent this network, like all transportation and communications services since the telegraph and the first macadam roads, simply has to be built in order to attract the traffic, as opposed to waiting for unmet demand to build before the network is built. After all, did America wait to build roads until after every garage had a car? Not at all; even while Ford's cars were pouring out of factories in the 1920s, Secretary of Commerce Herbert Hoover used government leadership to build a network of roads linking every town and city in the country. Similarly, even while computer processing speeds continue to double every couple of years and Internet applications consist of more and more bits all the time, we need to extend and expand the underlying communications networks so that they have the reach and the capacity to take advantage both of processing speeds and the complexity and volume of Internet applications.

If the government will help finance the network, in time it will recover the cost, directly from the fees paid by consumers, and indirectly from the gains in technology and productivity that will be part of our economy.

Mr. Chairman, as you and the Members of this Committee know from your deliberations and actions over the last many years, it takes vision and leadership to ensure that a sector of the economy like telecommunications remains vigorous, competitive and dynamic. Unfortunately, it is a job that requires constant attention. As markets and technology change, new visions are necessary. We will fail if we sit back, take a break, and hope that we can continue to lead the world by doing nothing here in Washington. Technology advances and we can either use the combined forces of the government and the marketplace to make technological innovation available to all Americans, or others will take the lead.

The CHAIRMAN. Very good. Mr. Price.

**STATEMENT OF MICHAEL J. PRICE, VICE CHAIRMAN,
EVERCORE PARTNERS, INC.**

Mr. PRICE. Thank you, Senator Hollings, thank you, Senator McCain for holding these hearings today. I would like to present you with my views of what has led to the telecom meltdown and highlight three observations about industry structure that need to be addressed, and leave you with one legislative proposal for you to consider.

The Telecom Act of 1996 created unbridled enthusiasm about the opportunities available to new competitors. It also created a consumer-friendly frenzy that has destroyed the balance sheets and income statements of many of America's largest and most important companies. In essence, we have too many competitors, particularly

in wireless and in the backbone transport. Further, our bankruptcy laws are a problem. They do not eliminate the capacity.

Normally, our bankruptcy process would allow the companies to reorganize and other companies would buy these assets. Using today's bankruptcy laws, what many companies do is use these laws to reorganize. When they reorganize, it is a path to liquidity, not a path to capacity reduction, and unfortunately this perpetuation of this capacity is going to make more trouble for the stronger companies as time goes on. You can imagine a WorldCom that is reorganized without its debt. How is it going to compete with AT&T?

So this is a problem that is not at the forefront yet today, but I think portends a looming problem that is going to happen in 2 or 3 years from now. To make Senator McCain's point of what did you predict in October 2000, when I was running my CLEC in Europe, we saw this coming. In August of 2001 we saw it coming again, so we have seen this coming for some time.

My concern about the bankruptcy laws in this country is, with these companies reorganizing debt-free, they will create a terrible situation for the companies that have been managed prudently and stay in business.

My second point is that we have too many competitors, particularly in the overcapitalized wireless industry. In my testimony, there is a chart which highlights the industry structure according to Michael Porter's five factors, and you can see that the wireless industry closely resembles the airline industry. Six, seven, or eight competitors are too many for a capital-intensive industry where the switching costs are near zero.

The wireless industry's capital structures are under tremendous strain due to the next generation technologies, upgrades, and marketing costs. In 2002, the wireless industry is expected to have zero dollars in free cash flow, yet suffering under \$84 billion of debt.

The European market provides evidence that three or four competitors can still maintain a high degree of competition, and in fact competition remains fierce, and penetration has reached 87 percent in Europe. My view is that if the same competitive environment would exist in the U.S. if there were three or four competitors. Remember, in the late 1990s, in the highly concentrated long distance industry, where three players, AT&T, Sprint, and MCI had an 80 percent market share, competition was intense. This is fundamentally because the switching cost was zero, just like it is in the wireless industry.

To Senator Burns' point, beyond allowing consolidation, I believe the government should also give additional spectrum to carriers at no cost. This is not the government's piggy bank. I do not think it should be seen as such. We can strengthen the remaining carriers if we give them this additional spectrum and allow them to have 60 or 70 megahertz per market. In an engineering context, spectrum is a substitute for capital. It is a direct economic tradeoff. This will allow the existing wireless carriers to be a strong, effective competitor to the land line communication network. In fact, it will also lead to the RBOCs competing with each other, which I also believe should be a broader public policy objective.

So let us get to the RBOCs. With huge cash flow EBITDA margins of 40 percent, and relatively strong balance sheets, the RBOCs

appear to be the stalwart of this industry. However, this is changing. With the improving coverage of wireless services, home phones are becoming optional. Several providers, like LEAP, estimate that 26 percent of their customers have dropped their home phone. According to *USA Today*, one in five Americans think of their cell phone as their primary phone.

The cost advantage of cable is an emerging reality. Coax cable technically has more capacity for a given level of technology spender than a copper loop. The average charge for the high speed Internet service by DSL is \$51, and the average charge for cable is \$45, and \$10 less if you already have video, so the cost advantage that they have is reflected in their pricing. This has led to cable capturing two-thirds of all broadband customers.

Cable's cost advantage is also due to lack of regulation, which in my view was a good policy decision. Freed from price caps 6 years ago, effectively, cable has now upgraded their plant for high speed Internet and digital cable. In 2 to 3 years, cable telephony will be providing voice, another effective competitor to the RBOC monopoly in residential voice.

When I recently surveyed a group of telco executives and asked them what they would give up first, their home phone or their cable TV, the answer was unanimous, the home phone, so in this regard the Telecom Act is an apparent success. The question for this Committee, I would pose, and the FCC, is, if facilities-based competition to the RBOCs' residential voice monopoly has become a reality, when should the regulatory environment be changed?

So now, let us get to the need for broadband, which I think is an important economic concern. We have all talked about the technology and telecom depression and the job force and the wealth loss. Furthermore, the trend of recycled bankrupt assets becoming viable again will only serve to hurt the strong players of today. Fundamentally, we need a Technology New Deal. I would propose a broadband subsidy of \$300 per month be paid to the provider if the provider agrees to provide high speed Internet service for under \$30 a month for a 3-year period. Just as we had a comment several years ago, "it's the economy, stupid," the problem with broadband is price. If we fix the price, we will get the demand caught up.

If we did this for 20 million homes, this plan would cost \$6 billion probably over 2 to 3 years. Without a change in the regulatory environment, there will be no catalyst to revise investment in the wireless networks. The equipment manufacturers will not survive the cutbacks that are currently being made in the capital budgets.

Lucent and Nortel have reacted by partially reducing their spending in next-gen technology. If this continues, the U.S. will lose its competitiveness. Already, Nortel has cut back its investment in its world-leading optical technology. How much longer do we expect Lucent to lose \$3.5 billion a year and continue funding Bell Labs, and where would the country be without Bell Labs?

I leave this Committee with three observations and an aforementioned proposal.

1. Our bankruptcy laws, which allow stand-alone restructurings, will perpetuate the overcapacity that plagued this industry for years to come by maintaining excess capacity and creating new low cost competitors.

2. The wireless industry resembles the airline industry and needs to be consolidated and given more spectrum. If they cannot earn a respectable rate of return on new equipment due to over-capacity, they will not innovate and continue to invest.

3. The historical regulation of the telcos needs to be examined in light of the changing regulatory environment, cable superior technology plant and the increasing quality of wireless offerings.

4. No constructive action this government could take with the three previous industries will solve this industry's problems for a meaningful time, and we need a Technology New Deal to stimulate demand.

Thank you very much. I appreciate the opportunity to appear before this Committee.

[The prepared statement of Mr. Price follows:]

PREPARED STATEMENT OF MICHAEL J. PRICE, VICE CHAIRMAN, EVERCORE PARTNERS, INC.

The Telecom Mess: How did we get here and how are we going to get out of it?

My name is Michael Price and I am Vice Chairman at Evercore Partners a private equity and advisory firm based in NY and LA. We have 2 private equity funds that invest in growth capital and one venture capital fund. Our advisory business focuses on strategic corporate services and restructuring. I have spent 20 years in the investment banking and telecom industries. In 1987, I joined Lazard Freres and ran their global telecom and technology practice. While there I was responsible for the sale of McCaw Cellular to ATT, SBC's acquisition of PacTel, the breakup of US West into Media One and US West, and the sale of MCI to WorldCom. In 1998, I left Lazard Freres to start FirstMark Communications Europe and raised \$600 mm to build a competitive carrier in Europe.

As an active participant, I have firsthand experience in the dramatic growth of this industry, as well as its contraction. I have watched the power shift from the incumbents to the upstarts, and now back to the traditional participants, the RBOCs and the cable companies. However, the current state of affairs is more dire than it has ever been. We are simultaneously fraught with excessive competition, fragile balance sheets, regulation which is constraining investment, declining profitability and bankruptcy laws, which recycle assets and allow them back to be competitive with those companies that have not restructured.

Furthermore, technology is finally creating alternatives for consumers to feast on. Wireless is an effective substitute for the landline telephone. Satellite is an effective substitute for cable TV, broadband Internet may one day be a substitute for the cinema as video on demand takes off. These dislocations change the power of the participants.

Today I would like to present you with my views on what led to the current telecom meltdown and highlight three observations about industry structure that need to be addressed and one legislative proposal for you to consider, which in my view, will lead to a more rapid recovery of this sector.

First, how did we get here?

The Telecom Act of 1996 created unbridled enthusiasm about the opportunities available to new telecom competitors. Unfortunately, it also created a consumer friendly frenzy that is economically unsustainable. It has destroyed the profitability, and balance sheets of some of America's most important companies. In essence, we have too much competition, particularly in wireless, and backbone transport.

Early successes like MFS and Teleport proved that investors could make money supporting competitive telcos. Extrapolation of early successes in the marketplace ignored the difficulty in gaining significant numbers of customers and assumed little competitive response from incumbents. In the late 1990s, we believed that telecommunications was a rapid growth industry, as early Internet growth was estimated at 100 percent per quarter for several quarters. This forecast gave proof to the capital markets that demand was indeed boundless. Following the closure of Napster and the rapid achievement of high Internet penetration, Internet growth returned to a much more normal pace. However, the future perceived "demand" curve of that moment in time in 1999, dictated the capital budgeting commitments

for the next 18 to 24 months. At the same time, dense wave division multiplexing (DWDM) and other next-generation technologies multiplied available capacity, leading to the massive oversupply with which we are now faced. These points we chronicled in last Thursday's Wall Street Journal.

Wall Street responded enthusiastically to the "Telecom Growth Opportunity" raising over a trillion in capital and spending in this industry dramatically increased with North American telco equipment capital expenditures rising from \$28 billion to \$123 billion from 1990 to 2000. While capital expenditures in this industry dropped to \$110 billion in 2001 and is expected to drop to \$78 billion in 2002, this is still above inflation adjusted 1990 numbers of \$39 billion. Thus, if we return to pre-wireless, pre-hype spending levels, Nortel, Lucent, Corning and Motorola will see their sales decline further.

Bankruptcy Laws Are A Problem

The good news about telecom deregulation is that it was extraordinarily successful in bringing new entrants to the market and creating new choices for consumers. The bad news is that it created too many competitors who did not have customer bases and this has resulted in stranded capacity, like the railroads of the 1880s, which will take years to disappear.

Normally the free markets eliminate capacity, however, our bankruptcy laws allow companies to be reorganized. In Europe, assets are liquidated. In the United States, management teams that have overextended themselves, get to wipe out their debt in Chapter 11, and start with a cost advantaged capital structure relative to those that have managed their businesses prudently. This means capacity does not go away.

In an industry where we have fundamental oversupply, we have a structural flaw, which in fact encourages the perpetuation of this oversupply. This recycling of assets, with their debt free capital structures will put pressure on the "still" strong balance sheets. Thus, the complete "capitulation" is still some years away. Chapter 11 is a path to liquidity, not a path to capacity reduction.

My first point is that our bankruptcy laws will actually lengthen the time period for this industry to recover, and this needs to be appreciated when prescribing "fixes" for this industry.

It's all about Industry Structure

My second point is that we have too many competitors, particularly in the over-capitalized wireless industry. Michael Porter provides a framework for evaluating industries structure in terms of the power of buyers and suppliers, the barriers to entry and exit and switching costs. The below chart summarizes the competitive nature of the telecom industry as compared to the airline industry.

	Wireless	Local Wireline	Cable	Airlines
Power of: Buyers	High	Medium	Medium	High
Suppliers	Medium/Low	Medium/Low	Medium/Low	High
Barriers to: Enter	High	Medium	High	High
Exit	High	High	High	High
Switching costs for consumers	Low	Medium/High	Medium	Low
Number of competitors per market	6-8	Residential: 1-4 (UNE-P, cable and RBOC, wireless) Business: many (Multiple CLEC's, IXC's, RBOC)	1-3 (satellite)	1-4 (per route)
Key Industry Issues	Excess competition, low switching costs, lack of product differentiation	Competition from wireless and cable, regulation (what is the true cost of UNE-P?)	Competition from satellite providers, leverage with media companies, balance sheet leverage	Labor unions, low product differentiation, supplier concentration

Using this analysis, the attractiveness of the wireless industry is only slightly better than the airline industry due to the airline's labor and concentrated equipment supplier issues. However, the larger number of (currently) well-financed wireless competitors may make its prospects worse. It is important to remember when thinking about this comparison that the cumulative net profitability in both the airline and U.S. wireless industry is negative.

The wireline industry is entering a battle with cable. While the intramural broadband wars have begun, and are painful for the ILEC which lose money on each DSL line sold, the real fight, over residential voice, has not yet begun. The outcome of this fight will determine the fundamental shape of the industry for the next generation.

So where do we go from here?

Wireless

Six, seven or eight competitors are too many for a maturing, capital-intensive industry, where the switching costs for the consumer are near zero. Recently, U.S. wireless penetration reached 50 percent. While minutes of use have grown dramatically in the last three years (447 per month for 2002 vs. 171 for 1999) and total revenues have grown materially (\$65 billion in 2001 vs. \$33 billion in 1998), we are entering the final stages of this industry's growth. We may be entering a phase where the elasticity of demand for voice services approaches one, i.e., increasing number of minutes leads to flat or negative revenue. When this condition occurred in the long distance industry in the late 1990s competition became cutthroat. Furthermore, the industry is not yet suffering from the churn caused by number portability.

The wireless industry's capital structures are under tremendous strain due to next generation upgrades and marketing costs. In 2002, the wireless industry is expected to have \$0 in free cash flow (EBITDA less capital expenditures) while it struggles under \$84 billion of net debt.

A recent report indicated that for the wireless industry to earn 10 percent return on invested capital, given the existing invested capital base, and the current profit per subscriber, the industry would have to double the number of subscribers, without investing any additional capital, and with no pricing degradation. Since this is unlikely, and as capital needs a return, only two conclusions can be made—consolidation must occur (to share the invested capital plant), or competitors need to leave the industry.

The European wireless market provides evidence that the existence of 3 or 4 competitors still maintains a high degree of competition. In Europe, wireless competition remains fierce and penetration has reached 87 percent.

My view is that the same competitive environment would exist in the U.S. if there were 3 or 4 competitors. Remember that in the late 1990s, in the highly concentrated long distance industry where three players—AT&T, MCI and Sprint, had 80 percent market share—competition was intense. The long distance industry, like the wireless industry, has no switching cost.

Beyond allowing consolidation, the government should give wireless carriers additional spectrum at little or no cost. In an engineering context—spectrum is a substitute for capital. We can strengthen the remaining carriers if we allow them to have 60–70 mhz of spectrum each, and make it available at low cost. This will allow the remaining strong carriers to be a truly effective alternative to the landline communication network and provide other broadband connectivity options. It will also lead to the RBOCs competing with each other, which ought to be a broader public policy objective.

Wire Line: They Are Not as Strong as They Seem!

With huge cash flow, EBITDA margins over 40 percent and relatively strong balance sheets, the RBOCs appear to be the stalwart of this industry. However, this trend is changing. Aggregate access lines at SBC are down 4 percent from last year but retail access line growth was down 6 percent, the difference being low/no profit wholesale access lines. It is clear that the RBOCs are facing stiff competition from the wireless and cable companies.

With the improvement in coverage in the wireless services, home phones are becoming optional. Several providers, including Leap Wireless and MetroPCS are pursuing a strategy of landline replacement. Leap estimates that in some markets 26 percent of its customers have dropped their home phone. According to *USA Today*, one of 5 Americans think of their cell phone as their primary phone.

Further, the cost advantage of the cable plant is an emerging reality. Coax cable technically has more capacity for a given level of technology expenditures than a copper loop. The average charge for high-speed Internet service by the telcos (DSL)

is \$51 per month and the average cable Internet service is \$45 per month, and \$10 per month less if you are already a video subscriber. This pricing advantage allows cable to capture two-thirds of all broadband customers.

DSL is a transitional product, which has less capacity than coax cable plant. Eventually, the RBOCs will have to spend billions to upgrade their networks to fiber just to compete. Nationwide, the estimate is \$100 billion to bring fiber to every home. If they do not have the profits from existing services they will be unable to afford the fiber upgrade.

Cable's cost advantage is also due to its lack of regulation. It was effectively freed from price caps 6 years ago and cable operators now have upgraded their plant to provide high speed Internet and digital cable. In 2 to 3 years cable telephony will be implemented using voice over IP at very low incremental costs to the cable TV provider. This points to the benefit of regulatory freedom.

The so-called cable triple play (voice, video and high-speed data) will allow it to offer all of the services of the RBOC, plus video, for a lower total cost.

When I recently surveyed a group of telco executives and asked which they would give up first, their home phone or their cable TV, the answer was unanimously the home phone.

The residential voice business traditionally had one strong competitor—the RBOC, a monopoly. Today, facilities based alternatives to residential voice, include six wireless competitors, with at least one of these wireless competitors offering a landline quality product. In the near term, the entry of the cable company into residential voice will add additional facilities based competition. Furthermore, UNE-P's are allowing AT&T and MCI to capture local customers.

In this regard, the Telecom Act is an apparent success. We have both facilities and non-facilities based competition. While the RBOCs still have 80–90 percent market share in residential voice, Verizon Wireless the largest wireless company has only 25 percent market share in wireless, and the telco industry has only has 33 percent market share in high-speed Internet. So, in the “next gen” platforms, the monopoly is waning, and either the rest of market, in the case of wireless, or cable in high-speed Internet access has the dominant share. But in the historical monopoly business—residential voice—competition is here today, before cable launches VOIP.

