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NATIONAL SUMMIT ON HIGH TECHNOLOGY: DAY THREE—ADVANCE

HEARING

before the

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

ONE HUNDRED SIXTH CONGRESS

FIRST SESSION

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NATIONAL SUMMIT ON HIGH TECHNOLOGY: DAY THREE—ADVANCE

Wednesday, June 16, 1999

Congress of the United States,
Joint Economic Committee,
Washington, D.C.

The Committee met at 10:02 a.m., in Room SH-216 of the Hart Senate Office Building, the Honorable Robert F. Bennett presiding.

Senators present: Senators Bennett, Mack, Allard, Frist, McConnell, Thompson, Gregg, and Robb.

Representatives present: Representatives Minge, Sanford, Watt, Larson and Smith.

Staff Present: Shelley S. Hymes, James Gwartney, Chris Edwards, Colleen J. Healy, Kerry Fennelly, Kevin Doyle, Lori Hodo, Stephen Schultz, Kurt Schuler, Lawrence Whitman, Howard Rosen, Daphne Clones and David Datelle.

OPENING STATEMENT OF SENATOR ROBERT F. BENNETT

Senator Bennett. The Committee will come to order.

As has been the pattern in the past two days of hearings, we will follow a strict schedule in order to make sure that the witnesses are given the full opportunity to present their information.

Opening statements will be limited to three minutes. And during the question and answer period, the questions and answers will be limited to five minutes.

Now, as we have done in the past two days, we will accept questions by e-mail. I know it's always frustrating when there are a number of people out there and they send their e-mail questions in and then they hear the question that's asked and say, well, why did they ask that one instead of mine, which was clearly much more brilliant than the one that the Chairman chose.

But we will do our best to get to as many e-mailed questions as possible, to highlight the fact that this is a hearing on the future and this is the kind of thing that will happen in the future.

And for those who wish to send us an e-mail question, our e-mail address is techsummit—as if that were one word—at jec.senate.gov.

And for those who wish to send us an e-mail question, our e-mail address is techsummit—as if that were one word—at jec.senate.gov.

That's g-o-v, not g-u-v. Some people do it phonetically.

And if your e-mail question is not answered live, we will do our best to get the e-mail question answered in writing for the record after the fact.

I received a number of e-mail questions from my constituents yesterday, which I thought were very good and I did not get a chance in the tight schedule to get them answered live.

But we will get answers for them.

And we are livestreaming over the Internet, which can be accessed from our website at jec.senate.gov/techsummit. Again, techsummit, a single word.

For those here in Washington, we remind you again that there is an R&D fair here in this building—no, I'm sorry. It's in the building behind me, the Dirksen Building. In room 106 Dirksen, from 1:00 to 5:00, in which Members of Congress and their staffs can get a hands-on feel for the kind of information that is available to us.

So we've been joined by Mr. Minge from the House and we'll turn to you for your first opening statement and welcome you to the Committee this morning.

OPENING STATEMENT OF REPRESENTATIVE DAVID MINGE

Representative Minge. Thank you very much, Senator Bennett.

I certainly compliment the Chair of this Committee and the staff for putting together an excellent series of panels. It's very informative.

And I would simply like to add my comments of welcome to those that have been already made. I look forward to the testimony and certainly look forward to the participation of the broader public through the e-mail system.

I think that this is a remarkable way to open up the congressional hearing process to the entire nation and it's a very positive way for us to make sure that the citizens of this country understand, appreciate, and participate in what we're doing here in Washington, D.C.

Thank you.

Senator Bennett. Thank you.

Senator Allard?

OPENING STATEMENT OF SENATOR WAYNE ALLARD

Senator Allard. Mr. Chairman, just a brief comment.

I want to thank you and Senator Mack for your great leadership in this particular area.

I think it's important that we continue to have this dialogue, that it not be for just these three days.

I'm a member of the Senate who takes great pride in thinking that we're staying up-to-date with a lot of the most modern technology.

I think as you do, Mr. Chairman.

So this has been particularly enlightening and exciting to me.

I think that our freedoms are based on the free exchange of ideas and technology is allowing us to have a greater exchange of ideas and more interaction than we've ever had before in the history of this country.

I think it speaks well for democracy. It speaks well for America.

I'm pleased to be a part of this panel and I'm looking forward to the testimony this morning. I think it's been superb up to this point and I hope that we continue to do this and not just stop after this Summit.

Senator Bennett. Thank you.

Mr. Sanford, we welcome you from the House.

OPENING STATEMENT OF REPRESENTATIVE MARK SANFORD

Representative Sanford. Thank you. And I would simply echo the sentiments that have already been expressed.

And I would say that I, at least philosophically, approach much of what we've heard as a skeptic. I have real concerns about this whole idea of there being a new paradigm in terms of American productivity.

Yet, a lot of what I've heard through the testimony that's been given has removed some of that skepticism. And I suppose that today will do more of the same.

Senator Bennett. Thank you. As has been the pattern in the past two days, we will start off with a primary witness. This morning, it's Scott McNealy, who is Chairman, President and CEO of Sun Microsystems. He will be testifying to us by videoconference.

We will not keep as close a clock on Mr. McNealy as we will on other members of the panel who are here, as we have not with our lead witness in the past two days.

We look forward to your testimony, Mr. McNealy, and we're grateful to you for your willingness to participate in this way.

We will then go to the panel following Mr. McNealy's opening remarks.

So, Mr. McNealy, assuming that everything is working, we can at least see an image of you here and hope we can hear you.

We now turn to you for your testimony.

PANEL I

STATEMENT OF SCOTT G. MCNEALY, CHAIRMAN OF THE BOARD AND CEO, SUN MICROSYSTEMS, INC.

Mr. McNealy. Thank you, Mr. Chairman. And it's a real honor, it's a real privilege to be part of this thing.

When my three buddies and I, 17 years ago, started Sun Microsystems, I never contemplated that I'd be here testifying on this technology.

I'd also like to thank you for the opportunity to do an electronic visit. I've been to Washington, D.C. twice in the last couple of weeks and I think three straight visits might be a bit much for this Californian.

But thank you very much.

I'd like to cover three topics—basically, what technology has brought us, where it's taking us, and maybe touch on some of the opportunities that I think government has to help in this Information Technology (IT) era.

We've heard a lot of stats, statistics, about what the technology is doing and what it's accomplishing.

My favorite statistic is that 35 percent of the real economic growth in the United States has come from the IT industry over the last three years, according to the Department of Commerce.

That's a fairly amazing percentage of growth in the United States that is targeted strictly or coming strictly from the IT industry.

We all know that the U.S. leads many IT sectors out there, both in terms of expertise and core competency, but also in terms of market position.

I think another pretty interesting statistic is the amount of venture capital that is being invested. Just in the Bay area alone, I've read approximately six billion dollars a year is being invested in new start-

ups, basically renewing our whole approach to technology with all of these start-ups.

Sun is—I wouldn't say a classic or an exceptional example. We're probably just a normal example of the kinds of things that can happen.

It was started 17 years ago by four 27-year-olds. I had three years of business experience, which was more than the other three founders combined.

Today, we've gone from zero to about 30,000 employees. That's just the direct job creation, not counting the indirect job creation.

We've gone from zero to a $12 billion run rate in that short 17 years. And that growth rate is not exactly slowing down. We grew at 24 percent last quarter alone, year over year.

And taxes—that's another nice benefit of all of these start-ups.

At least at Sun, we tend to make money. In fact, we've made money every year and, as a result, we're paying taxes every year, a little different from some of these other start-ups that you see today.

Exports. We do over half our business outside of the United States.

And we're investing heavily in Research and Development (R&D). We have developed an R&D organization that is currently investing at the rate of one and a half billion dollars of investment per year.

This is four 27-year-olds, we were able to start this. I think this is a great country and it's a great system. I want to thank all of America for providing this kind of opportunity.

And this technology has brought an amazing set of new capabilities, not just new companies.

My wife is due any day now, so I have a beeper and a cell phone. That's good news. That's good to know and I feel a lot more comfortable here and it's nice to actually be able to participate electronically and not be eight hours away by airplane.

My General Motors car has wonderful technology in it that if the airbag deploys upon accident, an answer center is notified immediately. And if they call me and I don't answer, they dispatch an ambulance immediately to the site based on the global positioning system in my automobile.

If I'm lost, I can call them and they can direct me to exactly where I need to go.

These are very interesting new capabilities that definitely improve the quality of life for people.

We can test-drive cars. We can test-fly airplanes. We even test all of our new computers completely electronically in simulation mode before we actually build a single part—the ability to save costs and bring new products to market.

You've heard a lot about distance learning, about tele-medicine, about electronic commerce, what that can do to free up the congestion on our freeways and save the environment.

The nice thing about the zeros and ones in computers is that they're basically generated through a renewable resource—electrons.

It is a very much more effective, quick way to do business.

And I think as you see this Christmas season happen, many more people will go online and do their shopping through electronic commerce.

And there's no way that companies today could run their businesses without e-mail, without the Web.

It just wouldn't be possible to be as effective and as efficient as we are around the world.

But more importantly, the topic I'd like to talk about is where we're going with this technology and what the big discontinuities are.

I heard someone earlier mention that the technology was fundamentally—it wasn't clear to them that we were actually driving productivity gains.

I have to agree. I think a lot of the computer technology has been very hard to deal with, very complicated and for mere mortals, if you don't have a teenager in your house, it's often very difficult to install this equipment, this technology, make it all work together.

There is a big change happening as we move to a new model of computing, a new model of technology. And this is a model where you don't go out and buy your own personal mainframe. You don't go out and buy your own computer.

Fundamentally, computing will be embedded in every appliance that you buy and you will know how to work those appliances. If I give you my car keys or if you give a kid a game machine or if you hand somebody your cell phone, you don't need to hand them a manual.

They just know how to work it. It's got a very simple set of buttons on it, on/off, go/stop, those kinds of buttons.

And this is what we call appliance-based computing.

Fundamentally, what we're doing is we're putting a java-based

browser in every appliance that you can imagine—set-top boxes, game machines, your thermostats, your televisions, your cell phones and all of your nomadic devices, the palm pilots, those kinds of devices.

And you'll be able to access all of the information and services that are available out on the great World Wide Web, which is where all information and all content is being put.

If you think about what's not available on the Web—if it's not available on the Web, it's probably not available, or you shouldn't be getting access to it.

So this is a new model of computing. And all of these appliances will be accessible through your service providers. This is where the carriers—the cable companies, the telcos, the satellite companies—all of these common carriers become a much more important component of the IT industry.

Instead of setting up your own home network or your own corporate network, you'll be accessing the AT&Ts and Sprints and WorldComs and the TCIs and the AtHomes and those kinds of companies out there as a service provider.

And they will be providing your mail, calendar, news, web pages, all the rest of it.

You'll access it using a Smartcard that will run the same java applications that run on your desktop computer or your cell phone or on your server.

We have a common language with the browser technology and java technologies that allow you to scale from Smartcard to the biggest web servers, all speaking the same common and open language.

My little boys are going to grow up some day and say, daddy, did you really have a computer in your home? You are so old. Did you have a well? Did you have a nuclear power plant in the basement, also?

This is just an old style of computing to own your own computer.

Now this is wonderful because it will lower the cost of computing. Computing will automatically be embedded in every device.

In fact, the automobile manufacturers have, through their AMIC consortium, announced that they are going to put java as the in-car operating environment.

I now look at an automobile as a java browser with tires. It's a Netscape communicator with tires that just rolls around and gives you access to all of this World Wide Web information.

Hopefully, you do that in the backseat and while you're driving, you stay focused on the road.

(Laughter.)

But this is a new model of computing. It will give you reliable, available, dial tone-like availability to all of these web environments.

Now this is good news and this will definitely change the way we operate. But I think the government has an opportunity, to finish quickly here, has an opportunity to participate and, in fact, help this whole process along.

First of all, I think the government ought to run its operations on the web and move to portals where every citizen has a private, customized web page that they can access from anywhere, any place, from kiosks if they don't have their own computer access and their own Internet service provider, where they can use a government Smartcard or whatever, to access their information, their entitlements, government information.

And I think state, Federal and local governments should all develop portal-based computing much in the same way you can go to Yahoo and get My Yahoo or you can go to Sun's website and get My Sun.

I ought to be able to go to the government website and get My Government, very customized to us.

That technology is available and can be implemented today. It would definitely streamline and lower the cost of delivering government services and information to all employees.

Secondly, government should be highly focused on picking the written and spoken languages for computing in a way that ensures that they are open.

Open—by that I mean open, multi-vendor, in the same way that English is open.

Nobody owns A through Z, nobody owns grammar, syntax. Nobody owns the words that we communicate with in English. And the government has a responsibility and an opportunity here to make sure that government information, government spending, and schooling is taught and is using open interfaces, open technologies like TCPIP, HTML, the Java language, and other technologies that run on any hardware, any operating environment, and can handle the rich different data types that we have out there on the Internet.

The third point I'd like to make in terms of government opportunity here is encryption. And there's a major battle, and we obviously don't have time to get into all of the details.

But, quite simply, I think as we go out and we do electronic commerce, tele-medicine, we do all of these activities out over the Internet, I think Americans deserve and have a belief—and a rightful belief—that they should be able to operate out on the information superhighway in a private manner.

And the way to do that is available today. It's called encryption—not crackable encryption, but encryption, uncrackable encryption, encryption that allows people a feeling that they can go out on the Internet safely.

Encryption is all about good and honest people protecting themselves from the bad guys.

It's not all about—it's not just about, I should say, the bad people protecting themselves from law enforcement. And there's a very tough balance and I think we need to continue to work through that.

But right now, with the limits on encryption, we are quickly seeing the U.S. lose its core competency in encryption and we see international companies around the world developing encryption expertise, which I think will put the U.S. at risk in local and global law enforcement.

The next point I'd like to make is we need export control relief.

Our computers and our technology move so fast today, that your basic game station is a real threat to be considered a super-computer and must then therefore be under license and export control restrictions that put us at a huge disadvantage to our international competitors.

We have a great industry here. It is fundamentally a U.S.-centric industry. We have a chance to maintain that. But we must be allowed to ship our commodity internationally-available technology quickly and aggressively to the market without having to go through a very cumbersome licensing process.

And the final point I'd like to make is that we need a competitive industry.

We have some great antitrust laws on the books. They're good. They're solid. They're proven. And as a result, the United States, I think is the strongest and most enviable economy on the planet because we have competition, because we let the market economy work, and because we have the rules and we have enforced them.

In the computer industry, in the early days, we had a very dominant IBM.

The government, quite rightly and quite legitimately, and I think, quite effectively and responsibly, scrutinized IBM for 15 years and provided a huge change in business practice at that company which allowed Sun, Intel, Microsoft, Apple, SGI, and all of these web start-ups over the last 20 years, to get started, to flourish, to create what I believe is the strongest IT economy on the planet. And industry on the planet.

That scrutiny was brilliant. It was well done. And we have another opportunity here, I believe, for the Department of Justice (DOJ) to scrutinize Microsoft, which is not—Microsoft is not operating under market discipline.

They are not under the same market disciplines that all of the other competitors in the industry are operating under today.

And in the same way that IBM was forced to open up its interfaces, I think we should look at doing that for Office and Windows monopolies.

We should have nondiscriminatory pricing, open, transparent pricing. We should have nonexclusionary contracts coming out of Microsoft.

And finally, we should make sure that Microsoft does not use its financial power, its monopoly money, if you will, to buy into its channel, to buy into the customer base.

In the same way it would have been very unfortunate to have Standard Oil buy up every gas station on the planet, I think it is a dangerous precedent being set with all of the Microsoft investments in the carriers, in the service providers that you have seen over the last couple of years.

So I think the DOJ ought to be supported very aggressively in its scrutiny, and responsible scrutiny, of the one company that has significant market power in our industry today.

The goal here is to allow a whole bunch of other start-ups to come and take on and keep honest Sun, IBM, Microsoft, Intel, and all the rest of us who have been blessed to have a chance to really achieve the American dream by starting and creating a great worldwide company and bring technology to people everywhere on the planet.

Thanks for the opportunity to share those thoughts.

[The prepared statement of Mr. McNealy appears in the Submissions for the Record.]

Senator Bennett. Thank you very much. We appreciate your candor. You've opened up a number of issues that we need to face directly.

I'm sure it will come as no surprise that there are some differences of opinion on some of the issues that you've raised, but that's what these hearings are for.

So if you will stay with us, Mr. McNealy, we'll now go to the panel. And when the panel is finished, you will participate with the panel in the questions that are asked from members of the Committee.

We'll go first to Mr. Sidgmore. John W. Sidgmore is Vice Chairman of MCI WorldCom and Chairman of UUNET.

He'll be followed by Morton Bahr, who is President of the Communications Workers of America.

We'll then hear from Mark Andreessen, Chief Technology Officer for America Online.

And our clean-up hitter will be Alfred Berkeley, who is President of the NASDAQ stock market.

So Mr. Sidgmore, we will go to you, please.

STATEMENT OF JOHN W. SIDGMORE, VICE CHAIRMAN, MCI WORLDCOM; CHAIRMAN, UUNET

Mr. Sidgmore. Good morning, Mr. Chairman, and thanks for the opportunity today.

I guess I'll start by saying that these are very exciting times for our communications industry. Some would say crazy, wild times.

It's almost hard to come up with adjectives any more to describe what's really been going on in our industry.

One way we look at it, though, is stock valuations.

Our stock, MCI WorldCom, was up over a hundred percent last year, which, by normal measures, would have been terrific. But if you compared it to pure Internet stocks, we would have been pretty far down the list.

Just think about what's happening with Amazon.com, market valuation of over $10 billion, a company that no one had ever heard of two years ago, a company with no stores, very little inventory.

It's got a valuation higher than Barnes & Noble or Borders, who have more than ten times the revenue, have thousands of stores, tons of inventory.

EBay, AtHome—there are lots of examples. There are lots of new Internet companies with almost no revenue and enormous stock prices, ten times, 100 times, 1000 times the traditional company valuations.

Now why is this happening? Is this ridiculous? Have we gone nuts?

Maybe. And some of this is starting to correct now as you see, and there may be some corrections. But I think, more importantly, the world has figured out that the Internet really is the future.

It's the future of the communications. It's the future of technology. It's going to create the business models for the next many years.

In our industry, communications, the Internet and deregulation helped by Wall Street here have really exploded, an industry that's been around for a hundred years.

The telephone industry has really been pretty boring for a hundred years. It moved very slowly. The technology was implemented slowly. It was heavily regulated, controlled by a couple of monopolies.

Until significant deregulation occurred and competition flourished.

Now, with the Internet combined with deregulation, we have stretched all the boundaries and all the infrastructure that have been built up in this industry for a hundred years and we're facing issues of growth and change that I'll talk about in a minute that are unprecedented, I think, and it's all very, very exciting.

I think, more importantly, those changes will pave the way for a new era of innovation and a new explosion of technology coming over the next few years, the likes of which probably the country has never seen.

So I guess one question is, what is this big deal about? Why is the Internet so different than everything else?

Well, for one thing, it's about growth.

We argue, and you can look back through history, there's never been an industry or a technology that has grown like the Internet has grown.

Demand on our Internet backbone, demand, has been very, very consistent over the last several years. It grows—it doubles every three and one-half months.

If you do the math on that, that means that's growing by 10 times every year, 1000 percent per year. Our network is 10 times the size today as it was last year at this time.

If you go back through history, and I defy anybody to find an industry or a technology that has moved that fast.

It moved faster than the take-up of automobile, radio, TV, computer. You can look up any single one of them. It's faster than anything.

Now why did this medium grow faster? I think there are a couple of reasons.

First of all, new competition in the communications industry is what really, really spurred it on and started the technology explosion because, for the first time in 100 years, now companies could actually come in and compete and that's a critical point.

But the real deal, I think, is that open access, open standards, allowed us to build the first truly public network.

The first time in history we actually have a public network that's interactive, where everybody can access.

It's ubiquitous.

Where a business, for example, could ubiquitously access all its customers, all its vendors, all its employees. First time in history.

And that's what makes the Internet unique and that's why it's so critical to the economy and I think to society generally.

Because of the ubiquitous reach of this public model, the Internet enables all kinds of new business models, opening new creativity that didn't exist before.

And I think the important point here is that this is a place now where the new guys, little guys can actually take on the embedded players for the first time in history.

Amazon.com—I used them as an example before—a company that no one ever heard of a couple of years ago, is taking on the biggest players in its industry with no stores, no inventory, not that much start-up funding, by creating a store, a virtual store that's easy to get to, it's easy to buy from, and it's easy to get service from.

You buy books, and it's attracting people because you can buy books when you want to buy them, not when some store says it's open. Whatever time day or night you want to buy, you sign on.

A friend of mine just started an online office supply business and she's taking on the big players there with very little capital, without any stores and inventory.

This is a completely different way of doing business. And it's all about decentralization and putting smaller people or small guys in a position to take on the big guys.

Senator Bennett. Could I ask you to summarize as we're trying to move along?

Mr. Sidgmore. Yes.

Senator Bennett. I apologize, but we have limited time.

Mr. Sidgmore. Okay. Well, I think the point is that the Internet levels the playing field like nothing has in the past. It levels the playing field between small guys and big guys in the business world, between rich and poor.

And it's very, very important that we keep the communication channels open, that we keep open what we've created here.

And the fact is that open access is really what created the Internet, open competition.

The real key questions here are how do we ensure that that continues? How do we ensure that the next generation, which will be brought on by broad-band access, how do we ensure that that gets accessible everywhere, not just in the major cities, but accessible from the small towns in the United States?

We don't think you can get there if you allow only the local telephone company to provide broad-band access or if you allow only the local cable TV company.

Yet, that looms on the horizon. And I think that that especially could be a problem for the rural environments.

So I guess, in summary, in this very, very fast-changing environment, which I think changes all the business models we know before, we have to make sure that we keep enabling new developments, we keep it free of restrictions and free of bottlenecks, and it's also important I think that we maintain a focus on keeping the competition open and keeping those pathways open all the way to the end-user.

We've got to make sure that we keep that creativity flowing.

Senator Bennett. Thank you very much.

Mr. Bahr?

STATEMENT OF MORTON BAHR, PRESIDENT, COMMUNICATIONS WORKERS OF AMERICA

Mr. Bahr. Thank you, Mr. Chairman, for this opportunity to offer our views on some of the significant issues involving the rapid introduction of technology into America's workplaces.

Communications Workers of America (CWA) represents 630,000 men and women employed in telecommunications, broadcasting, cable TV, newspapers, and in numerous other professional, technical and administrative jobs that are most affected by new technologies.

Our members have worked at the frontiers of technological change since the introduction of the dial telephone more than 50 years ago. We have embraced new technologies and tried to make them work for us.

If the United States is to be successful in the global economy of the 21st Century, we must develop an economy that encourages high-performance, high-skill workplaces.

The challenge is that such workplaces require employees who receive continuous skills training to become capable of working with evolving technologies, make decisions on the floor, and can work in teams.

This may seem a simple concept, but, unfortunately, relatively few frontline workers receive education benefits from their employers to prepare themselves for the future.

I served as Chairman of the Kellogg Foundation's National Commission for Lifelong Learning.

For two years, we examined adult learning in the United States. An astounding 75 percent of the current workforce will still be in the workforce in 2010, and many will need significant retraining to meet the requirements of their jobs.