The question for this Committee, and the FCC, is *if facilities based competition has become a reality*, when should the regulatory environment be changed.

The Need for Broadband

We are in a telecom and technology depression. With 500,000 telecom jobs lost, hundreds of bankruptcies and two trillion dollars of wealth lost, the effect of telecom bust have been wide spread. The trend of recycled bankrupt assets becoming economically viable again, will only serve to hurt the strong players of today in the years to come. Just as the 1930's economy needed a “New Deal”, today, we need a Technology New Deal.

My proposal would be a subsidy paid to the provider to stimulate broadband demand. The problem with broadband is that it simply costs too much. At \$20 per month, America has over 60 percent narrowband Internet penetration. Bill Gates has suggested broadband should cost \$25 per month—it currently costs 60–100 percent more. Broadband penetration in Korea is 60 percent as the cost of broadband (\$22) is almost the same as narrowband (\$20). America will fall behind other nations if we do not have pervasive residential broadband.

To foster broadband penetration, I would suggest a \$300 per subscriber subsidy be paid to the provider, if the provider agrees to provide high-speed service (defined as 384 kbs or greater) for under \$30 per month for a 3-year period of time. The payment would be made on the basis of net adds so the carrier would receive no benefit for churn. If we created this incentive for the 20 million new broadband homes the cost would be \$6 billion, probably over 2–3 years.

The secondary consequences would be dramatic. Tele-medicine, e-learning, telecommuting, and e-commerce would be more pervasive. Software, hardware, equipment companies and cable and telcos would all benefit. With a large enough installed broadband base, Hollywood will be forced to solve the digital rights issues that will eventually enable entertainment content to be broadly available over the Internet. This will be the killer-app that will massively stimulate further broadband demand.

The Korean market benefits from greater density (more apartment buildings, smaller cities), which has led to the lower cost to provide broadband and thus spurred its adoption. An American company ON2 is currently selling VOD using DSL in Korea. It cannot find a market here in America. Once broadband penetration reaches 30 percent (up from 10 percent today) the cost structure of the entire

industry will decline and these prices will be able to be maintained, eliminating the need for any possible extension of the subsidy.

Conclusion

Without a change in the regulatory environment, there will be no catalyst to revive investment in wired and wireless networks. The equipment manufacturers will not survive the cutbacks the carriers are making in their capital budgets. Lucent and Nortel have reacted by partially reducing their spending in next-gen technology. If this continues, the U.S. will lose competitiveness. Already Nortel has cut back its investment in its world leading optical technology. How much longer do we expect Lucent, which is projected to lose \$3.5 billion this year to fund Bell Labs and where would this country be without Bell Labs?

Without a rebound in carrier spending within 24 months, Corning, Lucent, and Nortel will either be bankrupt or become subsets of their current capabilities.

I leave this Committee with 3 observations and the aforementioned proposal:

1. Our current bankruptcy laws, which allow stand-alone restructurings, will perpetuate the over-capacity that will plague this industry for years to come by maintaining excess capacity and creating "low cost competitors". WCOM without its \$30 billion debt burden may now really have a lower cost structure than AT&T.
2. The wireless industry resembles the airline industry and needs to be consolidated and, GIVEN more spectrum. If they cannot earn an acceptable rate of return on new equipment due to overcapacity—they will not innovate new services and continue to invest.
3. The historical regulation of telcos needs to be reexamined in light of the changing competitive environment, cable's superior technology plant and the increasingly quality of wireless offerings. Their current regulatory regime may be appropriate in a monopoly context, but the RBOC monopoly is rapidly waning.
4. No matter what constructive action this government could take to the previous three issues, it will not solve the industry's problems for a meaningful time to come and thus this industry needs a Technology New Deal to stimulate broadband demand.

When considering the need for economic stimulus, I ask this Committee to consider this proposal in the backdrop of our overall economy, where the airline industry is deeply troubled, the consumer is becoming weary even before a possible war, and the auto industry may be "stuffing" the channel, with unsustainable free financing. In fact, the auto industry today, reminds me of what Nortel and Lucent did for their customers in the late 1990s in financing purchases they cannot afford.

Without some "HELP" the technology and telecom markets have little prospect for recovery until 2005. My hope is that with a broadband stimulus bill we can enliven the broader technology, media, telecom and entertainment sectors by creating a new pervasive communication medium called BROADBAND.

Thank you Chairman Hollings and Members of this Committee for inviting me to share my views.

The CHAIRMAN. The full statement of both Chairman Hundt and you, Mr. Price, and all the panelists will be included.

Mr. Mundie.

STATEMENT OF CRAIG J. MUNDIE, SENIOR VICE PRESIDENT AND CHIEF TECHNICAL OFFICER, ADVANCED STRATEGIES AND POLICY, MICROSOFT CORPORATION

Mr. MUNDIE. Thank you, Mr. Chairman, Members of the Committee. My name is Craig Mundie. I am senior vice president and chief technical officer of advanced strategy and policy at Microsoft Corporation. I am very glad to be here today, because I think we bring a different perspective than many witnesses the Committee would have seen in the past on telecommunications matters.

I think Microsoft has an almost unique perspective. We are not in the telecommunications business, but, rather, like many other high technology companies we are in the business of developing

software and services that will excite consumers enough that they will actually pay for bigger pipes to run ever more innovative services and applications and, like everyone in our industry, we believe that reasonably priced ubiquitous broadband deployment will advance economic opportunity for the American public.

The issue today before this Committee is how to use public policy to promote broadband deployment. We have two straightforward suggestions. First, make more unlicensed spectrum available and regulate it minimally but more smartly than we have in the past.

Second, protect consumers' ability to use the Internet free from any artificial interference by the underlying network provider. We understand several Members of the Committee are exploring proposals to address these goals, and we fully support those efforts, but time is of the essence, because the U.S. is falling behind in broadband deployment.

If analyzed closely, current statistics are not all that encouraging. According to a recent Commerce Department study, our country has the most households of any nation connected to a broadband service, over 11 million. However, as a percentage, our penetration rate is sixth in the world behind the likes of Sweden, South Korea, and Taiwan, among others, and the recent trend lines indicate that we are falling further behind rather than catching up.

The stakes in this debate are not as many would have portrayed it. The Internet is becoming a programmable medium, creating a potentially different model of broadband usage, not just one of carrying media. Therefore, reexamining our policies is critical, because we are rapidly moving from today's world, in which the vast majority of activities focuses on publishing of content, like web pages, to a different world, a world in which literally millions upon millions of computing devices will be simultaneously and constantly connected to the Internet, and on consumers' behalfs will be communicating with each other continuously.

Again, we need to take two critical steps. First, we need to have wireless broadband connections that will provide a third way for consumers. In particular, these are not the traditional forms of wireless communications that we all know today as cellular telephony. In particular, policy makers should more aggressively manage the Nation's unlicensed spectrum.

These systems are currently referred to today, as they get deployed, as 802.11b, radio LANs, or more popularly now, Wi-Fi. More generically, you should think of them or refer to them as emerging radio technologies. These technologies, and even more futuristic ones, such as ultra-wide band and software-defined radios, not only offer an additional means of delivering packets at high speed, they also allow new business models for delivering broadband connectivity to emerge. These are not your same old radio services.

To do this, the industry needs more spectrum for unlicensed use, and the FCC should adopt spectrum etiquette for the benefits of all Americans. If policy makers here at the FCC and, indeed, around the world make more spectrum available for these devices and simultaneously adopt minimalist spectrum rules or etiquettes that limit the devices' ability to interfere with each other, the result will

be more choice for consumers and stimulated innovation in broadband services overall.

That value proposition, higher speeds with relatively cheap and fast deployments, is especially compelling in rural areas, where distance is so frequently the enemy of network efficiency and a major cost driver for broadband deployments, as well as in the inner city areas, where the high cost of broadband is a significant inhibitor to deployment.

The second critical step is to assure consumers' freedom from network operator interference. We are troubled that in the ongoing debate on what our Nation's broadband policy should be, a fundamental lesson from the last century, and that has been an integral part of the Internet's success up to this point, may, in fact, be slipping away. Proposals pending before the FCC would remove long-standing obligations of network operators not to interfere and not to discriminate in their customers' use of the network.

At the same time, we see ominous signs that network operators will frustrate consumers' ability to go anywhere on the net. Already, cable operators have adopted provisions that impair the ability of consumers to use their broadband connection as they see fit. These issues have been documented to the FCC by a coalition of trade associations, the so-called High Tech Broadband Coalition.

In response to these kinds of restrictions, the High Tech Broadband Coalition has developed basic connectivity principles that we believe should be respected as we enter the broadband era. The first principle is that consumers should be free to attach to a broadband network any device which they may choose to purchase at retail, and second, that consumers should be able to use these devices to access any application or service for any lawful purpose, as long as it does not harm the network. As a company, we have urged the FCC to apply these principles to both DSL and cable modem providers.

In closing, let me be clear that we are not advocating forced or open access to these networks, nor do we suggest that DSL and cable modem providers should be limited in how they offer their services and bundle it with other services. At their core, the connectivity principles articulate nothing more than a noninterference rule.

We commend Chairman Hollings and this Committee for focusing attention on these issues, and I look forward to taking your questions. Thank you.

[The prepared statement of Mr. Mundie follows:]

PREPARED STATEMENT OF CRAIG J. MUNDIE, SENIOR VICE PRESIDENT AND CHIEF TECHNICAL OFFICER, ADVANCED STRATEGIES AND POLICY, MICROSOFT CORPORATION

Mr. Chairman and Members of the Committee, my name is Craig Mundie, and I am Senior Vice President and Chief Technical Officer of Advanced Strategies and Policy at Microsoft Corporation. I am glad to be here today because we bring a different perspective than many witnesses the Committee has seen on telecommunications matters.

Microsoft's Perspective on the Importance of Robust, Reasonably Priced Broadband

My company approaches this issue as a worldwide leader in developing software, services and Internet technologies, as well as a user of bandwidth. We are not in the telecommunications business, but rather, we, along with many other high-tech

companies, are in the business of developing software and services that excite consumers enough so that they actually will pay for “bigger pipes” to run ever-more innovative services and applications. Like others in the tech community, we see robust, reasonably priced broadband services as essential for enabling and encouraging the development of new applications and services that improve worker productivity, enrich personal lives and business operations, and deliver benefits to every sector of society and the economy. From that perspective, we see the topic before this Committee as important not just for the near term. Getting broadband policy right, here at the onset of the broadband era, will impact our national welfare and global competitiveness long into the 21st century.

Two Straightforward Steps That Will Promote Broadband Deployment

There is no doubt that the government, consumers and businesses now fully recognize the importance of broadband to our communications capabilities and the economy. As the Federal Communications Commission explained earlier this year, “ubiquitous broadband deployment will bring valuable new services to consumers, stimulate economic activity, improve national productivity, and advance economic opportunity for the American public.”¹ We agree with that view. Indeed, I expect that everyone agrees with that view.

The issue before this Committee, however, is more challenging: How do we get there? Of course, this is not a new question for this Committee or our country, but we must approach this question with renewed urgency, because the United States is losing the footrace for broadband penetration to other countries. To address the current inadequacies in U.S. broadband deployment, Microsoft believes this Committee and other policymakers can take two straightforward steps:

- Foster a third mode of broadband communications into the home by making more spectrum available for exciting, new unlicensed technologies and subject that spectrum to minimalist, efficiency-enhancing rules of the road.
- Preserve consumers’ ability to communicate and interact via the Internet with each other, and with new services and applications, without the threat that the underlying network provider will interfere with those relationships.

We understand that several Members of the Committee are exploring proposals to address these goals, and we fully support those efforts.

There is Urgency to Act on These Two Fronts

Our industry generally has not engaged in the telecom battles of the past because we develop software and applications that ride on the pipes that other industries supply. But we are watching with great concern because the current course is not aimed at achieving the broadband future we want as rapidly as possible, and we commend Chairman Hollings and other Members of this Committee for exploring new paths to a broadband future. The need for action is great because not only are we losing ground in the worldwide race to become leaders in deployment of broadband, the consequences also are being felt from our perspective in the invention of new broadband applications and services. If analyzed closely, current statistics are not encouraging. According to a recent Commerce Department study, our country has the most households of any nation connected to a broadband service (over 11 million). However, as a percentage, our penetration rate is sixth in the world, behind the likes of Sweden, South Korea and Taiwan among others. And recent trends lines indicate that we are falling further behind, not catching up.

The gravity of the situation is even starker when one realizes that the rules or laws being contemplated today will shape a future version of the Internet—a future which is much closer than many of us realize. A debate that simply focuses on how to download information faster from a Web site is somewhat akin to a debate at Western Union in 1902 as to how to move Morse Code faster across the country. We are rapidly moving from today’s world in which the vast majority of activities focus on publishing of content (be it Web pages or entertainment) and person to person communications (such as e-mail and instant messaging), to a different world, one which preoccupies the tech community and motivates all of us to innovate: a world in which literally millions upon millions of computing devices will be simultaneously and constantly connected to the Internet, and on consumers’ behalf, will communicate with each other.

This is not futuristic in the least. Personal digital assistants, smart appliances and computer-drive set-top boxes are just a few examples of the types of devices

¹In re the Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, Universal Service Obligations of Broadband Providers, *Notice of Proposed Rulemaking*, CC Docket No. 02–33, ¶ 3 (2002).

that will need affordable access to “always on” high speed connections in order to automatically bring new services and capabilities into the home. Wouldn’t it be convenient to monitor who is knocking at the front door of your home from the computer at your office? Or while away for the weekend, license via your PDA the right to view the latest episode of “The Sopranos,” then have it delivered to your home entertainment system to be viewed when you get home from your trip? The Internet is in transition. It is becoming much more than publishing. It is becoming a programmable environment in which computers, devices and services will need the ability to constantly stay in touch, and the ability to do so in a seamless, unfettered way.

To take full advantage of the programmable nature of the Internet, consumers will need affordable, reliable and fast connections. Some advocate that, with some rule changes, telephone companies will have greater incentives to deploy advanced services over their copper and fiber facilities. The argument is that without greater regulatory parity between telephone companies and cable operators the former cannot compete as effectively with the latter. We have a good degree of sympathy with these arguments and have been working with others in the tech community to promote greater parity here on the Hill and at the FCC.

Others have argued that the key to stimulating broadband deployment is to ensure that high-value content is available online. I know this Committee has addressed that question in other hearings, and that it is not the topic of this hearing. I want to assure the Committee that Microsoft is doing all it can to develop its own compelling content, services and applications for the broadband era, and we continue to work with other content producers to give them the tools they need to develop their own broadband offerings.

At the end, however, we submit that these ongoing efforts are not enough. Policymakers can and should do more. They should more aggressively manage the nation’s radio spectrum—and in particular, unlicensed spectrum—in order to give unlicensed wireless broadband services an opportunity to meet the demand that is simmering for these new technologies. And equally important, to assure the programmable Internet that is rapidly approaching is not derailed, policymakers should reaffirm that network providers should abide by certain, basic “connectivity principles.”

Wireless Broadband Connections Provide a Third Way for Consumers

Although much of the current debate over broadband services has focused on two platforms, cable and DSL, that perspective fails to consider that other technologies are available—other technologies that can jump-start consumer-driven investment in broadband services, provided policymakers aggressively manage the regulatory environment to foster that outcome. Specifically, I am referring to potential advances in the wireless sector, and even more specifically, advances in the development of unlicensed radio-based networks. These systems are currently referred to as 802.11b, radio LANs, or Wi-Fi. More generically, they might be referred to as “emerging radio technologies.” These technologies—and even more futuristic ones such as Ultra Wide Band and Software Defined Radios—not only offer an additional means of delivering packets at high speed, they also allow new business models for delivering broadband connectivity to emerge. These are not your “same old” radio services. Because they can be deployed in an unlicensed manner, the broadband connections can be deployed by the consumers themselves—using their purchasing power and interest to meet her personal demand for a broadband connection.

If this Committee and policymakers at the FCC and indeed around the world make more spectrum available for these devices and, simultaneously, adopt minimalist spectrum rules or “etiquettes” that limit the devices’ ability to engage in mutually destructive behavior (i.e., by interfering with each other), the result will be more choice for consumers and stimulated innovation in broadband services overall.

These emerging, unlicensed technologies can support the transmission of data at high speeds for a low cost. That value proposition—higher speeds with relatively cheap and fast deployment—is especially compelling in rural areas where distance is so frequently the enemy of network efficiencies and a major cost driver for broadband deployment, as well as in inner-city areas where the high cost of broadband is a significant inhibitor to deployment. With unlicensed technology and the appropriate wireless rules, Internet access and other types of community communications could be provided at comparatively lower costs. This promise is more than theoretical. In Iowa, one company, Prairie iNet, is using wireless technology attached to the side of grain silos to operate as a wireless ISP in 150 communities in the Midwest, with 5000 sites. Three fourths of their customers are residential. Today, Wi-Fi technology is deployed at lower costs where there is demand to provide consumers with more convenient wireless Internet access in places away from home

and office, such as coffee shops, airports, and hotels. These “hot spots” can provide speeds of 11 mbps, which is more than 10 times what 3G providers have promised, and 150 to 200 times faster than dial-up service. For those who have even greater bandwidth needs, a second generation of Wi-Fi has the capability to reach speeds of up to 54 mbps. Notably, these connections can be “always on,” assuring a pathway for the type of programmable services I described above.

What is even more compelling is that consumers who want this degree of connectivity can buy unlicensed equipment at a consumer electronics store, just as they buy a cordless telephone today, and then take it home to install it. An astonishing array of advanced communications equipment is now being developed, sold, and used to provide wireless broadband access in the unlicensed bands. These bands provide tremendous flexibility and are the opposite of the FCC’s traditional approach to spectrum regulation, which reflects centralization of control and specification of use. The current challenge is to provide adequate spectrum and the minimalist rules to allow this spectrum to be used for truly dependable communications by consumers. Current unlicensed approaches fail in both dimensions, creating a situation where the more successful the development and deployment of systems the more congested the environment becomes, frustrating attempts to make this a sustainable alternative to traditional broadband services.

Congress and the FCC can do more to encourage alternative wireless broadband connections using unlicensed spectrum. Today, there is insufficient unlicensed spectrum and, where it is being used for unlicensed networks, the nation’s regulations foster a tragedy of the commons. Use of the spectrum is so lightly regulated that, to assure their own success, radio manufacturers may have an incentive to maximize their use of spectrum to others’ detriment and, over the long haul, likely to their own. Within some groups of manufacturers, there are incentives to cooperate (such is the case with manufacturers of today’s Wi-Fi systems). However, without a modest degree of greater regulation, it is difficult to assure cooperation across different manufacturing interests.

Unlicensed spectrum bands, if upgraded modestly and in a targeted way, are uniquely well suited for the creation of broadband infrastructure for a variety of reasons. They are easily accessed by everyone, from the largest corporations to the smallest entrepreneurs to individual consumers. Indeed, the 2.4 GHz band, which supports everything from cordless telephones to radio-based LANs, reflects a significant level of innovation from entrepreneurs attracted by the band’s easy availability and lack of individual licensing requirements. It will not surprise the Committee when I say that the market moves a bit faster than the FCC’s licensing bureaus, however well-run.

Moreover, because unlicensed bands are open to anyone who buys a compliant device at a retail store and attaches it to the network, a significant proportion of the capital invested in the creation of networks comes from individuals and businesses, not from network operators. Wireless networks are truly built from the ground up, tapping an entirely new source of capital to build networks—the financial resources of the users themselves. This is remarkable for two reasons. One, there is no “build it and they will come” mentality, with its legacy of overinvestment and stranded capital. Instead, the wireless networks will grow organically, fed by new demand and marginal supply. Two, while this alternative source of capital would be important at any time, it is critical now, when even the most successful carriers have difficulty navigating capital markets.

Finally, unlicensed spectrum is open to and can support a multiplicity of technical solutions and contributes to redundancy, since future unlicensed wireless networks may be dramatically different from existing networks.

Over the last few years, the FCC, recognizing the potential benefits of new technologies and creative uses of spectrum, has been increasingly willing (with some helpful prodding by this Committee) to grant individual licensees greater flexibility in how they use their spectrum. This trend toward relaxing use specifications on individually licensed bands is an important and worthwhile innovation in spectrum management. It is in the same spirit of innovation that Congress should encourage the Commission to adopt more deliberate regulation of some unlicensed bands. No single approach to spectrum regulation is perfect, and unlicensed bands are no exception. While current rules for unlicensed blocks of spectrum have been enormously successful and have brought numerous benefits to the public, they have also permitted less than optimal use of available frequencies. Inevitably, where there are virtually no rules of the road and almost anything is possible, someone will design a technology that causes harmful interference to other technologies. Sometimes this is because there is no technologically feasible alternative. And sometimes it is simply cheaper to shout noisily than to speak in measured tones. Unfortunately, a spectrum free-for-all is not only messy, it carries a cost: innovative companies will steer

away from developing competitive unlicensed broadband networks unless rules of “spectrum etiquette” have been developed and implemented.

For this reason, it would be helpful for Congress to prompt the FCC, as we have, to foster the creation of more “unlicensed broadband spectrum” specifically for use by emerging technologies, such as Wi-Fi, UltraWide Band and Software Defined Radios, and new business models, such as community wireless data networks, that could supplement cable modem and DSL services. This is *not* a request for more spectrum for cellular or PCS or some generation of 3G. Instead, it embraces a flexible model that is driven by consumer demand and innovation and not the deployment schedules of cash-strapped carriers. Immediate steps by the FCC to allocate unlicensed broadband spectrum and adopt minimum regulations could accelerate the creation of wireless broadband services across the United States, making service available more quickly in unserved and underserved areas and stimulating rivalry with cable modem and DSL services. We strongly support proposals to address this important spectrum policy.

Consumer Freedom From Network Operator Interference Is Equally Important

Broadband connections accomplish little, however, if consumers are deprived of the ability they enjoy now in the dial-up and corporate network environments to roam freely over the Internet; to run the applications they want using the equipment they choose; to gather, create, and share information; and to connect to Web sites with no interference. Long before the creation of the Internet, policymakers around the globe recognized that freedom from interference by network operators was critical to consumer trust, as well as fostering gains in productivity and economic activity. The history of the Internet itself has been fundamentally characterized by unfettered consumer ability to use an unprecedented array of content, services, and applications via an ever-increasing array of products.

We are troubled, however, that in the ongoing debate on what our nation’s broadband policy should be, this fundamental lesson may have been lost. Proposals pending before the FCC would remove long-standing obligations of network operators not to interfere and not to discriminate, obligations which go back at least to the famous *Carterfone* decision and some of which go back to 1934. Watching the debate from afar, it appears that the freedom to connect to where one wants—the ultimate hallmark of the Internet—may be left behind. That would be a mistake, because the Internet and the economy have been well served by the unfettered ability of consumers to communicate and interact with each other.

This concept of promoting free interaction among people is embodied in our policy of universal telephone service—one of the singular successes of American communications policy. Universal telephone service is good social policy and good economic policy. Economists refer to the benefits of adding more people to a network as Metcalf’s Law. The principle is that by adding more users to the communications network, the economic value of the network increases for every user exponentially. But if network operators interfere with this interaction, or erect tolls on broadband highways that drive consumers in one direction or another, then they will be affirmatively undermining Metcalf’s Law. Those actions, if tolerated by policymakers, will frustrate our collective goal of adding more users, device types, and services to the network, benefiting not only new users, but the users who are already there.

One cannot ignore the ominous signs that network operators will frustrate consumers’ ability to go anywhere on the Internet. As a major user of broadband services, we think it would be a mistake for policymakers not to address these concerns.

Already, cable operators have adopted provisions that impair the ability of consumers to use their broadband connections. These issues have been documented to the FCC by a coalition of trade associations, the so-called High Tech Broadband Coalition. In one instance, a subscriber agreement says:

“You agree to only connect [company] approved equipment to the [company’s] network. . . . You will not connect the [company’s equipment] to any outlet other than the outlet to which the equipment was initially connected by the [company] installer. [Company] may relocate the equipment for you within the premises at the your [sic] request for an additional charge. . . . You understand that failure to comply with this restriction may cause damage to the [company] network and subject you to liability for damages and/or criminal prosecution.”²

In response to these kinds of restrictions, the HTBC has developed four connectivity principles that should be respected in the broadband era. And as a com-

²Full text of the agreement can be provided to the Committee. We have made the citation generic in order to illustrate our point without singling out a particular company.

pany, we have urged the FCC to apply them to both DSL and cable modem providers. Specifically:

- Consumers should have unrestricted access to their choice of lawful Internet content using the bandwidth capacity of their service plan.
- Consumers should be allowed to run applications of their choice and to attach any device they choose, as long as they do not harm the provider's network, enable theft of service or exceed bandwidth limitations of their service plan.
- Consumers should be given meaningful information regarding the technical limitations of their service.

Let me be clear that we are not advocating “forced” or “open” access. In our view, network operators need not be compelled to create a wholesale offering of a “bit transport service” so that third-party Internet service providers can compete with the facility owner on the same wire. Nor do we suggest that DSL and cable modem providers should be limited in how they offer their own service and bundle it with other services. At their core, the connectivity principles articulate nothing more than a noninterference rule.

These restrictions in existing contracts that interfere with consumer interests are troubling, and the Committee should review the complete record on these provisions that the high-tech industry submitted to the FCC. Unfortunately, the response by some at the Commission so far has been more of a yawn than of concern, as if those issues are out of fashion. Speaking on behalf of one company which thinks every day about how to use broadband capability to deliver better software and services to consumers, we disagree. As users of the Internet and builders of the Internet age, we believe that our success and consumers' enjoyment of the Internet has grown out of one fundamental feature—the ability of consumers to use their Internet connections without interference from network providers. This freedom has made the Internet the powerful communications and technology tool that it is today, stimulating small business development and benefiting the entire economy.

Freedom from interference from network operators has fostered tremendous gains in productivity and economic activity over the past decade. As this Committee and the FCC develop policies for next generation networks, now is not the time to abandon this fundamental feature. The lessons from the 20th century with respect to promoting consumer access to networks are as valid as ever. They will become all the more important as the Internet and the growth of Internet-based data services continue to blur the distinction among facilities-based broadband services, and as the high-tech community continues to develop smart devices and smart applications that can be attached to and run over those facilities. It is time to reaffirm that a basic noninterference rule—an essential element of today's dial-up Internet world—must be carried forward into the 21st century.

We commend Chairman Hollings and this Committee for focusing attention on these issues. Clearly, as our nation develops a broadband policy, we urge aggressive congressional attention on how to promote rapid, efficient, Nation-wide, and consumer-friendly broadband deployment.

The CHAIRMAN. Thank you very much. Professor Lessig.

**STATEMENT OF LAWRENCE LESSIG, PROFESSOR OF LAW,
STANFORD LAW SCHOOL**

Mr. LESSIG. Thank you, Mr. Chairman. There is a fundamental point that is being overlooked in this debate, and I borrowed—I insist, borrowed—from my hotel this morning some props to help make this point clear.

There are 65 million homes in America today that have two networks that enter the home. One network looks like this. It is the electrical network. The second network looks like this. It is the cable network. These are fundamentally different networks. This electrical network does not care whether I plug a Sony TV into the plug or a Panasonic TV. It does not know whether my computer runs Microsoft's operating system or Apple's operating system. Innovators realize that if they develop technology that plugs into this network, the network will run it regardless of the preferences of the network owner. This network, the electrical network, has

produced extraordinary innovation in the past 100 years in America.

The cable network is fundamentally different. A consumer sits here with this device and selects among the choices that a network owner has made for him or her. These choices, of course, are expanding. There are hundreds now, and 20 years ago there were only 12. But still, the fundamental architecture of this network is that the network makes the choice about what you see and what you get to do, and the consequence is, the only innovators for this network are the network owners.

The Internet took off and was the engine of innovation and growth when it looked like the electrical network, when anybody could devise an application or content and plug it into the network, and the network ran it whether or not the network owner wanted it. This was the principle of end-to-end in the network.

Senator McCain asked, who was pessimistic? I am the most famous pessimist about the Internet. I will take that claim. Since 1999, I have been predicting this decline. The decline in the Internet has happened as the Internet has become more and more like the cable network, as the network owners have increasingly been in a position to pick and choose what kind of content and what kind of applications will run on this network.

The key to innovation and growth in the broadband network is regulation that gets us back to the electrical network a neutral, end-to-end network. I think the model to get us there is exactly what Mr. Mundie has just proposed. It is two steps, but I am going to reverse the order.

The first step is to make sure that the wired providers of network service respect basic principles of neutrality, that they, like the electrical service, do not build in technologies that say, if you are running Microsoft's X-Box you have got to pay us 12 cents a month, but if you are running something else you do not have to pay us anything. That principle of neutrality is critical to assure that the next Microsoft can come along and displace this Microsoft. Neutrality on this network is crucial. But to get there it may well be that open access is no longer the solution. If not, then at least we need principles of neutrality enforced in a way that the competitive connectivity principles that Craig has described would. That is the first step, but the most critical step is what Mr. Mundie presented first, wireless.

Wireless technologies have got to be opened up for innovators to develop unimagined technologies for exploiting this network. This requires not more regulation. This requires a different kind of regulation. It requires opening up unlicensed bands and protecting them from government interference that protects particular uses of the technology. Mr. Mundie says we need certain minimal protocols, and so long as we insist on the word, minimal, as minimal as possible, I agree with that, too.

But those two changes would produce in the wireless context exactly what the Internet looked like 10 years ago today. It would produce a platform where an extraordinary range of competitors could develop new technologies that would drive demand for broadband services and explode the Internet on wireless technologies in the way 10 years ago wired technologies did the same.

The critical focus here is not whether there is regulation or not regulation. It is the mix of regulation and regulation to a single end, a platform where the innovators are not the network owners. The innovators are the people who build products that plug into that network. There are millions of those innovators, and it is that diversity of innovation that produced the explosion that we think of as the great innovation in the 1990s.

Thank you.

[The prepared statement of Mr. Lessig follows:]

PREPARED STATEMENT OF LAWRENCE LESSIG, PROFESSOR OF LAW,
STANFORD LAW SCHOOL

Every free and competitive market depends upon effective regulation. From rules that establish property rights, to courts that enforce contracts, to laws that assure competition is sustained, the government is always intimately involved in guaranteeing the conditions under which innovation and growth occur.

The growth of broadband technologies will be no different. It too will depend upon effective—and the right kind of—regulation. In my view, the sole and central purpose of that regulation must be to assure that the network maintains its character as a neutral platform for innovation. That neutrality produced the growth and innovation of the Internet in the 1990s. Corrupting that neutrality will stifle growth within the broadband market, and in markets that are affected by broadband technologies.

This neutrality was originally a feature of the network's technical design. Network architects call that design the "end-to-end" principle. But the ideals of end-to-end neutrality are familiar within many ordinary and important networks. Our highway, or "freeway," system was not built to favor one auto manufacturer over another. Electrical outlets don't function differently if you use a Sony rather than a Panasonic TV. The post office doesn't deliver mail favorable to Republicans any more quickly than it delivers mail favorable to Democrats. All of these networks are instead neutral among a wide range of compatible uses. These networks are not in the business of picking and choosing which applications or uses will be allowed. That neutrality in turn invites an extraordinary range of innovation.

This neutrality in the original Internet is now under threat. Changes in the ownership of the network, and in the legal rules under which the network is owned, increasingly give network owners the power to choose which applications will be allowed on the network, and which content will be preferred. That power in turn will reduce the incentive of others to innovate for this network. Corruption of the original network design will thus stifle growth of the Internet.

Open access regulations were originally intended to resist this corruption. By promising adequate competition at the physical layer of the network, the aim of open access requirements was to guarantee that no single network owner would have sufficient monopoly power to direct the network's evolution. If one provider biased the access it offered, then because of open access requirements, users would be able easily to switch to a different network provider. The competitive market would thus assure network neutrality without direct government intervention.

There is now a strong resistance to open access regulations. The current administration seems keen to remove any requirements that network providers make their facilities open to competition. The FCC is moving quickly to implement these policies.

Whatever the wisdom of open access, however, it would be a mistake to remove regulatory oversight from the broadband market. The consequence of total regulatory retreat will be an extraordinary concentration in network ownership, leading to less broadband competition, and higher broadband prices. That concentration will also, in turn, threaten the neutrality of the network, and hence growth and innovation on the broadband network.

In my view, it is crucial for Congress to insist that if the FCC intends to remove open access requirements, then it must substitute a different form of regulatory oversight to assure network neutrality. This oversight must guarantee that Internet service providers not corrupt the principles of neutrality built into the original network, by providing biased or non-neutral Internet service. Just as the electricity grid does not discriminate against Japanese televisions, or GE toasters, Internet service should not discriminate against games from Microsoft, or streaming video from Disney. And thus if regulation at the physical layer of the network (open ac-

cess) is to be terminated, then regulation at the “logical” layer of the network (to assure neutrality) must take its place. These regulations must assure that consumers using the network have the freedom to deploy legal content and legal applications as they choose, not as the network owner decides. Separating control over the use of the network from ownership of the wires that make-up the network is a necessary step to restoring the growth and innovation of the original Internet.

The “connectivity principles” described by the High-Tech Broadband Coalition are an important step to this end. At a minimum, Congress should require that no change in open access policies be permitted until the FCC articulates a set of principles like the “connectivity principles” to assure that all Internet networks provide neutral Internet service. The FCC should not unilaterally withdraw from regulation without assuring that rules to guarantee network neutrality continue to govern the Internet.

If the FCC implemented a strong set of rules designed to assure neutrality in the network, then it may well be advisable to relax requirements of open access. As a first step, in my view, this is the extent of the change that Congress should allow the FCC to effect. If this proves insufficient to spur growth in broadband adoption, then as with highways, it may well make sense for the government to subsidize further deployment. At this stage, however, I do not believe subsidy is merited.

In addition to these principles of neutrality, Congress should direct the FCC immediately to develop spectrum policies that will enable wireless “Wi-Fi” networks to compete with telecom and cable providers in last-mile service. The greatest innovation and growth in spectrum usage has come within “unlicensed” spectrum bands. This is consistent with the original history of the Internet, and it follows from major technological advances in spectrum technologies. It will soon be apparent that these changes in technology will fundamentally alter the way in which spectrum is allocated. In the meantime, the government could spur a great deal of competition in broadband access by freeing a much greater range of spectrum for unlicensed, or “commons” use.

For the first time in the history of network technologies, the United States is falling behind our allies. Korea, Canada, and even Japan are increasingly outstripping the United States with fast, cheap Internet service. In none of these countries has this deployment been produced by a totally unregulated market. In each case the government has played an important role in assuring that the infrastructure of the digital age get deployed quickly and efficiently. So too should our government.

I have described these principles more fully in the attached article from Foreign Policy magazine, which I submit for the record.

Foreign Policy magazine, November/December 2001

THE INTERNET UNDER SIEGE

By Lawrence Lessig

WHO OWNS THE INTERNET? UNTIL RECENTLY, NOBODY. THAT’S BECAUSE, ALTHOUGH THE INTERNET WAS “MADE IN THE U.S.A.,” ITS UNIQUE DESIGN TRANSFORMED IT INTO A RESOURCE FOR INNOVATION THAT ANYONE IN THE WORLD COULD USE. TODAY, HOWEVER, COURTS AND CORPORATIONS ARE ATTEMPTING TO WALL OFF PORTIONS OF CYBERSPACE. IN SO DOING, THEY ARE DESTROYING THE INTERNET’S POTENTIAL TO FOSTER DEMOCRACY AND ECONOMIC GROWTH WORLDWIDE.

The Internet revolution has ended just as surprisingly as it began. None expected the explosion of creativity that the network produced; few expected that explosion to collapse as quickly and profoundly as it has. The phenomenon has the feel of a shooting star, flaring unannounced across the night sky, then disappearing just as unexpectedly. Under the guise of protecting private property, a series of new laws and regulations are dismantling the very architecture that made the Internet a framework for global innovation.

Neither the appearance nor disappearance of this revolution is difficult to understand. The difficulty is in accepting the lessons of the Internet’s evolution. The Internet was born in the United States, but its success grew out of notions that seem far from the modern American ideals of property and the market. Americans are captivated by the idea, as explained by Yale Law School professor Carol Rose, that the world is best managed “when divided among private owners” and when the market perfectly regulates those divided resources. But the Internet took off precisely because core resources were not “divided among private owners.” Instead, the core resources of the Internet were left in a “commons.” It was this commons that

engendered the extraordinary innovation that the Internet has seen. It is the enclosure of this commons that will bring about the Internet's demise.