I'm pleased that the Administration and the Congress acted on a major Commission recommendation. This was the extension of Section 127 of the IRS Code to make employer-paid tuition nontaxable.

Congress, however, only extended it until this year, and I hope it's revisited. We have solid evidence to prove that when employer-paid tuition is taxed, enrollment drops sharply. Tax-free tuition should be made permanent.

Mr. Chairman, if we are to realize the full economic benefits of future technology, ongoing skills improvement and expanded educational opportunities for all workers are a critical mission for our nation.

Organized labor plays a valuable role in meeting this challenge. Through the collective bargaining process, we have worked with our employers to develop a wide range of educational opportunities for our members.

In 1986, we established the Alliance for Employee Growth and Development with AT&T, the first nonprofit, jointly owned education and training corporation in the industry.

Workers receive fully paid tuition to train for new jobs in the company or to prepare themselves for entirely new careers outside the company.

Similar programs exist with all the telephone companies and Lucent Technologies.

Last year, we created a labor-management coalition to respond to the potential skills shortage in the United States. The National Advisory Coalition for Telecommunications Education and Learning—NACTEL—was formed to train network technicians.

Communications Workers of America, Bell Atlantic, GTE, SBC, US West, and the IBEW are part of the coalition. The Sloan Foundation gave us $1.2 million in start-up funds. We intend to create a pool of trained workers that our employers can tap to fill good-paying telecommunications jobs.

Last January, CISCO Systems and CWA jointed in a partnership with the military to train outgoing service personnel in telecommunications technology. CISCO provides the equipment and the union does the training and placement of new technicians.

Communications Workers of America's apprenticeship program with U S West provides for school-to-work opportunities for high school students who move into skilled positions.

These are just a few examples of how a partnership of labor and management can work toward upgrading the skills of Americans, and fill the jobs of the future.

And instead of expanding such programs across the board, we hear demands to allow more foreign workers in the U.S. under the H1B program.

Mr. Chairman, we reject an economy that is based on part-time, freelance or temporary employment.

The future of technology holds the power to improve our lives—on the job, in our communities and at home. Technology also has the power to de-skill, disenfranchise, and de-value work.

Our union is committed to make future technology work for our members, our employers, our communities, and our nation.

Mr. Chairman, thank you for the opportunity to present our views. I would ask that my complete testimony be entered into the record.

[The prepared statement of Mr. Bahr appears in the Submissions for the Record.]

Senator Bennett. Thank you very much. Your testimony will indeed be entered. We appreciate your comments.

Mr. Andreessen?

STATEMENT OF MARK ANDREESSEN, CHIEF TECHNOLOGY OFFICER, AMERICA ONLINE, INC.

Mr. Andreessen. Thank you for the opportunity. I've got a couple of quick points and a couple of demos.

Senator Bennett. I understand you and Mr. Berkeley both have a little show and tell here.

Mr. Andreessen. We've got dogs and ponies here.

Senator Bennett. Okay.

Mr. Andreessen. When I looked back over the last ten years, I started using the Internet in 1989 at the University of Illinois, and then through '93 and '94, when we founded Netscape, looking back over the last six years, especially commercial development, clearly in my mind, the two big factors that have led to the Internet's explosive growth and the success of this Internet economy that we're building have been these twin principles of competition and innovation.

The ability for anyone to come into the market from nowhere, right out of school, from any background and be able to compete, has been a very exciting thing.

So you see these thousands of businesses being created because of this.

I think because of these twin principles of competition and open access to the network, these twin principles, in fact, point to the future of the Internet, or at least the best possible future of the Internet, which is an Internet where anyone can participate, an Internet where everyone has access, and an Internet that is much more woven into the fabric of our lives every day.

An Internet, as opposed to today, where we sit down at the PC and we log in and we do something and we log off and that's it, an Internet of the future where, in addition to using the PC, we also have access to the Internet from lots of different devices throughout our homes, devices we

carry with us in our pockets, and many different ways to access the Internet, both over fast wires as well as phone lines, as well as radio, as well as wireless technology.

So what I'd like to do is basically show you a few examples of what we mean by this new world where the Internet is much more interwoven into our lives.

Again, just to clarify what the demo is here, we're going to show a couple of handheld devices made by different companies that you can just carry with you, put in your pocket, carry with you, and use to access the Internet from anywhere without being plugged into any wires or connected to anything.

And we do think it's important to point out that, as Bill Gates has written recently in Newsweek magazine, these devices in no way, as you'll see, replace the PC. In fact, they very much augment it. They extend the experience to be much more part of our everyday lives.

With that, the first demo we're going to look at is a demo of a hardware device called the Palm Pilot. I've got one here in my hand.

In particular, there's a new version of the Pilot that has a little antenna, which is a nice feature. What that lets you do is it lets me connect to the Internet from anywhere without being plugged into the wall.

So what we're looking at on the screen is a demo of accessing your AOL e-mail from your Palm Pilot from anywhere you happen to be.

And so we've got various messages up here from perhaps staff members. Let's look at the one from our spouse. I think that we have a message that we've been waiting for directions to a dinner engagement.

Let's see if we can get that.

So suppose we're off the Hill. We're at a meeting. We're going online. We're logging in, doing many complicated things.

And what you'll see is that the message will pop up. It will have the directions to the dinner meeting that we have to go to. They'll be right there on the pilot.

The nice part about this is that we won't have to go borrow somebody's PC to check our e-mail. We won't have to call back to the office and find somebody who can log in.

We'll just get access to it from anywhere.

And then once we're online, we will be able to then use those directions, take them with us in the car, find out the directions to the restaurant.

In the future, these devices will have the ability to actually, through Global Positioning Systems (GPS), know where we are. So they'll automatically give us directions from place to place without even having to go into e-mail.

So we're almost signed on.

This is the risk right here of doing a live demo. We have what we call the demo gods in the technology industry. And unless we make a sacrifice of virgin hard drives to them in the morning, they don't smile on us.

(Laughter.)

We're now dialing in. Let's see if we have just a minute to go and we'll plug this in.

It's important to note that this kind of capability, this ability to access e-mail from anywhere, there will be lots of other devices where you can do this.

This device is a small wireless pager that actually has a little keyboard on it. If you have really small fingers, you can sit here and you can punch in messages and you can send e-mail back and forth.

I actually used this today to send a couple dozen e-mails a day.

Also, the cellular phones that everybody carries around now increasingly have text-messaging capabilities where they can send and receive e-mail messages much like this.

We're almost there.

(Pause.)

There we go. And I'm showing you the e-mail right now. There are lots of other functions that are going to be added to these devices and services will be available.

We're in our mailbox. We're pulling up our e-mail message. And there our spouse has sent us a message—Mark, the party tonight starts at 9:00. Here are the directions.

And then at the bottom it says, try to hurry. You know how boring these things can be.

Okay. That's good.

(Laughter.)

And then we just hit reply. The other nice thing is we can confirm. So we just hit reply. We write, okay. And we just send the message back and it gets sent regardless of where we happen to be physically, whether in the back of a cab or anywhere else.

So let me just close by saying, we have lots of other examples of this, we have examples this afternoon that we hope you'll take a look at in the exhibition.

These kinds of innovations are very exciting. They're exciting because the Internet is open for access, because of the principle of open access and the telephone system.

Without that, this wouldn't exist, the Internet wouldn't exist, none of this innovation would exist, none of these companies would exist.

And so, it's a very exciting prospect.

But I do think it is important, as Scott has mentioned and as John has mentioned, if we want to preserve all of this innovation, if we want to preserve this level of consumer choice, if we want to keep prices falling as fast as they have, really make this technology available to everyone.

The role that you will play in ensuring competition and ensuring open access to these networks will probably be the most important role that anybody in the world can play with respect to that.

And it will really help us deliver the benefits of all this technology to everyone in the country and, ultimately, in the world.

Thank you.

Senator Bennett. Thank you. You make me feel like I want to go back to the days where I can get in the car and nobody can get at me.

(Laughter.)

Mr. Andreessen. That's what the off button is for.

Senator Bennett. That's what the off button is for. All right. Fine.

(Laughter.)

Mr. Berkeley?

STATEMENT OF ALFRED R. BERKELEY, III, PRESIDENT, THE NASDAQ STOCK MARKET, INC.

Mr. Berkeley. Mr. Chairman, I represent the Nasdaq stock market. Our role in life is to bring entrepreneurs and money together in risk-taking equity.

I have the wonderful opportunity of being part of the value chain of this economic prosperity that we've had.

I put up on the screen behind you a symbol of that. This is our Nasdaq website that is available to the public. It gets about 24 million hits a day.

That is an enormous number of visitors, four million separate visitors.

I mention it to you and use it as a spring point to say that this has allowed us, as of January of this year, to become the largest market in the world.

What we are doing with this technology is to allow anyone in the world, anywhere, to see what is available to be bought and sold in the market.

We've passed, in conjunction with the SEC rules that allow anyone in our market to set the inside price, rules that allow anyone to trade. If you see it and your electrons get to it first, you own it.

We have democratized this market through technology.

Now, as I look at our responsibilities, it seems to me that there are four quick things that I ought to cover with you.

1. Some concerns that we have about keeping the companies that trade on our market competitive.

2. Some things about keeping our market itself competitive.

3. Some issues about the competitiveness of our workforce, and

4. Some issues about the nature of our nation's commitment to research and development.

Most of the Nasdaq companies that you read about in the news started somewhere, perhaps in a garage or a university, based on technology that was initially funded by a university or a Federal laboratory or a military service.

We have a tremendous cornucopia of benefits that have come to the Nasdaq market starting with that basic federal research and development.

Let me tell you what I think we're concerned about as it relates to companies.

First, we are concerned about maintaining strong intellectual property protection.

We would like the Database Piracy Protection Act that Chairman Coble in the House Judiciary Committee has proposed to be passed, or

in the alternative, Chairman Bliley in the House Commerce Committee has a bill on database protection.

Chairman Bliley's bill is specific to stock markets. Chairman Coble's bill is more general.

We would like those kinds of protections adopted, not just for ourselves, but for the whole corps of our companies.

Secondly, we want the Senate and the Congress to remember that it is employee stock ownership, broad employee stock ownership, that has created the incentives that have made these companies attractive places to work and that have released the entrepreneurial zeal of our companies.

We would like stock options to be protected.

Thirdly, we want protection from an entrepreneurial and what we consider often unreasonable plaintiff's bar.

The Year 2K is a major issue that is coming up. We believe it would be very reasonable to have the bill that has been proposed and passed not be vetoed.

In other words, we ought to allow companies to have a cure period. We ought to allow suits to proceed only if there have been real damages. And we ought not allow tremendous damage claims to be made simply based on large class-action suits alleging generalities.

We would like the ability for our companies to respond quickly to change.

The Federal Accounting Standards Board (FASB) is proposing to tinker with some of the accounting rules that have allowed our industries to grow great.

You heard Mr. Bahr talk about his partnership with CISCO. CISCO has created an enormous company and a larger number of jobs and it is a national resource and a national treasure. It did that by combining technology companies, again, and again, and again.

The new rules would effectively obviate the ability to do that. They would bar poolings.

Finally, we would like to have the export control restrictions addressed, as Scott McNealy discussed. We think the issue that he brings up is quite real.

Let me talk to you about two quick issues on keeping our markets competitive.

The first is that we need to have a level playing field domestically.

You may not know it, but companies are precluded from leaving our competitor and coming to us. We have a free market philosophy. If we're not serving our companies, they should be free to leave us.

We would like Rule 500 of the New York Stock Exchange erased.

We would like also to make an impact on the workforce issue. I would like to tell you, Senator Frist and Senator Rockefeller have been briefed on this before at a meeting they attended at the Council on Competitiveness.