This commons was built into the very architecture of the original network. Its design secured a right of decentralized innovation. It was this "innovation commons" that produced the diversity of creativity that the network has seen within the United States and, even more dramatically, abroad. Many of the Internet innovations we now take for granted (not the least of which is the World Wide Web) were the creations of "outsiders"—foreign inventors who freely roamed the commons. Policymakers need to understand the importance of this architectural design to the innovation and creativity of the original network. The potential of the Internet has just begun to be realized, especially in the developing world, where many "real space" alternatives for commerce and innovation are neither free nor open.

Yet old ways of thinking are reasserting themselves within the United States to modify this design. Changes to the Internet's original core will in turn threaten the network's potential everywhere—staunching the opportunity for innovation and creativity. Thus, at the moment this transformation could have a meaningful effect, a counterrevolution is succeeding in undermining the potential of this network.

The motivation for this counterrevolution is as old as revolutions themselves. As Niccolò Machiavelli described long before the Internet, "Innovation makes enemies of all those who prospered under the old regime, and only lukewarm support is forthcoming from those who would prosper under the new." And so it is today with us. Those who prospered under the old regime are threatened by the Internet. Those who would prosper under the new regime have not risen to defend it against the old; whether they will is still a question. So far, it appears they will not.

The Neutral Zone

A "commons" is a resource to which everyone within a relevant community has equal access. It is a resource that is not, in an important sense, "controlled." Private or state-owned property is a controlled resource; only as the owner specifies may that property be used. But a commons is not subject to this sort of control. Neutral or equal restrictions may apply to it (an entrance fee to a park, for example) but not the restrictions of an owner. A commons, in this sense, leaves its resources "free."

Commons are features of all cultures. They have been especially important to cultures outside the United States—from communal tenure systems in Switzerland and Japan to irrigation communities within the Philippines. But within American intellectual culture, commons are treated as imperfect resources. They are the object of "tragedy," as ecologist Garrett Hardin famously described. Wherever a commons exists, the aim is to enclose it. In the American psyche, commons are unnecessary vestiges from times past and best removed, if possible.

For most resources, for most of the time, the bias against commons makes good sense. When resources are left in common, individuals may be driven to overconsume, and therefore deplete them. But for some resources, the bias against commons is blinding. Some resources are not subject to the "tragedy of the commons" because some resources cannot be "depleted." (No matter how much we use Einstein's theories of relativity or copy Robert Frost's poem "New Hampshire," those resources will survive.) For these resources, the challenge is to induce provision, not to avoid depletion. The problems of provision are very different from the problems of depletion—confusing the two only leads to misguided policies.

This confusion is particularly acute when considering the Internet. At the core of the Internet is a design (chosen without a clear sense of its consequences) that was new among large-scale computer and communications networks. Named the "end-to-end argument" by network theorists Jerome Saltzer, David Clark, and David Reed in 1984, this design influences where "intelligence" in the network is placed. Traditional computer-communications systems located intelligence, and hence control, within the network itself. Networks were "smart"; they were designed by people who believed they knew exactly what the network would be used for.

But the Internet was born at a time when a different philosophy was taking shape within computer science. This philosophy ranked humility above omniscience and anticipated that network designers would have no clear idea about all the ways the network could be used. It therefore counseled a design that built little into the network itself, leaving the network free to develop as the ends (the applications) wanted.

The motivation for this new design was flexibility. The consequence was innovation. Because innovators needed no permission from the network owner before different applications or content got served across the network, innovators were freer to develop new modes of connection. Technically, the network achieved this design simply by focusing on the delivery of packets of data, oblivious to either the contents

of the packets or their owners. Nor does the network concern itself that all the packets make their way to the other side. The network is “best efforts”; anything more is provided by the applications at both ends. Like an efficient post office (imagine!), the system simply forwards the data along.

Since the network was not optimized for any single application or service, the Internet remained open to new innovation. The World Wide Web is perhaps the best example. The Web was the creation of computer scientist Tim Berners-Lee at the European Organization for Nuclear Research (CERN) laboratory in Geneva in late 1990. Berners-Lee wanted to enable users on a network to have easy access to documents located elsewhere on the network. He therefore developed a set of protocols to enable hypertext links among documents located across the network. Because of end-to-end, these protocols could be layered on top of the initial protocols of the Internet. This meant the Internet could grow to embrace the Web. Had the network compromised its commitment to end-to-end—had its design been optimized to favor telephony, for example, as many in the 1980s wanted—then the Web would not have been possible.

This end-to-end design is the “core” of the Internet. If we can think of the network as built in layers, then the end-to-end design was created by a set of protocols implemented at the middle layer—what we might call the logical, or code layer, of the Internet. Below the code layer is a physical layer (computers and the wires that link them). Above the code layer is a content layer (material that gets served across the network). Not all these layers were organized as commons. The computers at the physical layer are private property, not “free” in the sense of a commons. Much of the content served across the network is protected by copyright. It, too, is not “free.”

At the code layer, however, the Internet is a commons. By design, no one controls the resources for innovation that get served across this layer. Individuals control the physical layer, deciding whether a machine or network gets connected to the Internet. But once connected, at least under the Internet’s original design, the innovation resources for the network remained free.

No other large scale network left the code layer free in this way. For most of the history of telephone monopolies worldwide, permission to innovate on the telephone platform was vigorously controlled. In the United States in 1956, AT&T successfully persuaded the U.S. Federal Communications Commission to block the use of a plastic cup on a telephone receiver, designed to block noise from the telephone microphone, on the theory that AT&T alone had the right to innovation on the telephone network.

The Internet might have remained an obscure tool of government-backed researchers if the telephone company had maintained this control. The Internet would never have taken off if ordinary individuals had been unable to connect to the network by way of Internet service providers (ISPs) through already existing telephone lines. Yet this right to connect was not preordained. It is here that an accident in regulatory history played an important role. Just at the moment the Internet was emerging, the telephone monopoly was being moved to a different regulatory paradigm. Previously, the telephone monopoly was essentially free to control its wires as it wished. Beginning in the late 1960s, and then more vigorously throughout the 1980s, the government began to require that the telephone industry behave neutrally—first by insisting that telephone companies permit customer premises equipment (such as modems) to be connected to the network, and then by requiring that telephone companies allow others to have access to their wires.

This kind of regulation was rare among telecommunications monopolies worldwide. In Europe and throughout the world, telecommunications monopolies were permitted to control the uses of their networks. No requirement of access operated to enable competition. Thus no system of competition grew up around these other monopolies. But when the United States broke up AT&T in 1984, the resulting companies no longer had the freedom to discriminate against other uses of their lines. And when ISPs sought access to the local Bell lines to enable customers to connect to the Internet, the local Bells were required to grant access equally. This enabled a vigorous competition in Internet access, and this competition meant that the network could not behave strategically against this new technology. In effect, through a competitive market, an end-to-end design was created at the physical layer of the telephone network, which meant that an end-to-end design could be layered on top of that.

This innovation commons was thus layered onto a physical infrastructure that, through regulation, had important commons-like features. Common-carrier regulation of the telephone system assured that the system could not discriminate against an emerging competitor, the Internet. And the Internet itself was created, through its end-to-end design, to assure that no particular application or use could discrimi-

nate against any other innovations. Neutrality existed at the physical and code layer of the Internet.

An important neutrality also existed at the content layer of the Internet. This layer includes all the content streamed across the network—Web pages, mp3s, e-mail, streaming video—as well as application programs that run on, or feed, the network. These programs are distinct from the protocols at the code layer, collectively referred to as TCP/IP (including the protocols of the World Wide Web). TCP/IP is dedicated to the public domain.

But the code above these protocols is not in the public domain. It is, instead, of two sorts: proprietary and nonproprietary. The proprietary includes the familiar Microsoft operating systems and Web servers, as well as programs from other software companies. The nonproprietary includes open source and free software, especially the Linux (or GNU/Linux) operating system, the Apache server, as well as a host of other plumbing-oriented code that makes the Net run.

Nonproprietary code creates a commons at the content layer. The commons here is not just the resource that a particular program might provide—for example, the functionality of an operating system or Web server. The commons also includes the source code of software that can be drawn upon and modified by others. Open source and free software (“open code” for short) must be distributed with the source code. The source code must be free for others to take and modify. This commons at the content layer means that others can take and build upon open source and free software. It also means that open code can’t be captured and tilted against any particular competitor. Open code can always be modified by subsequent adopters. It, therefore, is licensed to remain neutral among subsequent uses. There is no “owner” of an open code project.

In this way, and again, parallel to the end-to-end principle at the code layer, open code decentralizes innovation. It keeps a platform neutral. This neutrality in turn inspires innovators to build for that platform because they need not fear the platform will turn against them. Open code builds a commons for innovation at the content layer. Like the commons at the code layer, open code preserves the opportunity for innovation and protects innovation against the strategic behavior of competitors. Free resources induce innovation.

An Engine of Innovation

The original Internet, as it was extended to society generally, mixed controlled and free resources at each layer of the network. At the core code layer, the network was free. The end-to-end design assured that no network owner could exercise control over the network. At the physical layer, the resources were essentially controlled, but even here, important aspects were free. One had the right to connect a machine to the network or not, but telephone companies didn’t have the right to discriminate against this particular use of their network. And finally, at the content layer, many of the resources served across the Internet were controlled. But a crucial range of software building essential services on the Internet remained free. Whether through an open source or free software license, these resources could not be controlled.

This balance of control and freedom produced an unprecedented explosion in innovation. The power, and hence the right, to innovate was essentially decentralized. The Internet might have been an American invention, but creators from around the world could build upon this network platform. Significantly, some of the most important innovations for the Internet came from these “outsiders.”

As noted, the most important technology for accessing and browsing the Internet (the World Wide Web) was not invented by companies specializing in network access. It wasn’t America Online (AOL) or CompuServe. The Web was developed by a researcher in a Swiss laboratory who first saw its potential and then fought to bring it to fruition. Likewise, it wasn’t existing e-mail providers who came up with the idea of Web-based e-mail. That was cocreated by an immigrant to the United States from India, Sabeer Bhatia, and it gave birth to one of the fastest growing communities in history—Hotmail.

And it wasn’t traditional network providers or telephone companies that invented the applications that enabled online chatting to take off. The original community-based chatting service (ICQ) was the invention of an Israeli, far from the trenches of network design. His service could explode (and then be purchased by AOL for \$400 million) only because the network was left open for this type of innovation.

Similarly, the revolution in bookselling initiated by Amazon.com (through the use of technologies that “match preferences” of customers) was invented far from the traditional organs of publishers. By gathering a broad range of data about purchases by customers, Amazon—drawing upon technology first developed at MIT and the University of Minnesota to filter Usenet news—can predict what a customer is

likely to want. These recommendations drive sales, but without the high cost of advertising or promotion. Consequently, booksellers such as Amazon can outcompete traditional marketers of books, which may account for the rapid expansion of Amazon into Asia and Europe.

These innovations are at the level of Internet services. Far more profound have been innovations at the level of content. The Internet has not only inspired invention, it has also inspired publication in a way that would never have been produced by the world of existing publishers. The creation of online archives of lyrics and chord sequences and of collaborative databases collecting information about compact discs and movies demonstrates the kind of creativity that was possible because the right to create was not controlled.

Again, the innovations have not been limited to the United States. OpenDemocracy.org, for example, is a London-based, Web-centered forum for debate and exchange about democracy and governance throughout the world. Such a forum is possible only because no coordination among international actors is needed. And it thrives because it can engender debate at a low cost.

This history should be a lesson. Every significant innovation on the Internet has emerged outside of traditional providers. The new grows away from the old. This trend teaches the value of leaving the platform open for innovation. Unfortunately, that platform is now under siege. Every technological disruption creates winners and losers. The losers have an interest in avoiding that disruption if they can. This was the lesson Machiavelli taught, and it is the experience with every important technological change over time. It is also what we are now seeing with the Internet. The innovation commons of the Internet threatens important and powerful pre-Internet interests. During the past 5 years, those interests have mobilized to launch a counterrevolution that is now having a global impact.

This movement is fueled by pressure at both the physical and content layers of the network. These changes, in turn, put pressure on the freedom of the code layer. These changes will have an effect on the opportunity for growth and innovation that the Internet presents. Policymakers keen to protect that growth should be skeptical of changes that will threaten it. Broad-based innovation may threaten the profits of some existing interests, but the social gains from this unpredictable growth will far outstrip the private losses, especially in nations just beginning to connect.

Fencing off the Commons

The Internet took off on telephone lines. Narrowband service across acoustic modems enabled millions of computers to connect through thousands of ISPs. Local telephone service providers had to provide ISPs with access to local wires; they were not permitted to discriminate against Internet service. Thus the physical platform on which the Internet was born was regulated to remain neutral. This regulation had an important effect. A nascent industry could be born on the telephone wires, regardless of the desires of telephone companies.

But as the Internet moves from narrowband to broadband, the regulatory environment is changing. The dominant broadband technology in the United States is currently cable. Cable lives under a different regulatory regime. Cable providers in general have no obligation to grant access to their facilities. And cable has asserted the right to discriminate in the Internet service it provides.

Consequently, cable has begun to push for a different set of principles at the code layer of the network. Cable companies have deployed technologies to enable them to engage in a form of discrimination in the service they provide. Cisco, for example, developed “policy-based routers” that enable cable companies to choose which content flows quickly and which flows slowly. With these, and other technologies, cable companies will be in a position to exercise power over the content and applications that operate on their networks.

This control has already begun in the United States. ISPs running cable services have exercised their power to ban certain kinds of applications (specifically, those that enable peer-to-peer service). They have blocked particular content (advertising from competitors, for example) when that content was not consistent with their business model. The model for these providers is the model of cable television generally—controlling access and content to the cable providers’ end.

The environment of innovation on the original network will change according to the extent that cable becomes the primary mode of access to the Internet. Rather than a network that vests intelligence in the ends, the cable-dominated network will vest an increasing degree of intelligence within the network itself. And to the extent it does this, the network will increase the opportunity for strategic behavior in favor of some technologies and against others. An essential feature of neutrality at the code layer will have been compromised, reducing the opportunity for innovation worldwide.

Far more dramatic, however, has been the pressure from the content layer on the code layer. This pressure has come in two forms. First, and most directly related to the content described above, there has been an explosion of patent regulation in the context of software. Second, copyright holders have exercised increasing control over new technologies for distribution.

The changes in patent regulation are more difficult to explain, though the consequence is not hard to track. Two decades ago, the U.S. Patent Office began granting patents for software-like inventions. In the late 1990s, the court overseeing these patents finally approved the practice and approved their extension to “business methods.” The European Union (EU), meanwhile, initially adopted a more skeptical attitude toward software patents. But pressure from the United States will eventually bring the EU into alignment with American policy.

In principle, these patents are designed to spur innovation. But with sequential and complementary innovation, little evidence exists that suggests such patents will do any good, and there is increasing evidence that they will do harm. Like any regulation, patents tax the innovative process generally. As with any tax, some firms—large rather than small, U.S. rather than foreign—are better able to bear that tax than others. Open code projects, in particular, are threatened by this trend, as they are least able to negotiate appropriate patent licenses.

The most dramatic restrictions on innovation, however, have come at the hands of copyright holders. Copyright is designed to ensure that artists control their “writings” for a limited time. The aim is to secure to copyright holders a sufficient interest to produce new work. But copyright laws were crafted in an era long before the Internet. And their effect on the Internet has been to transfer control over innovation in distribution from many innovators to a concentrated few.

The clearest example of this effect is online music. Before the Internet, the production and distribution of music had become extraordinarily concentrated. In 2000, for example, 5 companies controlled 84 percent of music distribution in the world. The reasons for this concentration are many—including the high costs of promotion—but the effect of concentration on artist development is profound. Very few artists make any money from their work, and the few that do are able to do so because of mass marketing from record labels. The Internet had the potential to change this reality. Both because the costs of distribution were so low, and because the network also had the potential to significantly lower the costs of promotion, the cost of music could fall, and revenues to artists could rise.

Five years ago, this market took off. A large number of online music providers began competing for new ways to distribute music. Some distributed mp3s for money (eMusic.com). Some built technology for giving owners of music easier access to their music (mp3.com). And some made it much easier for ordinary users to “share” their music with other users (Napster). But as quickly as these companies took off, lawyers representing old media succeeded in shutting them down. These lawyers argued that copyright law gave the holders (some say hoarders) of these copyrights the exclusive right to control how they get used. American courts agreed.

To keep this dispute in context, we should think about the last example of a technological change that facilitated a much different model for distributing content: cable tv, which has been accurately hailed as the first great Napster. Owners of cable television systems essentially set up antenna and “stole” over-the-air broadcasts and then sold that “stolen property” to their customers. But when U.S. courts were asked to stop this “theft,” they refused. Twice the U.S. Supreme Court held that this use of someone else’s copyrighted material was not inconsistent with copyright law.

When the U.S. Congress finally got around to changing the law, it struck an importantly illustrative balance. Congress granted copyright owners the right to compensation from the use of their material on cable broadcasts, but cable companies were given the right to broadcast the copyrighted material. The reason for this balance is not hard to see. Copyright owners certainly are entitled to compensation for their work. But the right to compensation shouldn’t translate into the power to control innovation. Rather than giving copyright holders the right to veto a particular new use of their work (in this case, because it would compete with over-the-air broadcasting), Congress assured copyright owners would get paid without having the power to control—compensation without control.

The same deal could have been struck by Congress in the context of online music. But this time, the courts did not hesitate to extend control to the copyright holders. So the concentrated holders of these copyrights were able to stop the deployment of competing distributors. And Congress was not motivated to respond by granting an equivalent compulsory right. The aim of the recording company’s strategy was plain enough: shut down these new and competing models of distribution and re-

place them with a model for distributing music online more consistent with the traditional model.

This trend has been supported by the actions of Congress. In 1998, Congress passed the Digital Millennium Copyright Act (DMCA), which (in)famously banned technologies designed to circumvent copyright protection technologies and also created strong incentives for ISPs to remove from their sites any material claimed to be a violation of copyright.

On the surface both changes seem sensible enough. Copyright protection technologies are analogous to locks. What right does anyone have to pick a lock? And ISPs are in the best position to assure that copyright violations don't occur on their Web sites. Why not create incentives for them to remove infringing copyrighted material?

But intuitions here mislead. A copyright protection technology is just code that controls access to copyrighted material. But that code can restrict access more effectively (and certainly less subtly) than copyright law does. Often the desire to crack protection systems is nothing more than a desire to exercise what is sometimes called a fair-use right over the copyrighted material. Yet the DMCA bans that technology, regardless of its ultimate effect.

More troubling, however, is that the DMCA effectively bans this technology on a worldwide basis. Russian programmer Dimitry Sklyarov, for example, wrote code to crack Adobe's eBook technology in order to enable users to move eBooks from one machine to another and to give blind consumers the ability to "read" out loud the books they purchased. The code Sklyarov wrote was legal where it was written, but when it was sold by his company in the United States, it became illegal. When he came to the United States in July 2001 to talk about that code, the FBI arrested him. Today Sklyarov faces a sentence of 25 years for writing code that could be used for fair-use purposes, as well as to violate copyright laws.

Similar trouble has arisen with the provision that gives ISPs the incentive to take down infringing copyrighted material. When an ISP is notified that material on its site violates copyright, it can avoid liability if it removes the material. As it doesn't have any incentive to expose itself to liability, the ordinary result of such notification is for the ISP to remove the material. Increasingly, companies trying to protect themselves from criticism have used this provision to silence critics. In August 2001, for example, a British pharmaceutical company invoked the DMCA in order to force an ISP to shut down an animal rights site that criticized the British company. Said the ISP, "It's very clear [the British company] just wants to shut them up," but ISPs have no incentive to resist the claims.

In all these cases, there is a common pattern. In the push to give copyright owners control over their content, copyright holders also receive the ability to protect themselves against innovations that might threaten existing business models. The law becomes a tool to assure that new innovations don't displace old ones—when instead, the aim of copyright and patent law should be, as the U.S. Constitution requires, to "promote the progress of science and useful arts."

These regulations will not only affect Americans. The expanding jurisdiction that American courts claim, combined with the push by the World Intellectual Property Organization to enact similar legislation elsewhere, means that the impact of this sort of control will be felt worldwide. There is no "local" when it comes to corruption of the Internet's basic principles. As these changes weaken the open source and free software movements, countries with the most to gain from a free and open platform lose. Those affected will include nations in the developing world and nations that do not want to cede control to a single private corporation. And as content becomes more controlled, nations that could otherwise benefit from vigorous competition in the delivery and production of content will also lose. An explosion of innovation to deliver mp3s would directly translate into innovation to deliver telephone calls and video content. Lowering the cost of this medium would dramatically benefit nations that still suffer from weak technical infrastructures.

Policymakers around the world must recognize that the interests most strongly protected by the Internet counterrevolution are not their own. They should be skeptical of legal mechanisms that enable those most threatened by the innovation commons to resist it. The Internet promised the world—particularly the weakest in the world—the fastest and most dramatic change to existing barriers to growth. That promise depends on the network remaining open to innovation. That openness depends upon policy that better understands the Internet's past.

[Want to Know More?]

This essay is based on arguments developed in Lawrence Lessig's *The Future of Ideas: The Fate of the Commons in a Connected World* (New York: Random House, 2001).

The literature on the commons is vast. The notion of the “tragedy of the commons” was made famous in Garrett Hardin’s “The Tragedy of the Commons” (*Science*, Vol. 162, No. 3859, 1968). Hardin’s view has led many to assume that any commons presents a “tragedy.” For a powerful empirical and theoretical view to the contrary, see Elinor Ostrom’s *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990). The importance of the commons within Anglo-American law is well described in Carol Rose’s “The Comedy of the Commons: Custom, Commerce, and Inherently Public Property” (*University of Chicago Law Review*, Vol. 53, No. 3, 1986).

The enclosing of the commons is described in many contexts. Mark Lemley and Lessig describe it in the context of cable in “The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era” (Stanford: John M. Olin Program in Law and Economics Working Paper No. 207, 2000). Yochai Benkler discusses a related enclosure of spectrum in “Free as the Air to Common Use: First Amendment Constraints on Enclosure of the Public Domain” (*New York University Law Review*, Vol. 74, No. 2, 1999). For a wonderful review of copyright’s enclosure, see Siva Vaidhyanathan’s *Copyrights and Copywrongs: The Rise of Intellectual Property and How It Threatens Creativity* (New York: New York University Press, 2001).

The end-to-end argument was first described in J.H. Saltzer, D.P. Reed, and D.D. Clark’s paper, “End-to-End Arguments in System Design” (*ACM Transactions on Computer Systems*, November 1984) available on the Massachusetts Institute of Technology’s Web site. A later paper, “Active Networking and End-to-End Arguments,” by Reed, Saltzer, and Clark (*IEEE Network*, May/June 1998) describes the importance of end-to-end to the network’s development. David Isenberg, who developed a similar set of ideas when he was an engineer at AT&T, praises “The Rise of the Stupid Network” (*Computer Telephony*, August 1997).

Finally, to track the progress of the range of cases affecting these matters, see the Web site of the most active organization in resistance, the Electronic Frontier Foundation. Further resources are online at the Center for the Public Domain.

- For links to relevant Web sites, as well as a comprehensive index of related Foreign Policy articles, access www.foreignpolicy.com.

The CHAIRMAN. Very good. Mr. Huber.

**STATEMENT OF PETER W. HUBER, SENIOR FELLOW,
MANHATTAN INSTITUTE FOR POLICY RESEARCH; PARTNER,
KELLOGG, HUBER, HANSEN, TODD AND EVANS, PLLC**

Mr. HUBER. Mr. Hundt remarked a moment ago there are two basic choices, monopoly or competition, but there is a third, and it can be implemented quite effectively if you have enough authority, which this city does, and the third is to impose from above on an industry a suicide pact, and we have come fairly close to doing that with broadband.

Three concrete facts about broadband which you do have to come back to after the long bombs are not working: first, demand for capacity keeps rising. You cannot subsidize your way to broadband, because broadband is not an end point. It is going to keep moving out ahead of us for as far forward as anybody can foresee.

Second, you really have to get concrete about the engineering here. Most of the traffic and the highest speed traffic will always be on wires. There are important innovations to be made in wireless, particularly for rural service, and for very short haul at the LAN level, and the short-haul level of things, but for the fastest systems—and these are solidly rooted in the laws of physics—the wires are crucial. You have to have a solid cornerstone of competition.

We are lucky to have two wires beginning to approach the level where they can compete head to head. They can get fully there if we give the right environment for this, but the foundation, the essential cornerstone of broadband policy, is going to be on wires.

This is not to take away from wireless policy, it is very important, but you have get real about where the traffic really moves, and moves fast.

And finally, the simple, plain, unambiguous fact—deploying wireline networks is enormously expensive. It takes very long planning. You have to have long, stable horizons of regulation and from that, horizons of investment to get these wires rolled out and to get this capacity upgraded. Without that, it simply does not happen.

Everybody can point the fingers of blame in this city and, as you have said, Mr. Chairman, it is not very productive, but the fact of the matter is, the broadband policies put in place in the immediate aftermath of the 1996 Act and still in place today remain an unmitigated disaster. Roughly speaking, the FCC, with all the best intentions in the world, decided that one wired medium would be left completely unregulated to do what it wished in the broadband arena, and the other medium would be intensely regulated, that it would be unbundled and price-regulated.

One medium was cut loose to build, the other was told to negotiate, for however long it might take, how to share this network that had not even yet been built, and at what price to share it. And that process has created tremendous delay and uncertainty, not just for the regulated targets, but for the entire industry, because the prices are ultimately set, and the level of competition is ultimately set by the lowest common denominator on price and on performance, the highest performance, the lowest price, and so long as there is intense uncertainty about how one half of this house is going to be regulated, and very long delays in determining how it is going to be regulated, you pull down the entire industry.

Time after time, the high tech industry has learned that the most important thing to get things moving is growth. Suppressing one rival helps one side in the short term. Cable has been the short-term beneficiary of these policies that have suppressed the telephone wire. It has gained approximately a two-to-one ratio of market share because of these policies in the short term, but that is not what creates growth in these infant industries. What cable most needed, what all the broadband sector needed, was the rapid innovation in digital content from the software providers and the video and audio and other providers, and that has not come because the market has not grown up fast enough.

Cable would have developed faster and would have invested faster, paradoxical though it may sound, if this entire industry had been deregulated, and if cable itself had faced much more competitive rivalry. The same is almost certainly true on the wireless side. But we got instead from the policies we put in place—and I know hindsight is easy, but in this case some of us were even saying it with foresight—we got a bubble of foolish investment in companies that neither had the resources nor the technical capability to build broadband networks.

We had more than 20 major data local exchange carriers, DLECs, growing together quarter-baked business plans. Nine of them went public when they had an average of under 300 employees each and they were serving fewer than 2,000 lines each. That was the kind of euphoria we created between a rising stock market and a regulatory system that could make profits for everybody.

The Internet bubble burst, the DLECs burst, and now we have to return to reality and see how we can get two wires competing head to head robustly, innovatively. What we ought to be seeing in this market today is the kind of leapfrog competition that we have seen in other sectors, with microprocessors and memory chips and software and so on, where no one player is solidifying a dominant position, where whoever is fastest today and has gained some edge in the market today seriously risks being overtaken a year from now, or 2 years from now, by a higher-speed, better-performing system.

Once again, wireless has a real role to play here. It will offer mobility and will offer large footprint service, particularly in rural areas, that wireline cannot match. But the backbone, the core competitive battle that has to be the central focus of people who really want to make a change here, has got to be wireline service. That is point number one.

Point number two is, you simply cannot subsidize your way to the end point here. It is almost meaningless, in my view—forgive me, Mr. Chairman—to talk of jump-starting this industry. Where did it start? I had a 300-bit-per-second modem 20 years ago; everywhere now, we are 20- to 50- to 100-fold faster than that, but we are nowhere near fast enough, and to think that we can ever subsidize our way to some “fast enough” end point is mistaken.

The new digital television standards are talking 20 megabits per second. Microsoft’s CEO, or Intel’s CEO says we will not even get excited about broadband until we are at 5 megabits per second, or possibly 100 megabits per second. This Congress cannot subsidize us to that end point. That kind of spending will have to come from the private sector; it has to come from a stable, balanced, competitive environment in which capital will return to this market and compete head to head.

Thank you very much.

[The prepared statement of Mr. Huber follows:]

PREPARED STATEMENT OF PETER W. HUBER, SENIOR FELLOW, MANHATTAN INSTITUTE FOR POLICY RESEARCH; PARTNER, KELLOGG, HUBER, HANSEN, TODD AND EVANS, PLLC

The uncertainty and delay that infect broadband regulation today are sharply depressing both investment and innovation. What the industry most needs from Washington isn’t any new form of affirmative regulation or subsidy; the industry needs even-handed and complete deregulation.

“Broadband” is a horizon that keeps receding. Microprocessors, computer buses, local area networks, and Web connections all run much faster today than they did 5 years ago. There is no reason to expect that our pursuit of higher speed in the processing and delivery of bits will ever end. Modem speeds on ordinary dial-up phone lines increased more than a hundred-fold over the last two decades. Broadcasting bandwidth progressed from radio to analog television to cable and digital satellite; the new digital television standard provides effective transmission speeds (with compression) of almost 20 megabits-per-second (Mbps). Speeds of 10 Mbps used to be quite adequate for office LANs, but 100 Mbps is now commonplace. Intel CEO Craig Barrett has remarked that “broadband” only “get[s] exciting when you get to 5 megabits per second or even 100 mbps.” By the time those connection speeds become widely available, however, they will no longer be exciting. New applications will inevitably emerge to push the threshold of excitement out further still.

Demand for broadband isn’t uniform across users, either. Businesses, universities, schools, and residences have different needs. Some require full two-way capabilities, others require mobility, others need far more bandwidth in one direction than in the other.

Sound policy must start with a clear understanding of how dynamic and varied broadband markets really are. Demand for broadband connectivity, and the technologies that supply it, evolve quickly and continuously. Connection speeds and the aggregate bitmiles of deployed capacity will continue to double and redouble every few years, indefinitely into the future. New applications will spur new demand for bandwidth, and new bandwidth will attract new applications. Most of the applications that will generate data traffic 5 years hence aren't running today, at least not in any way comparable to what they will become. Most of today's users aren't yet using broadband for what they'll be using it for in five years. Most of today's broadband infrastructure, both wired and wireless, will have to be upgraded again and again to meet the continuous rise in demand.

In such circumstances, policies must be shaped to promote dynamic and adaptable competition, nothing more or less. Whether by design or otherwise, regulations that favor some providers or technologies over others will do far more harm than good. So will fixed "universal service" targets, or sweeping plans to subsidize or "jump start" broadband service, because there is no start or finish to the broadband enterprise. At their least harmful, such policies will simply be overtaken by the market before bureaucracies can be set up to implement them. At worst—as is in fact happening today—such policies will impede investment, stifle innovation and penalize creative effort industry-wide. The broadband market does not need more help from Washington. It needs considerably less.

Competition

Cable modem service is currently available to between two-thirds and three-quarters of U.S. households; DSL service is available to between half and two-thirds. Approximately one-third of all U.S. households have access to both cable modem and DSL service. Approximately 20 percent of online households are broadband subscribers. Cable and DSL providers are now adding five million new broadband connections a year—an annual growth rate of nearly 50 percent.

One way to look at these numbers is complacently: the infrastructure is basically there now; the demand hasn't yet caught up; and the customers will come when the online games, music, and videos arrive to drive demand for broadband connections. But this is quite the wrong way to look at things. Sound policy must promote a dynamic competitive process—one that will keep pushing the boundaries for decades to come.

Most cable networks have been upgraded at great expense, but they still rely on shared bandwidth at the end of the line; they will have to be upgraded further, and then further still, as bandwidth requirements continue to rise. Substantial parts of the legacy telephone network are now capable of providing DSL, but phone companies will have to make huge investments in remote terminals and fiber-optic glass to keep pace with cable, or to forge ahead of it—DSL can't be provided at all over certain older loops, nor over loops that run further than 18,000 feet, nor can the bandwidth in ordinary copper loops be pushed much higher than where it's at now. So telephone and cable companies alike will have to extend fiber deeper and deeper into the local exchange, until it finally reaches the home.

Comparable levels of new investment will be required to develop broadband wireless networks. DBS companies have, in the last year, deployed a two-way highspeed Internet service capable of competing on equal footing with cable modems and DSL; other terrestrial and satellite technologies (MMDS, 3G, Digital SMR, 2 GHz MSS satellite systems, L-Band satellites, and Big LEO satellites) are also under development. The television set is now morphing into a personal computer, and the radio into a mobile digital receiver, both linked to high-speed digital wireless networks. DVDs, digital games like Microsoft's Xbox, and high-end digital video recorders like TiVo and ReplayTV already feed their content into analog televisions; in due course, the transition to digital TV sets and digital broadcasting will propel a new constellation of high-speed digital terminals and connections into the average American home.

When broadband wireless services do come of age, they are likely to expand very fast, just as satellite and wireless telephony did after their early years of incubation. Wireline services generally get rolled out incrementally, but wireless services tend to get turned on abruptly, to serve an entire geographic area. That wireless providers currently lag behind wireline providers in serving broadband customers reflects the none-to-all dynamic of wireless roll out, more than anything else.

The broadband market, in short, ought to be experiencing the kind of leap-frog competition that has characterized competition in many other sectors of the high-tech industry. No one network provider should be securing an overwhelming market share; the fastest and most affordable option today should always face the risk being overtaken by a faster, cheaper, or better alternative. Wireline networks should

compete on both raw speed and quality of service; wireless networks will offer mobility as well. Broadband content should be adding yet another important dimension to competition: the demand for the digital bandwidth depends on the supply of digital content, which should depend, in turn, on how successfully broadband suppliers package, promote, and protect the content that their networks distribute.

All of this should be happening, but much of it isn't. A legacy of botched regulation is largely to blame.

Regulation

The regulation of broadband has been split into two separate and unequal parts. One regime promotes a get-it-built objective: it is deregulatory, it leaves planning, investment, price, and profit with the cable and wireless companies that deploy real facilities, and it is working—the facilities are indeed getting built. The other regime requires phone company competitors who *do* build networks to unbundle and interconnect, at cut-rate prices prescribed by regulators, with free-riders who *don't*. This share-it-cheap regulation is intensely intrusive, it empowers the FCC and state commissions to control planning, investment, price, and profit, and if it has forced sharing, it has done so at the expense of investment and innovation.

To its credit, the FCC has recently begun to take the steps necessary to classify both cable modem and DSL as “information services” under Title I of the Communications Act. The logical culmination of that process, if the Commission sees it through, will be complete deregulation of both services, with no further unbundling, interconnection, or wholesale price regulation imposed on either service, by either federal or state regulators. To get to that point, however, the Commission must completely eliminate all sharing obligations in *new*, mixed-use facilities, that are deployed to provide broadband service but that can be used, as well, to provide traditional voice service. The continued regulation of legacy voice services cannot be permitted to continue depressing investment in the new facilities required for high-speed data.

Until the Commission finishes its job—if it finishes it—phone companies must continue to “unbundle” the wireline spectrum they use to provide broadband; cable companies don't. Phone companies must permit their broadband competitors to “collocate” equipment in telephone company premises to make it easier to use that “unbundled” broadband capacity; cable companies don't. Phone companies still remain largely locked-out of the multi-billion dollar market for Internet backbone service; cable companies aren't. Phone companies must offer their retail broadband transmission services to competitors at a federally mandated discount; cable companies have no such obligation. Phone companies have to pay into Universal Service Funds when they provide broadband access; cable companies don't.

The unbundling mandates of the 1996 Telecom Act should never have been extended to broadband services at all; Congress created those mandates to open up competition in the legacy voice markets, which incumbent phone companies had long dominated, not in broadband markets, which were traditionally dominated by analog cable. Almost four years ago, the Supreme Court made clear that—as Congress itself specified in the 1996 Act—unbundling is to be extended only to network elements that can't be provided competitively. It is, of course, preposterous to maintain—as the FCC has in fact maintained for almost 6 years—that competition in broadband markets would be impaired absent access to the unbundled elements the phone company's network, when the phone company itself is scrambling to catch up with the dominant provider of broadband service, the cable company.

Costs

A few years ago, one incumbent phone company concluded it would have to deploy new “remote terminals” and optical concentration devices (OCDs) to upgrade its broadband capabilities and extend them out to rural and other users located far from end offices. After the better part of a full year of painstaking discussion, regulators decided that the phone company would have to undertake various obligations for the “right” to complete this upgrade, including deployment of more capacious facilities to make sure there would be sufficient capacity to share with potential competitors. The phone company reluctantly complied with regulators' demands, at a total cost of approximately \$250 million dollars. Two years have since passed, but no competitor has arrived to lease any part of the new facilities.