We are backing a World Wide Web-based self-assessment testing program that would allow any student anywhere in the country to sign on to the web, be tested in the courses that they are taking, and be told where they stand nationally and internationally.

These are not high-risk tests. No score is kept. You're not jeopardizing your ability to get into college.

But it would tell you what that local B plus or A minus means and, on a world scale, it might actually be a D. And this will empower students and their parents to understand what that local education is really doing for them.

We believe this should be sponsored by our high-tech community. We believe that it is something that gets around all of the issues of government testing, but we believe the World Wide Web is a great enabler to make this possible.

Finally, with respect to R&D, we want our companies to have some certainty that the dollars that they spend in research and development will be able to be effectively used.

We would like them to be able to write off their research and development expenses immediately.

We do not want research and development to be forced to be capitalized in the event of mergers.

And finally, I wanted to show you quickly another project that the Nasdaq has been very interested in. This was started at Johns Hopkins. It is a database created by a group called the Community of Science, www.cos.com, which is an attempt to bring together science and money.

To my knowledge, it is the largest database of money available for science. There are over 220 American universities and 600 international universities whose scientists have given first-person narratives saying what they're interested in having funded.

We have over 15,000 funding sources available. And all we do is do what a dating service does and tell one about the other.

Thank you for the privilege of addressing you. I will stop.

[The prepared statement of Mr. Berkeley appears in the Submissions for the Record.]

Senator Bennett. Thank you very much. I appreciate that.

The Senate is now in the midst of a vote. Senator Mack has gone to vote. And when he returns, he will take the chair and I will go to vote.

But the exodus that you see of members of the Senate has nothing to do with our interest in the subject or our gratitude to all of you for coming here.

Since I will be leaving very quickly for the vote, I'll take the opportunity to ask a few questions before I go.

Mr. Berkeley, I'm very interested in your disclosure here about the testing side of the it.

One of the issues that we've heard over and over again for the last two days has been education. Mr. Bahr made reference to that, how education must be a lifetime experience, learning must be lifetime, as this rapidly moving situation in which we find ourselves can render some skills obsolete and leave a worker who has done everything right in his or her life, suddenly facing a very bleak economic situation, as his industry is wiped out or his job is destroyed.

So one of the question arises, of course, of standards and accountability. And we've had discussion in the past couple of days about the role of government and what we ought to be doing there.

Of course, we had Secretary Riley here to discuss that.

Now, let me understand what you're doing here. Anyone can log on?

Mr. Berkeley. Yes.

Senator Bennett. So a parent or a student or a teacher or a counselor can say, well, let's find out what your reading level really is?

Mr. Berkeley. Yes. Starting with eighth-grade math and science, we're building a prototype now. A number of Nasdaq companies, plus Eastman Kodak and Lockheed Martin, have contributed to a total of about $300,000 of development effort.

We expect to have that prototype finished in a month or so. And then, if it looks good, we're going to go to our companies and say, let's sponsor this. Let's get it out there. Let's let the world see.

I also went to Singapore and asked the government of Singapore if it would help us, using some of their test data. They scored best in TIMS. We have a substantial and high-powered advisory committee making sure that we do this right.

Bruce Alberts is helping us with some of the technical talent that the government has.

Yet, we believe this should be a free enterprise endeavor because we can move much more quickly.

Senator Bennett. So Mr. Bahr could take some of the groups with whom he has worked?

Mr. Berkeley. We would welcome his knowledge about what we're doing and participation and partnership in this.

We believe this is such a simple idea. It's so subversive in its own way. It empowers the student and the parent and the teacher to know exactly how effective they're being in what they're learning.

And the key that it is not based on what you should know against someone's arbitrary standard. It's based on how good are you versus all the people who are tested, so that you have a realistic, bottoms-up perception of where you stand.

This is both nationally and internationally, because this is a global issue.

You might say, why is Nasdaq doing this?

Nasdaq is doing this because CEO after CEO of our companies is telling us, "we've got to do something about this workforce issue."

Senator Bennett. Yes, we've heard that over and over in these hearings, that our biggest challenge—there are 400,000 jobs for whom there are no applicants currently in this industry.

Mr. Berkeley. Yes.

Senator Bennett. These are high-paying jobs and it's very frustrating to everybody to be unable to fill them.

Mr. Berkeley. Right. Well, we would be glad to give anybody who would like on this panel all the time it takes to take them through these basic concepts.

There's a corollary to this, Mr. Chairman. And that relates to the curricula in the United States.

I sent Secretary Riley a few weeks ago a report that was published by a group, I believe it was called the American Council on Research. They looked at 20 curricula that are being used in the United States.

It turns out that only three of these curricula have had the serious, rigorous academic testing to show that they're effective.

Most curricula in the United States are someone's toy. They're being foisted off on schools in an experiment that we wouldn't dream of taking were these curricula drugs.

If someone said, you can take a new prescription without the FDA approving it, we'd be up in arms. But every day, we allow new curricula to be foisted off on our students and modify the lives of thousands of people.

The kind of curricula that we need are the ones that have met the rigorous test of proven results.

I recommend that you all look at this report. There is one that I particularly note called Direct Instruction that comes out of the University of Oregon at Eugene that is one of these three effective ones.

Another is Success For All, which is a derivative of Direct Instruction.

There's only one other curricula besides those two in the United States that have been tested to be effective over long periods of time.

Senator Bennett. Thank you very much. I'd like to pursue this with you outside the Committee because it's an area of great interest to me.

Mr. Sanford?

Representative Sanford. I guess two questions for Mr. McNealy, or really, any on the panel that would feel comfortable with it.

The first question goes back to the skeptic in me. And that is this whole notion of there being a new paradigm in terms of American productivity tied to information technology.

In fact, I guess it was Mr. Sidgmore that talked about Amazon.com. And yet, it was Barron's that had an article—I think it was the front cover, not this last issue, but the issue before last. It was called Amazon dot bomb.

It basically made the case that while there may be a new paradigm in investors' minds in terms of valuations with a lot of the Internet stocks, that in fact, gravity always works and that these things will come back to reality, sooner rather than later.

What's wrong with Barron's argument that says, no, this doesn't make sense?

Mr. Sidgmore. I don't want to defend Amazon.com. It's not my job.

But I will say that I think there's a fair argument to be made and Barron's made it, which is that the valuations of these companies are too high.

But that is a very different thing from saying that this is not a new paradigm.

I do think, and I think it's widely held today, that there is a new set of players coming into the world that are going to be the future of commerce.

Now whether they're worth $12 billion or a billion dollars or something more rational is a whole different story.

But I think the Amazon.coms, the eBays, there are just dozens and dozens of these that are starting to work.

And as you see the Internet economy grow, you're going to see it more obviously this Christmas than last Christmas.

It's estimated at hundreds of billions of dollars today. It's a small percentage of the total economy. But it's still huge.

And I think by the time the end of this year runs around, I think there will be very few skeptics left in that element.

Whether those stocks are worth what they're getting traded at is a different, different piece.

Representative Sanford. Mr. Berkeley?

Mr. Berkeley. Let me add a little perspective. I don't know if you want Scott to talk or not.

But you have to understand that this is the fourth or fifth of these types of investment surges that we've seen.

Someone asked me if the Internet was a bubble. And I said, no, I think it's a foam—millions of small bubbles.

But the real point is that when you first looked at something on the Internet and realized you could go anywhere, you had a reaction that said, wow, this is really neat. This is really something.

Well, I'll tell you that my grandfather had that same reaction when he turned on his first electric light. Or when you picked up the first telephone. Or when you got on your first railroad train. Or turned on your first radio or turned on your first television.

In every case, we've had a dramatic, enthusiastic investment in that technology.

As one of my international visitors said—you know, we get international visitors at Nasdaq about every two weeks, saying, how do we get one of these entrepreneurial American economies in our country. As one of my international visitors said to me, the point is not whether any one of these companies fails or succeeds. But what you people in America are doing is quickly installing a true Internet infrastructure, just the way you installed a railroad infrastructure, an electric utility infrastructure, a radio infrastructure, a telephone infrastructure, a TV infrastructure.

So I really don't care whether—well, I care what happens to my Nasdaq companies, obviously, but I really don't care in a broader perspective if any one of them fails because they will be merged and we'll go through a period of ultimate consolidation.

The country will come out with a new way of doing things.

Representative Sanford. On that front, and I see I'm quickly running out of time here, is the educational impact to the Internet and all this technology overstated?

In other words, knowledge is not reasoning. And it seems to me that a lot of kids these days, they may be able to flip on a computer and they may be able to surf the web and see all kinds of different pieces of knowledge, and yet, not be able to reason.

I think the basics of math and English, the ability to learn how to learn, is a more important thing than, frankly, turning on a computer.

Mr. Berkeley. I agree with you. And I think that, to use an analogy in the brokerage industry, the web is changing our industry dramatically.

If the stockbroker thinks that his value added is giving out quotes at lunchtime, he's history. He's going to have to do more reasoning. He's going to have to add more value.

And I think that's going to be true in education. We're going to value the higher-level things.

Representative Sanford. The last question. I know I have to turn it over to my peer.

Mr. Bahr. I'd just like to move a little further on your last question, Congressman.

For years, we stressed the need for math and sciences. While that need is obviously still there, the new work places, the high performance work places, require liberal arts.

There's a great need for oral and written communications, the ability to make quick decisions on the floor, the ability to interact and work with others.

And so far as the issue of productivity, I want to deal with it from the realities, not that a company goes broke and it will show up somewhere else. Because we deal with the human being aspect.

In Lucent Technologies, for example, if Lucent does not double its business every three years, we lose jobs. That's how you measure productivity. Now, fortunately, they've been doing it.

On the operating side, if it wasn't for the continual innovation of new services, there would be a reduction of jobs rather than the growth that we're seeing.

So I feel very comfortable that the productivity in the industry is rising, will continue to rise. Nobody knows when it reaches a peak.

OPENING STATEMENT OF SENATOR CONNIE MACK, CHAIRMAN

Senator Mack. Mr. McNealy. Mr. McNealy, I think you wanted to respond.

Mr. McNealy. Yes. I was going to offer a couple of perspectives.

One is I think the Internet is an incredibly valuable and very important knowledge and educational device. I have a personal experience.

My father was facing a fairly serious medical situation and the empowerment that he had by being able to go out on the Internet and research his particular disease was just fantastic.

And if anybody has ever had a loved one who was facing a tough issue and they can go out and actually research this stuff and actually go into the doctor and not be just at the total mercy of the doctor—the knowledge—I think if you talk to most doctors, they are amazed at how often the patient knows as much or more than they do about any particular disease.

I just think that we think about some of the more popular notions or public notions about how people use the Internet to go surf and search, as opposed to people who are really using this thing in a way that they couldn't normally use.

And I would also like to offer that I think we focus too much on getting schools connected. We're spending a lot of money and taxing phone calls to be able to wire every school, all the rest of it.

I think the government has an opportunity, one, to drive testing, but, two, to put the investment in online distance learning-based, self-paced curricula.

The problem today is that if you put a telephone in every classroom, that's not going to educate students more. If you put a TV in every classroom, that's not going to educate them more. And if you put an Internet terminal in every classroom, that's not going to educate them more, unless there is investment in online, self-paced, interactive training capabilities that are proven effective.

And so, I couldn't agree with the panel more on this one. I think government dollars ought to be put into this.

The problem with software and content developers today is they are tending to develop applications for web sites that are commercially-oriented, private-enterprise, P&L kinds of things.

It goes back to the statement—why did so-and-so rob the bank? Because that's where the money is.

So why do you develop applications for noneducational, rather commercial, environments?

Because that's where the money is.

So the opportunity to get some funding for developers to go create content that will educate third-graders, eighth-graders, and college kids, putting that on an Internet web site for free as a government asset that is available to all school systems worldwide, I guarantee you, every school system in the United States will get access to that and make that curricula.