This kind of experience is not the exception, it is the rule. The current regulatory regime imposes massive uncertainty and delay on new investment. Sharing regulation assumes that the network is already in place, and focuses entirely on how to divvy up access. This form of regulation does not promote innovation or investment; it assumes that the innovation and investment have already happened, or are inevitable regardless of what regulators do. Sharing regulation operates entirely for the

benefit of competitors that *don't* build facilities, and its costs are shouldered by competitors that *do*. It is retrospective in that it kicks in only after facilities get built—but everyone knows that it will kick in, nobody knows on just what terms, and this uncertainty alone slows and depresses investment. In the worst circumstances, new investment doesn't happen at all because would-be investors fear that the benefits of good investment are destined to be shared with competitors, while the costs of bad ones are shouldered by shareholders. That is exactly what has happened whenever the prices set for shared elements have been set ruinously low, as they now have been in many major markets.

In an environment as dynamic as the market for broadband services, the forced sharing of innovation and new facilities has done little good even for the intended beneficiaries and their investors. Between 1998 and early 2000, more than twenty “data local exchange carriers” (DLECs) threw together business plans, raised large sums of money on the public market, and launched preposterously ambitious marketing campaigns. With an average of fewer than 300 employees each, and at a point when they were serving an average of fewer than 2,000 lines, nine DLECs completed successful IPOs. But as they and their customers soon learned, most of the new challenge and value in the broadband market lay in getting the broadband loop up and running, and that was especially difficult on copper wire that had been deployed, originally, only to carry voice. Counting on regulation to solve all their problems, the DLECs simply ignored the engineering and economic realities. When the Internet bubble burst, many of the DLECs burst with it.

Up to a point, and in the short term, cable and wireless operators benefited from all this turmoil on the DSL side of the house; roughly two out of three residential broadband subscribers are now with cable. But the development of broadband as a whole was seriously delayed, and that has harmed cable broadband as much as anyone. Some critical threshold size of broadband connectivity has to be reached to attract broadband content and software; the content and the software then propel further growth in broadband connectivity. In the early stages of the evolution of markets like these, competitors benefit much more from fast growth of the market as a whole, than they do from regulations that suppress competitive rivalry.

Finally, the competition-suppressing regulation has certainly harmed consumers, equipment manufacturers, and providers of broadband content. Robust competition between cable and DSL would have pushed up demand and pushed down prices; instead, however, unregulated cable has opened up a wide lead while phone companies have sunk deeper and deeper into the regulatory quagmire. In a true free-for-all, each major advance in one network will spur a comparable advance, and then some, in a rival's. The one sure way to kill innovation and new investment is to regulate in ways that allow a single provider to become so dominant that it no longer has to worry seriously about being overtaken by anyone else.

The delays in the synergistic development of broadband content are especially worrisome. As content providers have correctly recognized, broadband networks represent a huge new opportunity for distributing their products—and an equally huge threat if networks evolve in ways that facilitate theft. The potential downside has spawned many different proposals for mandatory new technology standards or legal liabilities for network providers. Standards and copyright laws do have important roles to play, but experience teaches that the best defense of intellectual property will be found in collaborative agreements hammered out privately between providers of content and conduit. The best way to protect the economic interests of content providers is to have different broadband service providers vie for the right to distribute the content. Cable already distributes significant amounts of digital content in ways that provide acceptable assurances against theft. Providers of broadband service know that content is what ultimately sells the broadband connection to the consumer. Robust competition among broadband providers is what will deliver the innovative technologies to protect—and thus attract—the valuable content.

Policies

Congress should urge—or direct—the FCC to complete the deregulation of broadband immediately. This means placing broadband service—in its entirety, including all underlying broadband transport components—under Title I of the Communications Act. Broadband Internet access service is an “information service,” not a “telecommunications service.”

Wireline broadband service should not be regulated at all; wireless broadband service should be regulated only as needed for the normal allocation and assignment of underlying spectrum. Sharing obligations must be confined to legacy voice service, provided on legacy networks, and even then, must extend only to network elements that are competitively essential to new entrants.

State and local authorities cannot be permitted to regulate broadband services in ways that undermine implementation of a uniform national broadband policy; patchwork regulation creates a serious impediment to the development of broadband services.

Effective protection of content is essential to the long-term development of digital broadband networks, but it won't come through technology prescriptions issued from Washington. The best long-term protection for providers of content lies in robust competition among providers of broadband connectivity.

The CHAIRMAN. Dr. Lessig, I agree, we have got to maintain the neutrality of the network. I think that is something that perhaps we can all agree on. We ought to get onto the FCC about that. Mr. Huber says no jump start, and yet I am hearing jump start from the first two witnesses.

Mr. Price, you say that \$300 will be paid to the provider. That is a price less than \$30 a month, or a 3-year program. Now, is that \$6 billion a year?

Mr. PRICE. No, it is \$6 billion in total.

The CHAIRMAN. \$2 billion a year?

Mr. PRICE. It would be for the first 20 million homes, however long that took, so 20 million, if it took 3 years, it would be \$2 billion a year.

Let me comment on Mr. Huber's point, because he makes a good point about the speed at which broadband should be available. He is right, it should be that fast, but in order to do that it is \$100 billion to upgrade the fiber network, or \$30 billion to upgrade the cable plant, and that is not happening tomorrow, so little steps are good.

The benefit of a broadband policy, the Commerce Department has pointed out, is way beyond the telcos and the cable companies. It is to society, so any bit of broadband is a good thing, and that is what my proposal is about.

The CHAIRMAN. But Chairman Hundt, you differ. You think what we ought to do is subsidize the actual broadband rather than the demand side?

Mr. HUNDT. I think that what we need to do, Senator, is find a way for consumers and users to be able to award a subsidy, a sum of money to the service provider in return for that provider building the underlying network, the underlying system.

Take the ancient and positive story of Ford Motors. What does that have to do with telecom? Henry Ford started two businesses, and they both failed, before he finally invented a car that changed the world, but what he did not do was go to the private markets to raise the money for the roads, nor did the first people who bought those cars have the job of themselves building roads. Instead, the Secretary of Commerce, Herbert Hoover, all through the 1920s led the Nation, and led all the municipalities, in using public money to build road systems.

We have always needed to find a way to get the transportation system to the farmer at the end of the road, to the small business in the building. It has always been the case, and there is no reason to think that a tremendously expensive broadband network relying on fiber and wireless technologies can be built entirely by the private market, and it certainly cannot be built by the private market at a time that capital is fleeing this industry, so the government, just as Secretary Hoover stepped in and created a national pro-

gram for roads, the government needs to step in and find a way to get that underlying network out there so the old users, the companies that attach the electronics, the companies that want to sell the PCs, the companies that want to distribute the software, the companies that want to distribute entertainment, all the users can find a way to benefit from that infrastructure.

The CHAIRMAN. And the money is to come, I take it, from spectrum auctions?

Mr. HUNDT. Senator, this is one of those cases where the witnesses get to say, this is where your leadership steps in.

[Laughter.]

The CHAIRMAN. Mr. Mundie, elaborate on Wi-Fi, because that fiber is too expensive to go all the way into that last mile. How do we subsidize and get it going, or what are the roadblocks or problems right now?

Mr. MUNDIE. I think there are two problems relative to wireless, and Wi-Fi, as you mentioned, is sort of the currently popular one. The first is that Wi-Fi has emerged, but along with it has emerged many other innovative uses of this current 2.4 gigahertz unlicensed band. Because, in fact, there are no rules of the road for operating within this band, each of these devices brought forward by different manufacturers around the world can actually conflict with each other, in fact to the point where they may not work at all, so this has the potential to create a tragedy where the more successful we are in getting people to adopt the technology the less well it might actually work, thereby undermining the ability for people to use it as a dependable alternative to other types of connectivity, and that is why we recommended that you need, and Larry endorsed the idea that you have to have some minimalist regulatory environment.

The second is that there is not really enough spectrum available for people to make business plans broadly that depend on that as the primary form of communication. You see innovation—I mean, I could have brought another socket from the Four Seasons today which actually has two little Internet jacks on it, all right, and in fact those things are Wi-Fi connected.

This morning in the Four Seasons there was a laptop sitting in the restaurant that said, this is connected by Wi-Fi for use of the patrons of the restaurant, so in these limited environments people are, in fact, using it, but you cannot really depend on it yet, both technologically and in terms of adequate capacity, and that is why we think we have to have more spectrum allocated.

The CHAIRMAN. Well, we get more spectrum allocated, and then what happens after that?

Mr. MUNDIE. I think what happens after that is, you will continue to see the kind of innovation, both in technological senses and also in business model senses.

One of the things that is—the reason I emphasize unlicensed spectrum as opposed to the traditional notion of licensed allocations that have been used for television or for cellular telephony in the past is that it allows communities to basically step forward. So, for example, if a rural community wanted to get together and put a transmitter on their silo and broadcast Internet services throughout the county, that could happen. In fact, that is happening today,

but it is hard to encourage that thing to happen because of the spectrum limits today.

The CHAIRMAN. Senator McCain.

Senator MCCAIN. Well, I want to thank the witnesses. This has been a very helpful panel to this Member, and I think I have been informed, and I know the rest of the Committee has been.

I do note that cable rates are up 45 percent since the passage of the 1996 Act. That cannot be right, and maybe it has something to do with Mr. Huber talking about two wires competing on a level basis. How do you do that, Mr. Huber?

Mr. HUBER. Well, there are several different ways to get there, and this at least does sharply divide the panel. The FCC has on the table now two proposals, one more or less implemented, the other still pending, to move broadband under Title I. That is where broadband should have been put in 1996. That is where it belongs today, a broad, complete definition of broadband, not just part of it, not just some of the facilities.

This movement of broadband into Title I, which is essentially the unregulated sphere, has got to extend to all mixed use facilities. It has got to extend to—anybody who wants to take glass, to take optical concentrated devices, to take the terminals, actually put them in the ground, which is an enormously expensive thing to do, and market them to end users ought to be able to do that secure in the knowledge that if they have done something stupid they will eat every last dollar of the loss, and if they have done something really smart, they will get the benefit from it.

That is not the law today. It ought to be the law today. You do not have to share those facilities. They are not yet built, and a law that is obsessed with how we are going to divide up that pie after it gets built is counterproductive.

Senator MCCAIN. Thank you. I have a question for all the witnesses, beginning with you, Mr. Hundt. You are either the czar of the FCC, which you once were, or have a majority in both Houses of Congress and are President of the United States. What would the law and/or regulations look like in order to address this problem, beginning with you, Mr. Hundt?

Mr. HUNDT. I would recommend to this Committee, to Congress that we face the economic reality that under any system of competition, or under any monopoly approach, it is simply not the case that the private sector is going to invest at the present time, in the present economic climate, is going to invest enough money to build a truly broadband 10 to 100 megabit second system—

Senator MCCAIN. What does your regulations or law look like, Mr. Hundt?

Mr. HUNDT.—so consequently you need to throw money at it. You need to have the consumers be able to have a subsidy in their pocket they can award the service provider to build that kind of network. The exact amount of money would be, I might add, a fraction of what we spent to build roads in this country, the kind of numbers that Mr. Price is talking about represent a fraction of even federal spending on roads on an annual basis. So—

Senator MCCAIN. So your answer is to set up a process and program of subsidization of broadband for all Americans?

Mr. HUNDT. That is right.

Senator MCCAIN. Thank you. Mr. Price.

Mr. PRICE. First, I think broadband should be unregulated. There are two competitors for it right now. I think a wireless, maybe a third competitor, and I think there is no reason for broadband to be regulated.

Second, I think we need more spectrum, and it needs to be available at low cost.

Third, I think we do need some short-term subsidy just to kick-start the market, to show a little bit of confidence to the whole industry participants.

And fourth, I think longer term, when cable is an effective competitor on the wire for voice in the home, we need to look at the regulation for the RBOC's and the residential voice monopoly.

Senator MCCAIN. Mr. Mundie.

Mr. MUNDIE. I would address it in two tranches. The first would be to create regulatory parity between the telephone wire and the cable wire. I agree with Mr. Huber that facilities-based competition is, in fact, the only way that we are going to get sustained investment in this area, and I would move aggressively to do that.

However, I think that regulation would essentially have to have a meet-in-the-middle property so that some of these attributes that Larry and I talked about in terms of the connectivity principles are applied uniformly to those, which would mean a diminishment of the regulations on television, but the addition of these connectivity principles to cable.

The second tranche would be essentially direction to the FCC and the NTIA to aggressively manage the country's spectrum to the benefit of creating many, many unlicensed uses of these novel radio technologies. Wi-Fi is just the tip of the iceberg.

The FCC this year approved ultrawide band, but due to concerns with the Department of Defense it was so narrowly constrained as to really limit its usefulness in many applications. I think there are many other techniques that could be applied to dramatically increase this.

The reason the two are necessary is that the historical regulatory environment in which the cable environment was invested in and the telephone environment was invested in has created a situation in this country where it has been demonstrated to be pretty much impossible to build a third wired network. It is noneconomic, and therefore if you really want to create competition it should be head-to-head facilities based within the existing wired plants with the encouragement through applications to grow their investment in that plant, and then essentially the wild card of wireless communication, but not in the traditional cellular telephony 3-G sense, but in the use of these novel radio techniques, but that can only happen if, in fact, people are confident.

I agree with the confidence question, and that is why the connectivity principle gives people confidence to develop apps for the wireline network, but it would be the regulatory change in spectrum that would actually give people confidence to develop the new products and the new services that would complement that and potentially create new types of networks that would compete with the wire line ones at much lower capital cost.

Senator MCCAIN. What about subsidy, as Mr. Hundt and Mr. Price recommend?

Mr. MUNDIE. I personally favor creating a lot more competition than direct subsidy. I think that as we have seen in other countries—I mean, last week, ironically the United States was now passed by Brazil in terms of the penetration of broadband usage in households.

If you look at Korea, where game usage is essentially one of the single biggest drivers of broadband adoption, Korea is now at 70 percent of all households penetrated, and our belief is that if you have these new kind of driving applications which will be brought forward if people have confidence that they have a sustainable business model, then in fact I think the cash flows will return to these networks, and therefore would not require the kind of subsidy that has been proposed.

Senator MCCAIN. Mr. Chairman, can I ask your indulgence for the final two panelists? Mr. Lessig.

Mr. LESSIG. I would agree with the same structure. I think if there are only two competitors, if it is the only two wired competitors that could provide broadband, then subsidy makes sense. But I think right now we can open a third line of competition to provide broadband if we had a much more aggressive wireless policy along the lines that Mr. Mundie was just describing. Wireless Last Mile is a technology which 4 years ago seemed impossible to imagine, but right now is being built by people who have technological capability to set up broadband connections. These do not require extraordinarily expensive investment to put wires out there. If the FCC's policy as to wireless were much more embracing of this wireless technology, that would produce extraordinary new competition here.

Senator MCCAIN. Such as Wi-Fi?

Mr. LESSIG. Wi-Fi and other technologies around Wi-Fi, meshed networks that would enable actually potentially increasing capacity as the number of uses increased. This is a potential that we have just not seen before in this context, but it is extremely important that one feature of it be emphasized.

Right now, the FCC has a string of companies coming to them saying, we like unlicensed. Unlicensed is great, but you have got to pass rules to protect us to make sure that our use of unlicensed does not get destroyed by some other person's use of unlicensed. But what that would do is lock in today's technology against future technological innovation. If there is an agreement between Mr. Mundie and myself about this, the critical feature about minimal regulatory protocols is that they truly are as minimal as technologically possible, the most minimal position, so that it enables lots of new technologies to come along and use this wireless capacity to compete with wired capacity.

I think my tendency is, on this side of the table, to believe that that will get us where we need to go without the subsidy, but if it is not, the subsidy point is an important one. When we built the highways we did not call up GM and say, if you build the highways, you can then build them so that only GM trucks run on the highways, or Ford trucks run a little bit slower. But my concern is that we are building the Internet such that the people who give

us must-see TV are giving us must-see Internet: where they get to say, “here is the Internet you are going to get, here are the applications you are allowed to use,”—defeating the basic neutrality of this network.

So subsidies may be an important part of this, but the critical feature of what made the original Internet run was not subsidy, it was not the fact that wires were there, it was that the rules enabled broad range competition among innovators outside of the network, not the network itself.

Mr. HUBER. I really hate this highway metaphor, and you should hate it, too. If you have \$1,000 per home to put 5 megabits in, or \$100 billion for the Nation as a whole, go ahead and spend it, and spend it fast, but if you are going to go a quarter way there, do not waste your money, because you will not even begin to catch up with what is needed and what ought to be happening in the market, and what the market—the market will spend \$100 billion. Give the market—if you want a one-line law, say that any provider or broadband service, any provider above 200 kilobits, say, can opt into the regulatory structure that is applicable to any other provider above 200 kilobits and see what happens.

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

The CHAIRMAN. Senator Burns.

Senator BURNS. Well, we have pretty well gone over that. Everybody gets a version of it.

I want to ask Mr. Lessig. You said, OK, interference in these unlicensed spectrum, tell me how you would award that spectrum? In other words, if we are going to be plagued with interference, then we are going to have to have some sort of a protection or licensing situation. How would you do that?

Mr. LESSIG. Well, the premise of the unlicensed spectrum is that the FCC is not in the business of awarding who gets to use it and who does not, and what has to happen in that context is that protocols have to be developed to facilitate exactly the kind of cooperation of the space that Mr. Mundie was describing. The only issue is at what stage the FCC plays a role in establishing or enforcing those protocols, and in my view, historically the FCC’s role in establishing and enforcing protocols has stifled competition for many reasons.

Mr. Huber’s work is excellent in showing this to be true, so I would resist the FCC’s role, except at the most minimal layer, and I think to cite Mr. Mundie’s proposal, it is actually at the 5 gigahertz band, not the place that we typically see Wi-Fi going on right now, the 2.4 gigahertz band.

Senator BURNS. In other words, the FCC would be in the business of developing protocols, rather than licensing the spectrum, is that correct?

Mr. LESSIG. I would not say the FCC is in the business of developing protocols. I would also say they are not in the business of regulating access. I would see protocols to be developed by the private sector, including protocol organizations, and then those protocols at some stage might need to be adopted as this minimal protocol to make sure that there could be cooperation among the uses at the different spectrum layers.

Senator BURNS. Would you like to comment on that, Mr. Mundie? I am really unclear on it.

Mr. MUNDIE. I think there are two things that are very important. The first is the idea that these are not allocated bands in the sense that there is no single entity who is given a right or permission to do anything with the band. In fact, to the contrary. The public is authorized to do anything they want with the band.

The key problem we have right now—and that is essentially what is driving Wi-Fi into existence. It drove Citizens Band Radio to some extent, and now the family radio services. These are all the things that were a bit more specific in their application, but it is an example where the public was given something they could take up and use.

The unlicensed bands, however, in the digital era, are not set up in a way that reflects how digital systems work. They are still designed and essentially controlled per the FCC's specifications, or rules, according to the way people have always used analog radios, and so there is an opportunity now to take the techniques that are used within that cable that hooks up your PC to the network, to take a similar kind of protocol and apply it in the air.

And if that is done, and there are a number of companies, and in fact the DOD are in dialogue now about how you would specify such a minimalist hand-shaking mechanism and, given that, we do believe it is possible to have really unlimited innovation within any one unlicensed band.

I think in addition we will need—and we propose, for example, how that might happen in the 5 gigahertz band, which would be Wi-Fi version, too, but we think other bands will also be required below 1 gigahertz to deal with both the distance propagation problem in the rural area and also to deal with the penetration of walls and concrete structures, like in the inner city. The current 5 gigahertz and 2.4 bands do not have the propagation properties we would want there, and that is why I recommend that there ultimately will have to be other unlicensed bands allocated, but they should all have the same uniform property of hand-shaking before use.

Senator BURNS. Mr. Price, walk me through what changes you would make in the bankruptcy law to facilitate the situation we are going through now.

Mr. PRICE. I really do not have any specific proposals. I merely brought it up to point out to the Committee how this is working. I will tell you, though, that I have witnessed first hand in our work in advising creditor committees and companies how companies can get bankruptcy judges to give them an enormous amount of leniency in terms of spending creditors' money and keeping the companies alive, so I just think that is a subject for another day.

Senator BURNS. I am really interested in this unlicensed thing, because I guess I am the only one in this room that ever said that spectrum was never the property of the United States Government. I always said it was the technology that was developed, and the reason we put the FCC in business in 1934 was to make sure that everybody stayed in their lane, so to speak. But it is interesting, on the unlicensed part of the spectrum, I am having a hard time converting over. It says, OK, you are going to be given so much.

Are they going to get it on a lottery, or is it just going to be a free-for-all out there?

Mr. MUNDIE. It is a free-for-all. That is how it works. Everybody can come forward, and the way the radios actually work allow people to all come forward and participate, and the radios sort out from each other who gets to talk, and that is how it actually works today.

Mr. LESSIG. Can I just add, Senator, that one way to think about this in on the model of the Internet. Right now, the capacity of the Internet is such that everybody talks in some sense at the same time, and the Internet protocol figures out how to make it all function without an FCC coming in and saying, you get to talk now, or you get to talk in this particular way. It is the same insight. It is just being applied in a different context.

Senator BURNS. If there is anything I love to watch, it is a good old-fashioned free-for-all. That is a great spectator sport.

Mr. MUNDIE. I think the one other thing that I might just go on record as predicting, I believe certainly 20 years from now, maybe even 10 years from now, we will look back and realize that the historical notion of band-oriented management of spectrum was, in fact, a quaint idea and that, in fact, we will find that eventually there are completely different ways to use the spectrum to control these things, and the challenge for this country and others will be to try to figure out how we carefully take ourselves from the band-oriented approach that we have as our legacy now, as does the rest of the world, into the management of the entire spectrum capacity that will allow the emergence of these new technologies, and that should actually be the long term mission of the FCC with respect to husbanding the spectrum.

Senator BURNS. Very interesting approach, and I think it merits more thought. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. Senator Dorgan.

Senator DORGAN. Mr. Chairman, we are really having a couple of conversations here, and let me try to ask about both of them.

First of all, Mr. Mundie, will there be enough unlicensed spectrum for all the applications that want to use it? I am trying to think through with you ahead here. How will it affect the wireless carriers who paid a substantial amount to use the spectrum that they do control?

Mr. MUNDIE. As the unlicensed bands are allocated today, I will tell you that there is not sufficient spectrum either in absolute bandwidth, and specifically not in the right places in the spectrum to allow a comprehensive and reliable, let us say, community network to form in your community or any other one, but both of those could be addressed by the FCC quite directly, and without forsaking any huge traditional notions of the amount of money that might have been garnered from the auction of those particular bands, in my opinion.

I think the more difficult question is, how do the applications emerge in this environment, and without assurances that these bands are going to be available you will not know.

Relative to the second part of your question, which is, how does this relate to the telecom companies who bought their spectrum, in essence, this is, as he has indicated, and Mr. Huber indicated, a

situation where you pay your money, you take your choice. At the point where you bet on what we know today as cellular telephony as the core of wireless technologies, which are big antennas with multimile radius transmission and receive capability, and what we know today as cellular phones, they have met and made a good business out of that, but in fact, the history of the technology industry is one that says you are always going to be surprised by the next thing that comes along, and essentially what I am advocating, and in fact what I think you see some of the cellular carriers today recognizing, is that they did not anticipate Wi-Fi and its popularity.

This little hunk of unlicensed band usage in this particular computer application is now getting some of those cellular companies to come forward and say, I want to buy a controlling interest in these little Wi-Fi hot spot companies, because, in fact, they recognize that that is likely to be true.

I have—I mean, this thing I use every day now is a combination of—you have a Blackberry. I used to have one. It has been replaced by this. It is a cell phone, World GSM cell phone with a pocket computer in it.

Senator DORGAN. Have you tried to use that in Fargo?

Mr. MUNDIE. No, I have not, but I expect it probably will not work, but it turns out that the next version of these things will actually support simultaneously not only the traditional telephone network, but the Wi-Fi network, and so, in fact, if somebody in Fargo decided to put up a Wi-Fi hot spot, I could come into town, and while I find that I might not get my telephone connection, I would get a local area connection, and I would have an alternative, and that is why I speak, you know, so enthusiastically about the potential for competition between the unlicensed band—which does not depend on capital flowing from Wall Street. It does not depend on any company owning or controlling spectrum. Its rate of diffusion at that point is limited only by the choice of the consumer to go down to the good guys, or Circuit City, and buy a little box, and take it home and plug it in, and therefore you get to do this third option on the back of the bank accounts of the American public at their discretion, as opposed to some large *a priori* allocation.

Senator DORGAN. Let me ask—well, I do not want to use my whole 5 minutes on one question.

Mr. PRICE. Senator, if I could just explain, we at Evercore have an investment in a company called Boingo. Its purpose is to negotiate with the guy in Fargo, the guy in South Carolina who has the hot spot and provide a universal access mechanism to that, so it cobbles together all of the entrepreneurs to a uniform system, and you sign up for a service called Boingo. Wherever you are, it works.

Senator DORGAN. I will not ask the question, but I am curious, because all of you have talked about competition, how many of you have the same local telephone provider you had in 1996? I will not ask you, but the reason I would ask the question if I had time, it would be about how much competition really does exist in the local exchanges around the country. The answer is, not much, and I believe in competition. I believe we ought to do what we can to foster more and more competition.

I am going to ask two things quickly in my remaining time. One is the issue of the Universal Service Fund, which has kind of become a forgotten stepchild in these days of telecommunications policy. We specifically wrote in law in 1996 that the Universal Service Fund shall support advanced telecommunications services, so that seems to me to be a platform for policies that make sense in terms of what some of you are suggesting as we try to provide the impetus for a better and more robust buildup.

Mr. Reed, you might want to comment on that, but second, some of you mentioned Korea. I do not know much about Korea, but I am curious. You said 70 percent of the Korean households have access to broadband?

Mr. MUNDIE. Subscribe.

Senator DORGAN. Subscribe to broadband. Presumably, then, it is affordable in Korea, is that correct, or is it subsidized?

Mr. MUNDIE. It is partially subsidized by the government, I think, but there is really aggressive competition between two DSL providers.

Senator DORGAN. But if it is partially subsidized by the government, if you come here and tell us how great things are in Korea, and someone says, it is because they are playing video games, and the government subsidizes the subscription to broadband, I think it suggests at least that whether it is through the Universal Service Fund or some other device, that governments are deciding that in order to have universal access, like the old REA program, you have to do something to stimulate that. Would you disagree?

I raise it only because you all have raised the question of Korea, and someone Brazil. I do not know much about those countries, but I assume that if it is affordable there, the ingenuity of the American marketplace could make it affordable here if we had public policies that supported that through some kind of cross-subsidy, if we need to, through the Universal Service Fund.

Mr. MUNDIE. Maybe I could comment that many, many countries have contemplated this question over the last few years, because they recognize that having an accelerated deployment of broadband is an opportunity to steal a march on the major, established countries, including and especially the United States in terms of participating in this sort of information economy, so many of them have actually been more aggressive than we have in this country either in subsidies or regulatory environment.

Canada, for example, I do not think has done anything in subsidy, but they actually forced cable to provide open access.

Senator DORGAN. Is there also more aggressive competition in those areas?

Mr. MUNDIE. In many cases there are. For example, there is both real competition between different, mostly telephone suppliers in those countries, because cable is not as uniformly deployed. The reason I say the United States is slightly different is because we have such a huge penetration of cable already in place, and largely upgraded for these services, and we also have the telephone network, which could be fairly directly used to provide these services.

Senator DORGAN. I should just confess that I still have the same local exchange service I had when we wrote the law, and I assume you do.

Mr. MUNDIE. Has the company changed names?

Senator DORGAN. I have not had one telephone call during dinner time suggesting I change it, because there is no competition.

Mr. HUNDT. Senator Dorgan, I recall you when I first came into office at the FCC explaining to me the cost of telephone service, the economic cost of telephone service in your home town, which was \$300 a month, I think was the number. That is the problem with broadband, whether it is your home town, not a large place, not even Fargo in North Dakota, or whether it is even some of the suburbs around our major cities, the underlying economic cost of building a truly high speed fiber-based wireless LAN, all the different technologies, even the most efficient, the underlying economic cost is greater than any private market is going to invest.

That is why Korea, that is why China and Shanghai, that is why the European countries all are going to have policies—some will be wise, some will be less wise, but they will all have policies in which the government steps in, as it did with the road system, as it did with broadcast TV, as it did with radio, as it did with rural electrification, and figures out how the network is going to reach everyone, and it is an imperative that we do that in this country, but it would be a godsend to our capital markets to know that there was such a plan, so that all the other technologies that the learned gentlemen are speaking about would be able to enjoy the benefits of it.

Senator DORGAN. I should—just to clear it up, in my home town they drove down the price of that, or the cost of that telephone service by the Universal Service Fund support in order to make it affordable, which was the case all across the country.

Mr. Chairman, as is always the case, I am supposed to be in two places at once, and I have to leave. I really appreciate your holding this hearing. I know we have got tough decisions ahead of us, but we need to start making those decisions.

The CHAIRMAN. We have got the best of advice.

Senator Breaux.

Senator BREAUX. Thank you very much, Mr. Chairman, members of the panel. Mr. Hundt, I am not sure I agree with your suggestion that we apply the Herbert Hoover economic model to the telecommunications industry, and apparently the rest of your panel do not think too highly of it either, from what I take from their testimony.

Mr. Huber, comment on Mr. Hundt's last statement about the fact that the government came in and built the roads, built the television, and there was a whole bunch of other things that Mr. Hundt said that we did through subsidies. Why isn't that a good example of why we should do it in this area?

Mr. HUBER. Well, to begin with, certainly with the major network industries there was a long period of private sector incubation before the government even touched them. Edison built the Pearl Street Station in New York to sell light bulbs; the first radio broadcasters were built to sell radios. It was completely closed in the private sector.

Number two, the key problem with this highway metaphor is, go ahead, subsidize the highways, but keep in mind that it is 4 lanes this year, within 3 years it is going to be 8, and then it is going

to be 16, and then it is going to be 32, and there is no sign whatsoever that that progress will stop. It ought not to stop. We are not going to pave over the whole country and then have to stop building digital highways. You cannot subsidize your way to a horizon that is always receding on you, and receding that fast.

Senator BREAUX. Your testimony on page 3 I think answers what I was going to ask, but can you elaborate on it? Are there things that are short of what Congress can do to help move this process forward? I think Congress is hopelessly log-jammed on these issues, and someone pointed out all the television ads are back on, do this, do that. I mean, most people quite frankly do not understand what the ads are advocating. It is very, very difficult. I just do not get a lot out of that.

You talked about the FCC having various issues before them now that if they acted on it, what do you think the results could be?

Mr. HUBER. Well, on broadband we simply have to get back to where we ought to have started in 1996. We have to move the main wireline infrastructure broadband regulation to a system that applies one set of rules for all, a system that says, we mean it, it is going to stay this way, and you can invest your next \$100 billion in joint-use facilities, and if it turns out to be a stupid investment, you'll lose your money, or else you are going to get as rich as Croesus if it is a really good one. You have got to get that message out emphatically. It is not hard, but you have got to do it.

As for subsidies that everybody was discussing, before you cook up the next one, try enforcing the 1996 Act, which said subsidies had to be made explicit. People are not competing for residential service in Dakota because it is ridiculous to compete for residential service in Dakota. It is subsidized like crazy internally, the subsidies are not explicit, nobody can beat the rural rates when they are so heavily subsidized.

Make the subsidies explicit. In other words, implement what was in the 1996 Act, and then talk about your next round of subsidies, but do not do it the other way around.

Senator BREAUX. Mr. Price, you mentioned on page 12 of your testimony—can you elaborate on number 3, when you talked about the historical regulation of telcos need to be examined in light of the changing competitive environment in cable's superior technology plant and the increasing quality of wireless offerings? The current regulatory regime may be appropriate in a monopoly context, but the RBOC monopoly is rapidly waning. There are some who would argue that they still have a lock, mortal cinch from a monopolistic standpoint. Can you elaborate more about what you meant on that point number 3?

Mr. PRICE. RBOCs generally—

Senator BREAUX. Use your mike.

Mr. PRICE. The RBOC generally provides three services today, residential voice, data, and wireless. In the residential voice business they have 80 to 90 percent market share, in data it is one-third market share, and in wireless the strongest person nationwide, Verizon, has a 25 percent market share, so the only monopoly that still exists is in residential voice.

In residential voice, we have wireless carriers increasingly impinging on this monopoly. If any of you has college kids, just ask

them which phone they use. I mean, there is a sea change coming like this, that is going to take maybe a half a generation to be implemented, but it is coming with respect to the wireless phone.

With respect to cable, it is going to impinge upon the residential voice business, and what I am saying is, in a very short period of time, relatively, 3 years, 4 years, you are going to see the RBOC residential voice monopoly gone, and at that point in time, you need to examine the entire regulatory regime for the RBOC.

Senator BREAU. Mr. Huber, you outlined this in your testimony. Maybe you would be the best. Suppose the RBOCs had the same regulatory requirements that they had to meet in providing a broadband that the cable companies currently have to operate under. What would be the result of that?

Mr. HUBER. They would be rolling out glass very aggressively. The copper network, they are squeezing it out to the very last limits of what it can do today, and they have had concrete proposals like this on the table, and they spend 3 to 4 years negotiating with the FCC and with State regulators to see how they can share this glass network once they have deployed it. They would be pushing remote terminals out to rural areas.

Senator BREAU. Well, how different is it from what the cable operators have to do versus what the telco companies have to do in providing a broadband?

Mr. HUBER. Cable, of course, has—they do not like to talk about it, but they are still a shared medium. In the last ½ mile or mile they are bandwidth limited. They claim that they have got more than they have got. They cannot actually deliver real broadband during peak usage. They have a lot of work to do. So do the wireless people, and they will all do it in an environment that leaves them free to upgrade and build, or else be beaten by the competition.

Senator BREAU. You are talking about the regulatory requirements and comparing that to what the telcos have to compete with?

Mr. HUBER. Cable is under Title I for broadband. They can do what they like and charge what they like. Telcos today, if they build it, they will find out sometime, next year or two years from now, whether Illinois or the FCC or somebody else will tell them, look, you have just put in \$5 billion here now, take it apart and sell it at the price we prescribe. That is the situation, that is the law today.

Senator BREAU. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Allen.

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

Senator ALLEN. Thank you, Mr. Chairman, and thank you for holding this hearing. I have thoroughly enjoyed it. Whether I agree with each one of the witnesses, your perspective has been outstanding for us. I think it might be helpful, and we have gotten into it, looking at this in a third way, or a different way, and alternatives, rather than worrying about the ILECs and CLECs and the old way of looking at things, whether they are highways, rural electrification and so forth, and I think we ought to focus on spectrum-

efficient technologies, satellite services, wireless technologies, and possibly even power line broadband capabilities.

All of these incentives, there are not enough incentives or tax credits available to make sure that folks will dig up into mountain hollows or across wide expanses of our country and to that extent I have been working, along with Senator Boxer, for several months now, and our staffs have been working very diligently on coming up with the proper approach, and I have heard our witnesses talk about it as far as Wi-Fi, wireless fidelity.

I think that that is a third way that is not bogged down by all of the legacy litigation, regulations, precedent, animosity, and everything else that is engendered in the other way of thinking, and I feel that we are making progress, and I do want to commend Senator Boxer and her staff and mine for working together on this, and we are working also with the FCC and the Department of Defense, which has not really been mentioned much in here, but is very, very important as we move forward, and this is just a working draft of where we are, and I am going to ask some of the gentlemen, especially those who focused on this, their views on it as we are trying to go forward.

And Senator Hollings, I know you care a great deal about Wi-Fi as well. In listening to some of the comments of others, we might be able to get a convergence of views. The goal of our legislation, at least at this stage—and this is not the legislation. This is a working proposal to provide an alternative to broadband wireless service by using advances in wireless technology and spectrum efficiency. It is to accelerate the development of wireless broadband networks in both residential and business markets, and allow schools and libraries the ability to purchase wireless devices that deliver broadband services under the Universal Service Fund.

Now, the specifics are as follows, and again, this is a draft at this point, but we would require the Federal Communications Commission to make additional unlicensed spectrum available for wireless broadband services. The draft approach would also require the FCC to establish quality of service and technical rules of operation that facilitate spectrum efficiency for unlicensed wireless broadband technologies, require the FCC to establish baseline Internet connectivity principles that ensure consumers have access to Internet content services, applications and devices, as was mentioned, and obviously allows the schools and libraries to pay for it with the Universal Service Fund.

What is your horseback reaction to such a draft proposal, and again, we have been working for several months and have gotten to this, and we are obviously getting comments, but I certainly would like your comments and insights on such a framework or structure of principles.

Mr. LESSIG. Senator, let me start by saying I would agree with the framework and, in particular, in response to some of the discussions about subsidy, as Mr. Mundie suggested, the critical feature about wireless technologies is that, like computer infrastructure, the subsidy for this technology is in large part coming from consumers purchasing the devices necessary to make it work. It is not Wall Street that needs to do it. It is actually the consumers that

are developing the technology to make this work, so you are getting consumers to help make this project go forward.