If it's there, if it's good, if it's effective, if it's proven, if it's available, they would go find a way to get that down to their classrooms.

So I think we're kind of going cart before the horse. We should get on-line curriculum and testing funded and on the education web site in Washington, D.C.

Everybody will come and get it then.

Senator Mack. All right. Well, thank you very much for those comments.

Mr. Minge?

Representative Minge. Thank you, Mr. Chairman.

I have two questions I'd like to ask. The first has to do with trade, jobs, visas and opportunity.

Mr. Bahr, I'm very interested in your perspective and others on the panel, as to how do we find a balance between the opportunities that we have for international trade exports—whether it's software, hardware, or whatever the technology of the product might be—and what that creates in the American economy.

And then balance that opportunity against how we're fair to American workers, to make sure that we've established workplace protections and rights here are not compromised by our relationship with other countries that may have no such protections.

Yet, we're trying to somehow build this into a greater and greater international economy, integrated employment opportunities.

Mr. Bahr. Well, the position of the AFL-CIO has been oftentimes misinterpreted.

The position is not one of protectionism.

We say that our trading partners should play on a level playing field. While we say that there should be a minimum wage, for example, we don't say what that minimum wage should be in another country.

When we talk about child labor, everybody knows what we're talking about. And I see that there's more and more discussion now on the elimination of child labor.

When we talk about the environment, I think it's clear what we mean.

So, really, what we seek is a level playing field with our trading partners. Open trade on those bases, fair trade.

Representative Minge. That's helpful. So it's not an anti-trade approach. Instead, it's one that advocates for a level playing field and promotes trade in that context.

Mr. Bahr. That's correct.

Representative Minge. Okay. Thank you.

The other question I'd like to ask goes to our witness by tele-link-up, Scott McNealy.

I was very interested in your comments about antitrust. As you know, we had Mr. Gates with us yesterday. We're not here to somehow second-guess the litigation that's in progress.

But I think there's a keen concern that exists in the American economy over the accelerating pace of combinations and mergers and the resources that the Justice Department and the Federal Trade Commission have to adequately monitor what's happening, review these cases, assess

them, determine what their policy will be, or their positions will be in those two agencies.

And could you please expand on your very brief comments about the open trade problems we face and the anti-trust issue that we face with this sector of our economy?

Mr. McNealy. Yes, I'll try to do that. Obviously, there have been more words written about the DOJ case with Microsoft than we could certainly address here in a very short period of time.

I think the big issue that everybody needs to stay focused on is, do consumers have a choice? Do they have an opportunity to compare?

I think if you all go back to your offices and look and see what you have on your desktops, you probably have a Windows machine running Microsoft Office.

And in fact, a lot of the government business is probably buried into Microsoft Office formats —Word, Excel, Powerpoint—and applications that run, and only run, on Microsoft environments.

That's a lack of choice. There is no choice.

When you get to 90, 95 percent market share, you're not talking about choice—and especially with something that is as fundamental as the written and spoken language of computing.

Wouldn't it be great if you owned English? You could make a lot of money charging $249 for the right-to-use to learn, read, write English. And then when you add new alphabet characters, to charge upgrade fees when you add characters like N and T.

And I think we don't really understand what the cost is because we aren't running the other experiment.

In East Berlin and West Berlin, we ran a perfect experiment across the wall of a market economy versus a planned economy.

Monopolies are all about planned economies where we have somebody setting the rules. Unfortunately, there aren't people out there—when was the last time you heard about a new OS start-up or a new office productivity suite start-up?

They aren't happening.

Out of the six billion dollars of venture money here, you can't get anybody in California here to fund a new office suite start-up. It's just not happening.

We're not getting the competition. We're not getting the choice.

I think those are the places.

With such an enabling technology, I think the DOJ is right to be working this one and to be spending resources on this one because the written and spoken language of computing is such an enabling technology that I don't think any one company should be able to set prices discriminatorily, should be able to do bundling tactics that basically allow it to buy products and bundle into their monopoly and do that.

Or buy upstream, as I mentioned, in the Standard Oil case of buying stations.

These things need to be scrutinized.

One of the things that I think people find unusual is we're not arguing for a break-up of Microsoft. I think it would have been bad to have broken up IBM. We have a great company today in IBM that's doing very well and has certainly survived quite nicely the scrutiny of the DOJ.

We're not arguing to break up Microsoft. It's a great company and it's a great opportunity for the U.S. economy.

But they ought to be scrutinized so that their behavior does not limit consumer choice.

It's not about Sun versus Microsoft or anybody versus Microsoft. It's all about the consumer having a choice, and Microsoft not leveraging their monopoly position into the appliance space with CE.

Would AT&T really be using CE if they hadn't gotten a five billion dollar investment from Microsoft? And all about Microsoft leveraging into the server room, into the switch room, if you will, of the web tone environment by using their equity investments into the cable companies, into the telecommunications companies, who wouldn't normally put that technology in there, except that they're getting monopoly of the equity investments.

Those issues need to be scrutinized very, very carefully.

Representative Minge. Thank you. I see my time is up.

Senator Mack. Mr. Larson?

OPENING STATEMENT OF REPRESENTATIVE JOHN B. LARSON

Representative Larson. I'd like to follow up on the infrastructure concerns that were addressed, both by Mr. McNealy and by Mr. Berkeley, and will seek to get more input about the testing mechanism.

Mr. McNealy, I believe you were saying that Congress should not look at investing, in terms of infrastructure, in the connectivity between our schools.

Everything that I've read and learned and come to believe is that there is this vast digital divide between those who have access to information and those who do not.

I think our public education system especially is at risk here in terms of not being connected.

Only the very affluent and wealthy, it seems, in a lot of communities are connected.

Am I misreading what you're saying? Are you saying that there is a need to put the cart before the horse here with curricula, online curriculum-based education?

Mr. McNealy. Well, in fact, the schools are getting wired. In fact, there are just literally hundreds of thousands—Sun invented and pioneered a concept called Net Day, where we got together and facilitated a whole bunch of industry partners who went, in fact, around the globe and in fact, most states have had Net Days over the last few years.

We've wired tens of thousands of schools.

Representative Larson. I headed the one up in Connecticut.

Mr. McNealy. About 50,000 schools and libraries have been wired with 500,000 volunteers here in the United States alone. In fact, we've expanded that internationally.

Schools are getting wired. They are wired up.

I think the problem is that once you get the wire into the school, who cares? So what?

I think very few of us feel great about our elementary or high school kids sitting up in their room out on the Internet. That doesn't make them better students.

Now, hopefully, they're reading more than they are watching TV, so there are potentially some side effects or by-products of being on the Internet that are positive.

But I believe that without—it's kind of like building classrooms without textbooks, is kind of what we're doing. We're building a virtual online classroom without teachers, without textbooks, without a curriculum.

It just isn't useful.

In fact, there are lots of bad things that they can be doing out on the Internet that are actually taking away from good, positive schooling time, learning about reading, writing, and arithmetic.

So that's my big issue.

I just wish we would—I think industry and communities will get their schools online if there's a very, very good reason. And I don't think that's where government necessarily needs to step in.

Representative Larson. Do you think that any superintendent, it was mentioned here before about technology outpacing or eclipsing itself?

Depending upon whom you talk to, it's every three and a half months or every six months.

My concern is what superintendent of schools, and having come up through the process, or any individual educator is going to make an investment in technology where he's held to scrutiny by his board of finance that eclipses itself?

And if there isn't some ongoing means of maintenance or some source by which we're going to be able—ultimately, I agree with your sense that we need to have the curricula first, that we certainly need to have teachers that are trained in this digital economy, or multi-faceted trained in our colleges and universities so that they can use voice, video and data and integrate that in the classroom, the object being to individualize instruction and be more diagnostic in their approach and put the human face necessitated by a teacher, within the context of the classroom.

But how do these individual superintendents of schools make these decisions when the technology is changing so rapidly?

Senator Mack. Mr. McNealy, let me just ask you to give this response very briefly, because I've got to go to other Members and then move on to the next panel.

Thank you.

Mr. McNealy. Well, again, I think this is where state, Federal and local government efforts can help in terms of amassing resources across a broader group of people so that you can get the economies of scale and shared experiences.

I don't think any particular classroom or even school can keep up with the technology and the investment required to build this online content.

And so, I think that that's where, again, the Federal Government has an opportunity with a checkbook that certainly dwarfs any community, to go create standardized testing and standardized curricula that can be used as a basis to customize things for local communities based on need.

Senator Mack. Mr. Watt?

OPENING STATEMENT OF REPRESENTATIVE MELVIN L. WATT

Representative Watt. Thank you.

Senator Mack. And Mr. Watt, before you begin, let me just advise everybody of the situation.

We're running a little bit behind time. I'm going to move to the next panel after your question. I apologize to Members for not having the opportunity to ask this panel.

I actually apologize to the panel for the confusion this morning. I've had to be at a mark-up on some trade issues, very important issues.

We've had several votes on the floor of the Senate and we're doing our best.

But, Mr. Watt, if you will ask your questions.

Representative Watt. Thank you, Mr. Chairman.

I want to address my question or questions to Mr. Berkeley, if I can get his attention.

Mr. Berkeley. You have it, sir.

Representative Watt. There has been a substantial amount of value creation over the last ten, 15 years in the technology field.

I'm wondering whether anybody has done any kind of ballpark numbers on that value creation in terms of stock values and actual market values.

Mr. Berkeley. Yes. I can certainly get you those numbers. I don't have them on the tip of my tongue.

I will tell you that when I first came to Nasdaq in 1996, I asked for a study to understand the impact on job creation in the United States. And while this is—

Representative Watt. I'm not talking about job creation. I'm just talking about economic value at this point.

If you could get me that information, I would certainly appreciate it.

Mr. Berkeley. I'd be glad to do that.

Representative Watt. It kind of lays the foundation for a series of questions.

I take it—and I think you alluded to this in your presentation—that the Federal Government has set in place some infrastructure to make it possible or to facilitate that value creation.

And you made reference to some of those things—Federal research and development, which in fact started the whole Internet process—training dollars, the framework for—antitrust creates a framework.

Mr. Berkeley. The rules of engagement.

Representative Watt. That keeps the rules of engagement there. And you asked for more, and permanent research and development credits.

All of those things I'm fully in accord with you on. But then you went on to one that I have some trouble with. It's there that I want to address my question.

And that, one of those Federal infrastructure rules of engagement, if you will, has been in the area of balancing the risks and the rewards, or should I say the rewards and the risks.

One way of doing that has been through our tort law process that has been in place for years and years and years, and through our contract law that has been in place for years and years and years.

I notice that one of your points was that we ought now adjust those laws to accommodate this particular industry and to accommodate the Y2K issue.

And I want to take some issue with you on that, especially in light of the fact that all of this value has been created. And that, along with that creation of value comes an assumption of risk, in a framework that has been well defined for years and years.

And just like you would not, as you said, impose a curriculum which has not met the test or rigorous results—those were your words, I believe—

Mr. Berkeley. Yes.

Representative Watt. —it seems to me that we run some risk of imposing a whole new tort and contract law regime that has not run the test of time and the rigorous test that our existing tort law has been subjected to.

How do you defend basically making an exception to well-established tort and contract law theories in one particular situation, especially in light of the fact that tremendous values and economic wealth has been created?

Shouldn't it be the market and the well-established laws that are defining those risks, rather than some new untested theory that we might put in place?

Mr. Berkeley. There's no more ardent advocate of the sort of democratic disciplines and give-and-take that you discuss that have come about and given us the tort laws that we have now.

We believe, however, that the Year 2K is not a well-established issue. It is a new issue. We've actually never run across it before.

And, no matter how skillfully we craft legislation on the issue, there is ambiguity in it which has not yet worked its way through the courts and the rest of this process to bring that standard set of reasonable laws to bear on a new issue.