The one thing that I would again emphasize, though, is that quality of service protocols should not interfere with experimentation for the next generation of technologies.

The history of damage that the FCC has done—and again, Mr. Huber's book is, I think, excellent in describing this—has been the FCC putting out the equivalent of “quality of service” protocols, that have had the effect of stifling the next generation technologies. It has got to be minimal in the way that Mr. Mundie has described, leaving open an extraordinary range of experimentation. Technologists are humble.

This is a rare quality among lawyers, and I do not know about Congress, but technologists will tell you that they do not know what the future could hold for wireless technology. There is a great potential that it could provide more capacity as the users increase, something we have not seen before. But technology needs the space to experiment with that, and the FCC regulations that set up certain protocols have the potential to interfere with that opportunity in a way which I do not think has yet been appreciated.

Senator ALLEN. Thank you. Mr. Mundie, what is your view, seeing how you obviously focused on this, and we seem to share similar philosophies and ideas?

Mr. MUNDIE. Well, clearly your bill, as you have outlined it with respect to wireless, seems to be completely compatible with the recommendations that we made. Again, I think the thing that is important to realize is that if this is really going to be what I would say is a dependable medium today, I mean, if you think back to Citizens Band Radio and other things, people used it, but it was hard to really depend on it, and I think the problem we have got today is, two problems. If we do not get the etiquette right to allow this innovation to occur, then, in fact, even within the bands we have, we will end up with just congestion, or cacophony.

I think the other problem with dependability is the fact that we ultimately want to see this used in many different environments, inner city, rural, et cetera, and to do that, physics plays a real role here, and the different bands have different propagation properties, so for example, the good old television band was chosen because it goes through bricks and mortar and everything else, and you can watch TV with your rabbit ears.

None of the spectrum in that band, for example, has been allocated for these kinds of applications and, as a result, it is very hard to get those kind of propagation characteristics, and so I think as I mentioned earlier, the other key idea that you should consider is directing that we need a bouquet, if you will, of bands that are all unlicensed and managed in a compatible way so that people could, in fact, have assurances that it would be both dependable under heavy use, and that it would be dependable relative to the different propagation environments.

Senator ALLEN. I thank you. My time is up. I was going to ask that question.

The CHAIRMAN. Go ahead.

Senator ALLEN. You generally have—well, in response to a question from Senator Burns as to which of the gigahertz, bandwidths

and so forth, the part of that spectrum is most important, and you answered that previously on the record, and obviously I am not sure if in our legislation, or any legislation, you would want to micromanage to that level. I do not mean to be legislating on a draft proposal here. I think that if you establish the proper principles, that is the way to go with it.

If necessary, I suppose you do have to come in and tell them what to do, but nevertheless, if you have knowledgeable people such as yourself and others working on that and adapting the bottom line principles, hopefully it would be done.

Mr. MUNDIE. The industry is fully engaged, both with the FCC and the DOD, around these questions to try to find a compromise that works for everybody, and I agree with your statement about principle. It is less important to pick which bands than it is to realize that there are two fundamental principles. One is that it has to be reliable under heavy use, and the second is, it has to work no matter whether you are in Kansas or Manhattan, in a building or on a farm.

Senator ALLEN. There is a Manhattan, Kansas.

[Laughter.]

Senator ALLEN. Or in Washington, D.C.

Well, I do think the application, Mr. Chairman, is—you and I, I know, care about rural areas, and rural areas look at access to broadband as they did rural electrification. I hate to get back to those, and interstates and railroads and so forth, and it is important in rural areas. It is also important in inner city areas, or metropolitan areas, where it gives the consumer another choice, and you are not having to dig up all the roads constantly for another wire to be laid, so it is applicable anywhere, and I look forward to working with you, Mr. Chairman, and I know Senator Boxer will and also these gentlemen.

I thank you all for your insight and perspective, and really I think Wi-Fi, out of this whole hearing, which was generally gloom and doom, that this is one area where I think innovation is exciting and has tremendous potential, and I thank you again for your great leadership on this issue, Mr. Chairman.

The CHAIRMAN. We are just trying to find something we can get done along that line, and you mentioned rural. Chairman Hundt, you heard Mr. Huber say, let us take broadband out from Title II, put it under Title I, remove the common carrier obligation on the one hand. What happens to the CLECs? On the other hand, remove the support of universal service. What happens to the rural areas? What happens if we do that? You heard that suggested.

Mr. HUNDT. Well, the CLECs, the competitive local exchange carriers have, in fact, broad competition in voice and data to small businesses in the United States since 1996. There are now 22 million lines supplied principally to small businesses by CLECs.

The CHAIRMAN. But they are not facilities-based. They depend on that connection.

I am an RBOC, and now on broadband I do not have to really make that connection under 251.

Mr. HUNDT. Well, those CLECs—

The CHAIRMAN. What happens to me?

Mr. HUNDT. As you know, Senator, those CLECs have only been able to come into existence and provide that competition because they have been able to lease the last mile, or the local loop. Now, if that is going to be upgraded to fiber, which is what we are all talking about as a core technology because the wireless solution is not going to be a complete solution, although I agree with Senator Allen, it is going to be a tremendous advance, that local loop, if it is going to be subsidized, needs to be available to be leased by competing companies.

The CHAIRMAN. But Mr. Huber is against all of that subsidization. We are not going to have the subsidy. I am talking about the situation today, and I am just trying to find where I am with respect to broadband. If I take it and put it under title I, remove any kind of common carrier obligation, specifically I do not have as an RBOC, then, to connect to any CLEC, and other than Covad or something like that, they all depend on that business customer you are talking about for connection, so I have eliminated—I am an RBOC. I can eliminate that competition by getting that done, is that not correct?

Mr. HUNDT. I think that is right. I think that the move to title I, if that is what we are going to do, is pretty much tantamount to the attempt to recreate the old AT&T monopoly, at least in this particular space.

The CHAIRMAN. And what happens to the rural areas that Senator Allen and I are both interested in? What happens to the universal service contribution? No contribution at all.

Mr. HUNDT. No contribution at all.

The CHAIRMAN. You know, it is very interesting, I have been trying to get—you see, what we had is, you and I seven years ago, prior to 1996, we all owned, let us say at that time, Bell Atlantic up here. I have been paying the rates for the last 36 years, or back home, not 80 years, but almost that. I am still 20 years younger than Strom.

[Laughter.]

The CHAIRMAN. But that was Bell South, but what we had was not a subsidy. We set up the monopoly and said, you do not have any competition, and you have got the right of way and everything else of that kind and no competition, and the guaranteed return, and it worked, and so here we were sitting around, everybody agreed, wait a minute, when we deregulate, deregulate, deregulate—particularly me, it did not work with the airlines, and it did not work with natural gas, and it did not work with trucking. It did not work with the Securities and Exchange Commission, all of this deregulate, deregulate, deregulate.

I said, wait a minute, I am a born again regulator now. Before I go along with this deregulation, I want to make sure we do not mess up the RBOCs, the Bell Companies. You used the word dependable seven times, I counted them, Mr. Mundie, and they are dependable. I can pick up my telephone and I can get Verizon right now, and so the system is working.

One of the biggest reasons they have all gone broke is, my early morning TV, the district attorney in New York is carrying five of those super duper, wonderful executives to the hoosegow. I can tell you that right now. I mean, they were swapping each other and ev-

everything else. That is why they lost all the money, and now they lost all the employees you know what I mean, so nobody says something is wrong with the law. If somebody had said it, we would have amended the law right away. You could get a majority vote around here.

I am back to Mr. Price's observation that the RBOCs' monopoly is gone. What we had was the task of letting the RBOCs continue to perform and give that good universal service, common carrier responsibility and public interest. It was working fine. And yet—let the competition ensue. Let it be deregulated. How do you deregulate a monopoly? And I am hearing you, Mr. Price, saying the monopoly is gone in 3 or 4 years. How does that happen? Tell us about it. That is wonderful.

If we can get that and get all of the competition going, that is what we all around here keep telling each other, is that what we are trying to get is the competition, so how do you get it? They have still got 91 percent, right this minute. That is why Senator Dorgan says, you pick up your line—I have got the same one that I have had for years, and still have the same one here. There have been some mergers, but how has the monopoly gone, as you see it?

Mr. PRICE. We acknowledge that cable has two-thirds market share in broadband.

The CHAIRMAN. You have got two-thirds market share in broadband in the business area?

Mr. PRICE. No, in the residential.

The CHAIRMAN. I mean in the residential area.

Mr. PRICE. That is right, in the residential. We acknowledge that in wireless no one RBOC has more than a 25 percent market share, so now it is down to residential voice, is the market that we are talking about. Ninety-one percent is your figure. Let us take that as a good figure.

We see increasing substitution today from wireless. We are going to see increasing substitution from cable. Now, is cable ever going to have power down the line? I do not think so, not near term, so we are talking about second lines. We are not necessarily talking about lifeline voice service, so there may be some period of time when it is still the primary line. Reed tells me that two-thirds of lines are lifeline lines, the first line.

I would tell you that 20 percent of the people today have a proclivity to give up that lifeline service for mobile service, and have the freedom of flexibility, so in time the residential voice monopoly gets withered away. Does it go down to 40 percent, 50 percent, 60 percent? Probably towards the higher end of that is what I would see in some period of time.

Now, with respect to broadband, broadband is already a competitive market with respect to interconnecting a CLEC so that he can have access to that business customer. Somehow I think that needs to be preserved. I do not quite know how, but in that part I am in agreement that we should allow the competitor to get there, but there is a fundamental technology difference and a choice that this country is going to have to make, because if we want the RBOCs to upgrade to fiber, they cannot do that easily any more, so there is a policy decision that is going to have to be made here of, do you

want pervasive broadband, or do you want to preserve those CLECs in providing that service to anybody.

The CHAIRMAN. Well, I am back, then, to the universal service. I am thinking out loud, if I go all to wireless and there is no universal service, and the rural areas and the sparsely populated areas are underserved or unserved, they could come undone. I mean, if you have got my monopoly gone there is no reason for me to continue the wireline. Yes, the RBOCs have taken on now the wireless, too. They will take on that wireless, but why should they carry it into North Dakota? That is a big problem.

Mr. PRICE. The whole telecommunications system is fraught with subsidies.

The CHAIRMAN. All the time we get these smart witnesses. Is there any comment, something you all want to correct, or elaborate on? Chairman Hundt.

Mr. HUNDT. Senator, I just would say that the whole economy is looking in particular at the information sector for leadership in the right direction, not in the wrong direction, and this is a time when the government could play a crucial role. The kind of bill Senator Allen was talking about would be a big contribution, expanding universal service and having the plan over the next 5 or 10 years to really have a truly high speed network everywhere in this country, would be a tremendous contribution.

We are right at that brink where we could—we all hope it is not so. We could slip into our second recession in 2 years. We should go the other way. We could have another resurgence of growth in our economy. The congressional leadership is absolutely critical.

The CHAIRMAN. Very good. Mr. Price, have you got any elaboration?

Mr. PRICE. I think we need to do two things. One is the new technologies. I am a big fan of Wi-Fi. I have it on my PC. I love it. It is great service, but recognize the technology issues that Craig points out. At 2½ or 5 gigahertz it goes 2 miles.

Mr. MUNDIE. 300 yards.

Mr. PRICE. So if you want to get a 50-mile radius in rural areas you are down at 300 megahertz, or some pretty low—

Mr. MUNDIE. Well, it is different power, different antenna. There are many ways to solve the problem without necessarily changing the frequency, but the way that the band is regulated today makes it very hard for people to do that.

Mr. PRICE. So it is not a little leap. It is not a little snap to get there.

The second thing I would say is, I am very pessimistic about this economy. When I look at the auto companies today financing the customer purchases, it just brings to mind Lucent and Nortel stuffing their equipment down the throats of all their CLEC customers and financing consumer purchases that would become unsustainable next year. So I worry about this economy, and I am more free market than you would ever think, but I am so scared for this economy that I say, let us do something—let us do something that stimulates demand, because if we do not, I feel bad about this sector in particular.

The CHAIRMAN. Very good. Mr. Mundie.

Mr. MUNDIE. First of all, I thought I would share with you at the end that this really is an issue for ultimately the country's national security. We learned on 9/11 among the NSTAG, the National Security Telephone Advisory at the White House, when the buildings fell down in New York and took out the wireline network, we had congestion in the cell phone network, and it turned out the only thing that people could work with was their Blackberries, and they worked because they were wireless, and they were not one of the centralized environments as much, and the economic security today is critical to national security, and the IT sector is, in fact, one of the biggest contributors to overall productivity.

The reason other countries are so focused on this is, they understand that, and we have kind of taken it for granted because it was all invented in America, but I think for both economic well-being, and then ultimately to have flexibility in our critical communications infrastructure, finding a balance between these wire line and wireless technologies and getting them deployed I do not think can be emphasized enough these days.

The CHAIRMAN. Technically you said, with the wireless and everything else, but a lot of the firemen and policemen did not get the wireless message in the building, that it was about to come down. Technically, have you corrected that? Can we correct that?

Mr. MUNDIE. Yes, I believe that can be corrected. And to some extent those firemen are using radios that were designed conceptually about in the 1940s and 1950s.

The CHAIRMAN. So the new designed radios is the logic that—

Mr. MUNDIE. It is my opinion some of these novel radio techniques could, in fact, be made to work in that environment. I mean, for example, just having—Larry mentioned the idea of having these mesh radios, where every radio guy gets to talk to the next radio, and they become a lifeline, if you will, so if you had that as the architecture that was on the belt of every fireman in the World Trade Center, it might have been a different result, because you did not have to worry about propagating from a central tower, or down all the way to the truck, and these are the kind of innovations that I think we need to enable, and that is not happening now with the way we manage spectrum in these highly regulated bands.

The CHAIRMAN. Mr. Lessig.

Mr. LESSIG. First of all I want to go to something Senator Allen said about finding a third way. I think it is important to note what has been said on this panel about the different ways to deal with this regulatory problem.

We had in the broadband wire context with the telcos a requirement of open access, and Mr. Huber is describing moving all of the broadband into a place where there would not be that requirement anymore for open access at the physical layer of the network—no common carrier requirements at all.

But I think what I have described, and in a minimal way I think what Mr. Mundie has described is, even if you do that, and you eliminate open access requirements at the physical layer, it is critically important that you have a different kind of regulation to assure that at least neutrality on the network is sustained. So it might be that you give up a failed method of regulating—(I am still

a believer in many contexts in open access, but let us just assume it fails.) But that does not mean you go to no regulation. That means you change the kind of regulation that you embrace.

The second important point, is that these new wireless technologies, as Senator Allen and Mr. Mundie were suggesting, are fundamentally different from the wireless technologies that existed for the last 70 years. We do not understand them yet, and they need lots of encouragement and space to grow, and the FCC so far has been pretty good about protecting the unlicensed band from lots of regulation. But it has got to be encouraged by this Congress to open up a much wider range of spectrum for this type of unpredictable innovation, not controlled by the traditional carriers, because it is not the traditional carriers that produce the great innovation that produced the Internet.

It is shifting the ability to innovate and build outside of those carriers to the millions of innovators at the edge of the network that will be the key to turning this wireless opportunity into something special.

My parents live in South Carolina, Senator, and I promised them broadband as a Christmas present 5 years ago. But today, I still cannot deliver on that promise, because there still is not broadband in their community, even though they come from the Hilton Head area. This is a failure of national policy.

Right now, I am living in Japan for this semester. In Japan, they are offering 12 megabits per second DSL service for \$20 a month. That is 12 times what you can get in the United States for ½ the price that you pay for DSL service in the United States right now. For \$50 a month you can get 100 megabits per second. Now, that is a fundamentally different opportunity for growth in Japan and many other countries that we are missing because we failed to find a way to push this innovation into the broadband space.

The CHAIRMAN. You see what Senator Allen and I have. We have to contend with the Department of Defense. We have got to contend with the FBI, Mr. Huber, because if we transfer it over from Title II to Title I, then the FBI says, wait a minute, we cannot wiretap and enforce the law.

But excuse me, Mr. Huber, your comments.

Mr. HUBER. If the FBI has, in fact, told you they cannot wiretap Title I services, I can give them some help, believe me, Senator. It can be done.

The CHAIRMAN. We will have to work it out. We are working it out.

Mr. HUBER. Mr. Chairman, however much we may disagree about what the law ought to be, we should be able to agree about what the law is, and the law today is that the dominant provider of broadband service to residents is—the provider that actually serves two out of three residential customers that subscribe to broadband today is deregulated, not “should be,” not “might be some day”: it is deregulated today, has been deregulated since well before 1996. So all we are debating is, ought we deregulate or regulate the nondominant providers, and that makes no sense.

There is no serious disagreement among anybody, including the Bell Companies, about the legacy copper network and legacy voice services. That sharing decision has been made, and it is going to

stick. There is a lot of debate about pricing, but there is no debate about the principle. The debate is about the glass network that ought to be built by phone companies that has not been built yet.

The CHAIRMAN. Well, one last question, George, unless you have got any.

Senator ALLEN. No, I do not.

The CHAIRMAN. I am, Mr. Price, concerned not just about communications, but the economy. I agree with you. I know yesterday was a \$386 billion deficit for fiscal 2002. Now, it got up, in the early part of September. Last month, it got up to 412, something like that, but they have been moving things over into October to try to get it down below the 400 mark, but you watch it, in the next 2 weeks it will zoom right over the 400 mark. So we ended up, instead of a \$5.6 trillion surplus this time last year, now we ended up this one fiscal year \$400 billion, and the deficit and the balance of trade \$400 billion, and the manufacturing sector is just about gone.

Jack Welch led the way several years ago. He said I am not contracting with any subcontractor for General Electric unless you move to Mexico. People just do not factor that in. They are talking about jobs, jobs, jobs, and fast track. Free trade, I believe in free trade and everything else, so the economy is on its heels, and we have got to do something, but—and I am intrigued by the point, and I do not want to be quoted as having asked a question, would you deregulate the RBOCs?

Mr. PRICE. Not yet.

The CHAIRMAN. When, at what stage?

Mr. PRICE. I would have a market share test. When market share gets below X, then they are deregulated, and then you would have to put some subsidy back in for rural. You would have to do that.

The CHAIRMAN. Well, this has been outstanding. The Committee is indebted to each of you. The Committee record will stay open for further questions. Thank you very much. The Committee will be in recess.

[Whereupon, at 11:45 a.m., the hearing was adjourned.]