So we are concerned that entrepreneurial law firms seek to push aggressively into this new, gray, undefined, unexplored, undisciplined area of liability.

And, in fact, tie up the resources of the industry and the management of the industry in hours and hours and weeks and weeks and months and months of defensive litigation.

Representative Watt. But I think any tort litigation takes time. It's based on the theory of negligence and contract law is based on what the contract said.

Every new case is a new area in some respect. What's wrong with the existing laws that we have in place insofar as this particular issue is concerned?

Mr. Berkeley. Well, in this particular issue, it was never contemplated in the contracts that people put in place years and years ago, when software was developed, that it would ever be used this long.

There's nothing in most of the contracts that we have at Nasdaq until recently that address the issues of the millennium.

Representative Watt. Thank you, Mr. Chairman.

Senator Bennett. Thank you very much. We could usefully spend the whole day with this panel.

But, as is always the case, we have another one waiting and we need to move forward.

Let me thank each of you. Let me thank the Members for their thoughtful questions, and we'll move to the next panel.

Mr. McNealy, thank you again for your willingness to participate in this way.

Mr. McNealy. Thank you.

Senator Bennett. Mr. Carlucci has an appointment that requires him to leave and so, we will hear from him first.

We apologize to all for the fact that we are running behind. It's a combination of the Senate's schedule and other things that has put us here.

I would ask each of you to recognize the time limit. I perhaps was too loose in the last panel in letting the red light go on and stay on a little longer than maybe it should have.

But if you can come as close to the timing of the lights in your opening statement as possible, we would very much appreciate it.

Frank Carlucci will be the first member of the panel. He is Chairman of the Board of Directors of Nortel Networks and an old hand at testifying before Congress from his previous incarnations.

Then we'll hear from James Morgan, who is Chairman and CEO of Applied Materials.

Mr. Morgan, like Mr. McNealy, will be with us by videoconference..

Then we'll hear from Gordon Binder, CEO of Amgen.

Esther Dyson, Chairman of EDventure Holdings.

Dr. Lester Thurow, who is Professor of management and economics at MIT.

And Mark Benerofe, Executive Vice President and Chief Marketing Officer of Priceline.com.

So we'll go in that order. Mr. Carlucci, we appreciate your being here and appreciate your patience, as we do all the members of the panel as we've gone through the other panels.

In a way I don't apologize because we've learned a lot from all of these panels. This has been a very worthwhile experience for the Congress and I hope for those who are watching.

Mr. Carlucci?

PANEL II

STATEMENT OF FRANK CARLUCCI, CHAIRMAN, NORTEL NETWORKS

Mr. Carlucci. Thank you, Mr. Chairman, members of the Committee. It's a pleasure to be invited to speak before this very important hearing.

Nortel Networks is one of the world's largest suppliers of digital network solutions and it is the most broadly diversified developer of high-capacity switching and optics technology.

We are at the heart of the Internet. Over 75 percent of all Internet traffic travels over Nortel Networks infrastructure.

We're a global company with a presence in over 150 countries, where we work with customers to build and deliver communications and IP-optimized products and networks or what we call "Unified Networks."

No other company in the world can deliver global applications and services that merge new and existing networking elements and technologies into a seamless open network.

While we have a Canadian heritage, our U.S. presence has been steadily increasing over the past 25 years and we have had more employees here than anywhere else for a number of years.

Since our merger with Bay Networks of Santa Clara, California last fall, we are an even stronger U.S. company.

About 35,000 of our 75,000 worldwide employees work in our U.S. facilities.

Nortel Networks has an invested base in the U.S. of $10 billion and growing. Fifty-six percent of our 1998 revenues were generated in the United States. And we export over two billion dollars from the U.S. each year.

All four of our business units are based here. We have state-of-the-art centers, including R&D development, manufacturing, semi-conductor and software engineering facilities in California, Colorado, Connecticut, Florida, Georgia, Illinois, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Carolina, Tennessee, Texas and Virginia.

On the first two days of this High-Tech Summit, you heard about the industry's impact on the U.S. economy. Today, we at Nortel would

like to take advantage of your request to demonstrate some technology by giving you a little glimpse into the future.

Our choice is the next generation of payphone.

Nortel Networks unveiled the NetVenue e-commerce kiosk on June 8th. NetVenue enables consumers at airports and other public places to access the Internet, send and receive e-mail, purchase a concert or airline ticket or make a telephone call from an interactive public, multi-media kiosk.

As you can see, the kiosk includes a touch screen and a phone. It also has a printer to provide consumers with a receipt for a purchase or reservation or directions to their destination.

It allows consumers—

Senator Bennett. What should we be seeing? All I'm seeing is a commercial.

Mr. Carlucci. We'll walk you through the demonstration, Mr. Chairman.

Senator Bennett. Okay.

Mr. Carlucci. It allows consumers to conduct business transactions that would have required in the past a trip across town or a long wait in line.

For the demonstration, we've set up applications appropriate for an airport.

When not in use the Nortel Networks NetVenue kiosk displays messages designed to draw the user to the device. Once at the terminal, the user touches the screen to start the device. The user is then presented with a number of applications. These applications can range from information-gathering, web-browsing, to e-commerce.

For instance, I am at the airport when I realize that I have forgotten to buy a present for my wife for our anniversary—not the first time this has happened to me.

(Laughter.)

Using NetVenue, I can send flowers to her by simply touching the screen. I'll be prompted through an e-commerce transaction in minutes.

In this example, I have a choice of bouquets and accompanying cards. At this point, I enter my wife's name—hope you get that right, John.

(Laughter.)

And her address, the delivery date, and whatever message I want to send.

Senator Bennett. Can you send her a short greeting?

Mr. Carlucci. It is a short greeting. I think it's two words, Mr. Chairman.

(Laughter.)

And the machine responds and confirms the message, including the total cost of the flowers.

And then the machine prompts the user to select the method of payment. I chose to use a VISA card and we swipe it through the reader. I think, John, you've already done that.

The credit card is verified through an online credit card validation service. If the card is valid, the transaction is completed and a receipt is provided. The flowers are delivered.

At any time throughout the transaction, I can call the flower shop by telephone by simply touching a button the screen.

I now can use the machine to book a hotel reservation. I am connected to Marriott's web base hotel reservation service and it allows me to do this. Once my hotel reservation has been made, I decide to take a shuttle service to the hotel using a specially designed application.

I select the number of tickets I need and the transaction is completed with the payment of tickets using my credit card.

My credit card is verified and at the end of the transaction, the ticket is printed that will allow me to board the shuttle.

By combining several applications, we provide greater value to the user. And for those of us who are accused of never stopping to ask for directions, we can get these from the machine as well. The machine will print them out and no one will know.

In this case, NetVenue knows that I just bought a shuttle ticket. I can be directed to the mapping application which would help me locate the shuttle pick-up area.

Then before boarding the plane, I access my e-mail and respond to my messages.

The terminal can also function as a public pay phone and works by simply lifting the receiver or pressing the payphone button on the screen. I can place an 800 call, use a calling card or whatever.

NetVenue is different from other kiosks because it uses a nonproprietary open-platform, which allows service providers to easily create their own content and specialized e-commerce applications.

The types of web-based applications that could be provided are restricted only by your imagination and the ability to set up business agreements with service providers.

This, Mr. Chairman, is just one example of the new and exciting technological changes that are altering the way we do business, the way we socialize, and the way we live.

To ensure that we remain on the cutting edge, we invest in the future by spending 14 percent of our revenues on R&D, one of the highest percentages in the high-tech industry.

In closing I would note that there are three things that you as leaders of this nation can do to ensure that we remain a high-tech leader.

And I know you've heard these before, but I'll make them just for the record.

And that is, to make the R&D tax credit permanent. The off and on has been going on for eight years and R&D is not a short-term operation.

It's very important, so we would ask that you do this.

Second is Y2K legislation. You're working on this and we very much appreciate it.

The greatest threat to our company is not that our technology will not be Y2K compliant. We spent $130 million and expect to spend another $25 million to make us compliant and to make sure that our customers have the software they need to be compliant.

We have no problem with our technology. What we are threatened by is the prospect of lawsuits which have no merit. We fear that our high-tech competitiveness will be significantly harmed by the drain of R&D and other resources from the potential explosion of Y2K legislation.

I urge you to adopt legislation which will, at a minimum, ensure that corporations who have made every best effort possible to ensure they are Y2K compliant, will be able to address the Y2K issues in a reasonable manner before they are sued.

And I know you are working in that direction.

Senator Bennett. We passed the bill yesterday.

Mr. Carlucci. Yes, sir. I know. And we think that's very constructive.

The final point I would make is on export controls. And I'll be testifying before the Banking Committee on this tomorrow. We need to be very careful here not to place broad export controls on technology which is simply not controllable or which is available elsewhere in the world. The result would be to threaten our high-tech leadership position.

We need to identify precisely those categories of new technologies that we are confident have important military uses and then seek agreement by our partners multilaterally to control these categories.

Mr. Chairman, I have attached to my testimony some documents which expand on these policy issues and I thank you for this opportunity to appear before the Committee.

[The prepared statement of Mr. Carlucci and accompanying documents appear in the Submissions for the Record.]

Senator Bennett. Thank you very much for your presentation.

Mr. Morgan?

STATEMENT OF JAMES C. MORGAN, CHAIRMAN AND CEO, APPLIED MATERIALS, INC.

Mr. Morgan. Thank you, Mr. Chairman, and I thank the Committee.

My name is Jim Morgan and I am the Chairman and Chief Executive Officer of Applied Materials, a global company headquartered in Santa Clara, California.

Thank you for inviting me to take part in this Summit today. Hopefully, by taking the time to examine the emerging industries of the new economy, we will be able to forge some high-tech policies more conducive to the high growth, high return industries that are helping to lead America's economy into the 21st Century from a position of strength.

Applied Materials is the world's largest maker of semi-conductor manufacturing equipment. We develop and manufacture the multi-million-dollar sophisticated systems that are used around the world to produce semi-conductor chips.

Some of you saw our capability during your visit to Applied Materials last fall. This is an example of one of the systems we produced. Systems like this one take thin wafers of silicon and perform the complex processes and steps necessary to create the millions of micro-structures that make up semi-conductors.

These wafers are then sliced into small pieces to become individual semi-conductor chips.

We conduct nearly all of our R&D and manufacturing here in the United States and export about two-thirds of everything we make.

For our purposes here, it's easier to remember that Applied Materials makes the systems that make the chips that make the products that change the world.

Nearly every chip in the world passes through a piece of Applied Materials equipment during the manufacturing process. So you can say that every time you log onto a computer, surf the web, place a call from a cell phone, you benefit from technology created here at Applied Materials.

And of course, Frank's example required the utilization of a significant number of chips.

By providing key enabling technology, Applied Materials has figured into some of the most significant break-throughs of the information age.

Aided by Applied Materials' achievements in processing technology, Moore's Law of increasing chip capacity has held true for decades.

The micro-processor alone has improved its performance 7000 times in 25 years. Right now, we're working on manufacturing solutions that the world's leading chip makers will put into practice several years from now.

In the past few weeks, you might have heard of the latest generational change that our industry is launching. For the past half-dozen years, the standard of chip-making has been a 200-millimeter silicon wafer, shown here.

Hundreds of labs around the world are processing thousands of these wafers even as we speak. Now the standard is shifting to 300-millimeter, like that shown here.

Basically, the whole industry will advance from a salad plate to a dinner plate size silicon wafer.

Why do we do this?

Basic economics. You can get two and one-half times the chips on the bigger wafer. And what do you have to change on the technology side?

Just about everything.

At Applied Materials, we've been working for several years in our own labs with our customers to develop a full line of 300-millimeter systems that will allow our customers to switch rapidly and confidently to the new larger wafers.

It took a massive investment in R&D from us. Last year alone, we spent over half a billion dollars to move forward the many required technologies. And we are only one company in our industry.

And what will be the result for you and me?

Cheaper, more powerful chips that can be more efficiently manufactured by American companies like Intel, Motorola, IBM, Texas Instruments, and Micron.

This is merely one example of the kinds of transformational change that takes place all the time in the semi-conductor industry.

In technology, progress is a process of connecting known things to one another to achieve new outcomes. And the semi-conductor itself is a child of many of these innovations.

So is the Internet. The Internet is a technology of technologies. It is a product of everything that we've been working on here in Silicon Valley for the past 30 years. The Internet stands as the culmination of a generation's work in high technology up and down the food chain, from Yahoo to CISCO, from Intel to Applied Materials.

Thanks to the Internet and its derivatives, our global economy is changing. There is no regional advantage, no time zone edge. Where capital and information goods flow more rapidly, the old rules of the physical economy apply less and less.

To succeed in this new environment, first, we must lead with superior technology.

Over the past two decades, a new generation of semi-conductor chips has been created every two to three years. To remain the leader, America must be in the forefront of developing technologies to create these chips.

Maintaining a competitive advantage in the information age requires a strong commitment to research and development and we must encourage education, basic research and private R&D investment through tax accounting and regulatory policy.

As the technology advances, government leaders need to fully understand the tradeoff between export controls and export opportunities.

The U.S. has little monopoly on technology, so we must select the few areas of technology that are critical for national defense and let the others develop into open commercial applications.

Second, we must capitalize on the global infrastructure. One of the most enduring and often forgotten lessons of the digital age is that technology is not enough.

Companies must be structured to deal with the full implications of doing business in a world-wide market place, including a multi-ethnic workforce, variable laws and governments, and diverse local cultures.

Information age technologies must invest in creating the global infrastructure needed to respond quickly to customer requirements around the world.

Here in the U.S., access to the best talent from around the world is a critical component for our future competitiveness and long-term global success.

Because the speed of introduction of new products is essential in an environment where life product cycles are measured in months, we must insist on clear access in all key economies around the world so that the new products can get to the global market quickly and have the effective protection of the intellectual property once they are there.

And finally, the new economy demands a new millennium company. In the years ahead, you'll want to work for, partner with, and invest in companies with the ability to change, adapt and grow, leveraging their fundamental strengths to take advantage of this new economy.

Leadership companies in the new millennium will take everything we already know about business and speed it up. The companies will succeed because they foster a culture of resilience and reward success.

To be global leaders, we need a regulatory environment that allows us to keep pace with the changing work place, to track, retain and compensate employees, and compete with companies around the world.

As we look toward the future, greater change is expected to accelerate and the challenges and opportunities will be great.

So the new economy offers our companies both unparalleled market opportunity and risk. As Asia's boom and gloom has shown us, the global market can be both rich and volatile.

Driven by the instant information of the Internet, the global economy rewards speed, resilience, and most of all, courage.

I hope this Summit is a positive step that will help us to prepare ourselves, our economy, and our nation to meet the challenges and leverage the opportunities offered by the information age well into the next century.

Thank you.

[The prepared statement of Mr. Morgan appear in the Submissions for the Record.]

Senator Bennett. Thank you very much.

Mr. Binder?

STATEMENT OF GORDON M. BINDER, CHAIRMAN AND CEO, AMGEN, INC.

Mr. Binder. Thank you, Mr. Chairman.

My name is Gordon Binder and I'm Chairman and Chief Executive Officer of Amgen, the nation's largest biotechnology company and one of its premier high technology enterprises.

Amgen's story is in many ways typical of the entire story of high-technology's role in America's economic growth.

So, with your permission, I'll take a moment to sketch it out.

Amgen began operations in 1981. We shipped our first drug in 1989. In the eight years in between, we only did two things—we pursued our research and development program, and we raised the capital to pay for that program.

Raising capital and funding research, that's really the heart of the high-tech story, and the heart of a good deal of our nation's economic success in the last two decades.

For example, from that 1982 standing start, Amgen now has nearly three billion dollars in revenues and more than 5000 employees around the world.

Nationwide, biotechnology employment has grown dramatically, to over 150,000 people with salaries that average $50,000 each.

We're now the third-largest part of the economy of southern California.

And that's not the industry's only economic impact.

Our first product is EPOGEN. Well-functioning kidneys produce this protein naturally. It stimulates bone marrow to make red blood cells.

Without enough red blood cells, you're anemic. And if you're severely anemic, you simply don't have any energy.

It used to be that kidney patients received frequent blood transfusions, which are expensive and carry risks. Even so, many remained anemic. Some cut back on work. Some had to quit jobs altogether and go on public assistance.

EPOGEN lets the body create red blood cells again, and gives people back their energy for work and for better quality of their lives.

In other words, in the past decade, EPOGEN has helped millions to remain productive. It has cut transfusions in the United States by nearly one-fifth—that's one out of five blood transfusions eliminated.

Fewer people have contracted blood-borne diseases, which has also saved the system money.

So on top of creating tens of thousands of jobs and billions of dollars of national wealth, biotechnological innovations like this are cutting the cost of disease—and not just the out-of-pocket costs that insurers pay, but the total cost to society and patients.

But biotechnological innovations do not come cheaply. It takes on average $500 million and 15 years to develop a new drug. And only one in three drugs that actually succeed and go to market recover their R&D costs.

High costs and long odds are the realities of our industry and that leads to my two recommendations today.

The first has to do with the R&D tax credit. You heard other speakers mention this.

The credit is a good idea. It reduces our R&D costs. It means that we have more money to spend on R&D and it helps us develop more new medicines.

But R&D investment is not on-again, off-again. And the consequence of the credit lapsing nine times in the last 17 years has been uncertainty. The credit isn't delivering the full benefit that it could if we were sure we could count on it.

The second recommendation is not to put government price controls on pharmaceuticals.

Innovation is too expensive, too risky, and too fragile. Price controls, even the threat of price controls, can discourage it badly.

There is a chart of total pharmaceutical company R&D spending in the U.S. during each year of the last decade attached to my testimony. For those who don't have it, the chart shows steady and dramatic growth in the last 20 years from $1.4 billion in 1979 to $24 billion in 1999.

Growth has been steady in every single one of those years except one—1994.

Why did that growth almost stop in 1994? That was the year that the President put forward his health care program with price controls in it.

If the mere threat of price controls can slow the growth of R&D, I shudder to think what the effect on R&D would have been if price controls had actually been enacted.

We've run this experiment many times. We used to have government price controls on airline fares. We took the controls off—the industry got more efficient. Prices went down.

We used to have government controls on long-distance telephone prices.

We took the controls off—industry became more efficient. Prices came down.

Railroad freight charges, truck freight charges, and now electrical power is being deregulated.

Every time we let competition work, every time we let capitalism work, we find out it works better than prices set by the government.

Thank you very much, Mr. Chairman.

[The prepared statement of Mr. Binder and accompanying chart appear in the Submissions for the Record.]

Senator Bennett. Thank you. We appreciate your testimony.

Ms. Dyson.

STATEMENT OF ESTHER DYSON, CHAIRMAN, EDVENTURE HOLDINGS INC.

Ms. Dyson. Thank you, Mr. Chairman, and Committee members.

I'm very glad to be here. I'm testifying not representing a large company that has produced thousands of jobs, but first, as an observer of the industry, as the author of a book and publisher of a newsletter. And second, I'd like to talk at the end briefly about ICANN, the Internet Corporation for Assigned Names and Numbers, of which I'm currently interim chairman.

What I'd like to do in my five minutes is talk about the impact of the Internet on individuals.

All the technology you've seen, the ability to send flowers to your wife, to talk from airplanes, all this stuff, what does it mean to people?

What it means is something very exciting, and at the same time troubling to many people.

It means a profound shift in the balance of power between individuals and large institutions of every kind—from Congress to large companies to mass media.

It means a shift in power from employers to employees, from companies to consumers, from large companies to small companies.

As you've heard many times, knowledge is power: The ability to know what their options are, the ability to compare prices, the ability to compare job offers, the ability to know what people in Congress are doing, the ability to know what kind of real estate deals the local county official has engaged in.

Those all give power to individuals.

Now, the challenge of course is that not all the information on the Internet is true. And so we all face a really challenging world ahead of us.

One more point.

The Internet empowers individuals not just as consumers, but as producers. I now find people on the Internet competing with my print newsletter. People trying to run large businesses are competing with consultants.

And so, as the communists put it, our wonderful capitalist system has in fact put productive capacity in the hands of the people.

Get a PC. You can start your own website and go into business.

The role of government shouldn't be to get into the business of certifying content, regulating newspapers, or making sure that everything on the Internet is true.

What it should be doing is helping to educate people so that they can make decisions for themselves about what choices they want to make, about what is credible and what is not.

That is our best defense and our best hope for the future, to create an educated citizenry that can think for itself and have the capacity to fulfill all these jobs that this new system is going to create.

Now let me talk very briefly about the Internet Corporation for Assigned Names (ICANN).

The Internet, as you probably heard in the first couple of days, was created on the basis of government funding given to a bunch of scientists

and researchers several decades ago. There was no controlling legal authority, so to speak.

(Laughter.)

It was simply a bunch of guys trying to get their computers to talk to each other. They gave their machines numbers and names so they could talk to one another. And then they put those names into a little database so that people could find each other.

Out of this grew up the Internet, with protocols that were open so that any machine on the Internet could talk to any other machine. Any person at a computer on the Internet could send e-mail to any other person all over the world.

There's a database that listed all these machines and where they were. And then we created the domain-name system so that they would have nice names, like Amazon.com instead of 129.543.28.673.

And that underpinning simply existed. It was indirectly funded by U.S. Government contract and it was basically managed by one man, Dr. Jon Postel, who worked at the University of Southern California. Doing this was part of what he was doing under a U.S. Government contract.

It wasn't a big deal.

As more and more computers came onto the Internet, they decided to contract out management of .com, .net, and .org to a U.S. company called Network Solutions, which managed the domain name system for those three top-level domains.

And that's where all the .coms that you hear about are kept and stored and managed and assigned and so forth.

Now this informal system began to look a little creaky because the Internet is doubling in growth every year. It's not just U.S.-based.

People went to Jon Postel to resolve their disputes. And nine times out of ten, he'd say, go away. Figure it out for yourselves. Come back to me and I'll bless the result.

But that simply isn't going to work as the system grows larger and larger.

And so, a couple of years ago, the U.S. Government, in its wisdom, said, we need to create something that will actually set policies, resolve disputes, and be a little more predictable, to manage the technical underpinnings of the Internet.

Not to resolve issues like content or privacy, but just the domain name system, the protocols that make the whole thing work, the

addresses, how they're allocated, keeping the database in order, making sure the whole thing is stable.

But rather than say, let's create a government agency to do this, they said, we want the Internet community to create its own.

We believe in self-government. We believe in the Internet's decentralized, bottom-up approach, and we'd like to see the Internet do that.

The result of that process, which has been sometimes confusing, sometimes messy, has been this private, not-for-profit corporation called the Internet Corporation for Assigned Names and Numbers, of which I am currently interim chairman.

Our major tasks currently, which we are along the way to achieving, are the introduction of competition into the business of registering .com, .net, and .org.

We also need to figure out how to develop a membership so that the board members going forward can be elected rather than appointed as we were.

And we need to create a lightweight system that is both flexible, but not subject to capture by corporate interests, by foreign governments, or by anybody else, but that is truly representative of the consensus of the Internet community on how these things should work.

And with that, I'll finish. But I'd welcome your questions.

[The prepared statement of Ms. Dyson and accompanying report appear in the Submissions for the Record.]

Senator Bennett. Thank you very much.

We now go to Dr. Thurow.

STATEMENT OF DR. LESTER THUROW, LEMELSON PROFESSOR OF MANAGEMENT AND ECONOMICS, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Dr. Thurow. I'll be short because I have a long-winded version of this that was sent to you all. I have a brand-new book that just came out called, Building Wealth — the New Rules for Individuals, Companies and Nations in A Knowledge-Based Economy.

It sets out what I think governments have to do in this new world.

But one of your witnesses yesterday is the symbol of this era.

It's literally true that for all of human history, without exception, the wealthiest person in the world has owned natural resources—land, gold.

And for the last hundred years, it's been oil, starting with John D. Rockefeller in the 1890s and ending up with the Sultan of Brunai in the 1990s.

But as of 1996, it's Bill Gates. For the first time in human history, the wealthiest person in the world doesn't own anything.

He doesn't own any land. He doesn't own any gold. He doesn't own any oil. He doesn't own any factories. He doesn't own any machines.

He doesn't even really own knowledge. What he does is control the knowledge process.

And it's a real symbol of the new era we're in. And I think that economic historians looking back are going to talk about this as the third industrial revolution.

The first industrial revolution was steam engine, the train and all that.

The second industrial revolution was electrification at the end of the 19th Century.

And the third industrial revolution at the end of the 20th and the beginning of the 21st Century, is an industrial revolution based on the interaction of six technologies.

And I don't think it's right to call it the information age because some of these technologies, like biotechnology, have very little to do with information.

Biotechnology, micro-electronics, new materials, telecommunications, computer software and hardware and robotics. And it's the interaction between these things that are creating a global economy and it's the interaction between these things that is causing a revolution.

Now to be an economic revolution, you can't just create a big industry.

For example, the internal combustion engine created the world's biggest industry, the automobile industry. But it wasn't a revolution. Because if you do the mental experiment and say, what would have happened if we had never invented the internal combustion engine, the answer is you and I would have driven steam and electric cars that went a little slower and didn't go quite as far and we'd use trains a little bit more. But modern life would be pretty much exactly as it is.

To be a revolution, it has to change everything, other businesses. And of course, this is. And that's why Internet retailing is so interesting,

because what the historian says about the first industrial revolution is that 8000 years of agriculture came to an end and industrial activities became the prime human activity for creating wealth.

What the historian of the future may very well say about our time is that 5000 years of going to the local store to buy the necessities of life came to an end and we're doing it in a different way because it's literally true that 5000 years ago, the ancient Egyptians went to their local stores to buy the necessities of life.

And you can tell a story in every industry how this revolution is changing it.

Take the oil industry.

I was at the World Oil Industry in Norway not long ago in February, when they were behind closed doors setting prices, but in front of closed doors having an intellectual conference on the oil industry. And there was a gentleman there who was an expert on oil technologies.

Twenty-five years ago, if you wanted to find a barrel of oil, you build the infrastructure, you build a transportation system to go to Rotterdam and find the oil outside of the Persian Gulf, it required thirty dollars.

Today, it requires nine dollars.

And the answer, of course, is that we're using super-computers to do three and four-dimensional acoustical sounding, horizontal drilling, drilling in water two miles deep off the coast of Norway.

This is a knowledge-based industry, even though it produces a commodity called oil.

And so, I think the important thing to understand is that we're in a very different world, and I mean literally—my subtitle here —individuals, companies and nations—that's what we are here in the United States—are going to have to do things very differently.

And let me focus briefly on the three areas where we're going to have to be different.

Take skills.

If you're an individual, the name of this game is skills, skills, skills. And see, there's something that ought to be represented at this hearing and you can see it very clearly if you go back to the data pages in the Economic Report of the President.

It's a boom decade in the 1990s, right? But what do you think has happened to the wages of full-time American male workers between 1989 and 1997, the last year for which we have data?

The answer is it went down five percent in real terms.

We're making Mr. Kennedy's statement—a rising tide raises all boats—into something that isn't true.

We've had a rising tide, a boom economy for many of us, and at the same time, 60 percent of the boats have sank with lower wages at the end of the decade than they had at the beginning of the decade.

And there's only one solution to that problem. We're going to have to systematically redesign, re-engineer, and refinance American education for the bottom half of the American workforce. And if we don't do that, we're going to have that work force with lower wages in the future as we plow into this knowledge economy.

The second place where we need government activity is to make sure that we're doing the new things that are the equivalent of the Internet.

We don't have to have government running or financing all of the infrastructure. But we have to have government doing pioneering activities and infrastructure.

And the third thing is I think we need to make a basic distinction between research on one side and development on the other.

Companies do development. The government has to pay for basic research.

Despite the good things that the biotech companies had done, it wouldn't exist as an industry if the National Institutes of Health starting in 1960 hadn't started to put billions of dollars into research into an industry at that time which was called biophysics.

And as far as I can calculate, about $100 billion in today's dollars of research money from the National Institutes of Health have gone into biotechnology over the last almost 40 years.

One of the interesting things about economics, if you go off and look at the studies of the pay-offs on basic research, it's one of the strongest studies that exists in economics.

If you average the eight studies that have been done, they average out as a 66 percent rate of return, with the lowest return 50 and the highest return 105.

And the interesting thing about it is that the result is no contrary conclusions to the best of my knowledge exist in the economic literature.

So when you're thinking about your role, you ought to think very carefully about basic research. And if you believe the 66 percent number, and there's no counter-evidence, the answer is we should be pushing that number up and see what happens, whether we get the kind of 66 percent pay-off we've gotten in the past.

Thank you very much.

Senator Bennett. Thank you.

You get to be last and, in my experience as Chairman of the Y2K Committee, the last witness very often tells us more than all the others put together.

(Laughter.)

I've put that burden on you, Mr. Benerofe.

Senator Mack. It's certainly no reflection on the previous witnesses.

Senator Bennett. No.

STATEMENT OF MARK BENEROFE, EXECUTIVE VICE PRESIDENT FOR CORPORATE DEVELOPMENT AND CHIEF MARKETING OFFICER FOR WALKER DIGITAL PRICELINE.COM

Mr. Benerofe. I'll try and live up to that challenge. Thank you to the Committee and Mr. Chairman, for this invitation.

I've watched two days of the Committee's presentations that have raised many of the benefits of the digital economy, as well as significant and long-term issues for us to consider.

I think it goes without saying that America's economy is at a unique moment in history.

Just as other key transformation moments—electrification, the highway system, voice communication—we're seeing the door open to new models, new participants, and new drivers of extraordinary economic growth, with potential benefits and risks to all sectors of the economy.

I think the digital economy allows one thing very clearly, and Esther mentioned it—the balance of power shifts and in some ways, buyers and sellers get to come closer together.

I'm Executive Vice President for Corporate Development at Priceline, and I just want to correct for the record, and Chief Marketing Officer for Walker Digital, a sister company. I want to talk a bit about Priceline, that it's doing something that political leaders and voters have been talking about since organized societies began.

And that's how to provide a more egalitarian approach to the market place for young, for old, for rich and for poor.

It focuses on pricing and pricing mechanisms.

We've been living with fixed prices, the concept of retail prices, for about 400 years.

You see the first use of pricetags in that period that's very popular in the movies today, Shakespearean times, "Shakespeare in Love," and widespread use in the 19th Century.

They're glued today to our fruit. They're wrapped on our music CDs. They're barcoded onto our products.

Retail and fixed-price systems were a tremendous mechanism, offering great efficiencies and growth to economies in past centuries. But they also forced businesses, such as airlines, hotels, and others, to fly with empty seats, to let empty rooms go unused, and let inventory perish.

These inefficiencies are sort of a Gordian Knot that's being untied today by some of the unique opportunities created by the digital economy.

And one of the key things that Priceline is focused on is essentially giving people power by putting them on the price elasticity curve, so that constituents of members of Congress can make offers and get prices for products and services that they couldn't get before.

It's certainly part and parcel of the American dream, much more about opportunity, equality, giving more people a chance. And it also provides sellers with really unique benefits by letting them see what true demand is en masse.

So one of the things I'd like to do, if I can, is just walk through it.

So Priceline.com is a revolutionary pricing mechanism, a compelling value for both buyers and sellers. And it's an e-commerce financial model that's uniquely enabled by the net. It's not simply ported to the Internet.

And it obviously, as many Internet opportunities do, has highly scalable and huge market opportunities.

So if we look at the history of pricing mechanisms, we have barter, back to biblical times, no monetary pricing plays a role.

We have auctions. We're often consumed with an auction, where buyers compete with each other for the benefit of the seller.

We have markets, informal like bazaars. And formal markets that started in Amsterdam and London and we now track and have talked about a lot today, the Nekkei and the Nasdaq that introduced negotiated pricing.

We have retail, which I spoke about.

We have the concept of RFQ, which is really a reverse auction, where people compete on price for the benefit of the buyer.

And then what we call a demand collection system. And the brand name for that is Priceline.

What makes all of these systems succeed? Everyone always talks about what is the next big business model? It's really simple.

They work for both buyers and sellers.

We see all of these models ported to the Net today. So we have barter on the net. And we have auctions on the Net. And we have markets on the Net. We have retail on the Net. We have blended models on the Net.

And a demand collection system.

We think that this demand collection system is based on two mega-trends. And a lot of this also Esther mentioned has to do with more information and pricing knowledge out there.

One is a brand-neutral customer. And that's brand parity within categories of quality. And then permanent excess capacity.

So I think all of us have groups of products for which we have acceptable equivalents. And everyone here has products for which they have brand loyalty.

So permanent state of excess capacity. And one of the things that all of the businesses you've heard from today deal with is the marginal cost of building excess capacities, typically very low.

The problem with it is in order to move it, you have to reduce your prices or be really great at marketing and spend a lot of money.

So that's why Priceline was invented, to be able to, for sellers, move those products. And for consumers, give them more control and power over the price.

So it lets consumers decide how much to save in any of these categories. And we really view it as the personal computer has given rise to the personal price.

So consumers let Priceline choose the brand and they give us a credit card that, if they get them what they want, is charged immediately.

So an example is, you say I want to go from Los Angeles on June fourth and return on the ninth of June. I'll fly any time of day and perhaps make one connection. And if you can get me this price in an hour, I want the ticket. Buy it for me.

And that's the trade-off for having that control or power over the price.

So just key benefits for buyers—obviously, they get to name their price. They don't exert price pressure on each other. They're charged only after they get what they want. It happens around the clock because it's the Internet. And people get to advertise what they want.

This is a key concept. We deliver true demand to sellers, a pyramid of demand.

It's not, I might do it. It's this is what the demand curve looks like. And that becomes a key business tool for them that they can't walk away from.

And then, obviously, buyers save money.

For sellers, they evaluate those offers. They can manage their revenue without threatening existing distribution. Their price structure is intact.

And they see real quantifiable demand. And it's serious consumers who are ready to buy.

So, an example of the model is, if you're interested in hotels, there is about—we might collect a million dollars worth of demand in a month for Chicago. And for a hotel, the incremental cost of that room that sits empty is $20.00 to clean it.

So there is lots of available margin.

This is, again, the change of the balance of power where the consumers now can make their demand known.

It's been a roaring success story. We collect tens of thousands of offers in a day for airline seats, huge demand, deliver thousands of tickets every day.

And the consumers save tremendous amounts of money, opening up transportation for people to visit family, friends, reunions, trips that they might not go on or they might use other modes of transportation.

The unsold capacity and waste in the industry is huge. This is just in the travel segment. It's billions of dollars. And we're now bringing the same pricing mechanism to the financial industry, with hosts of sellers, as well as to the auto industry, all of whom have been very brave in adopting these new models—airlines, hotels, financial services, looking at this revolution, this cliff, and figuring out how they can use it to benefit and how they need to adjust their models for the future.

And this is what I talked about, a pyramid of demand. Every day you can walk into an airline, a mortgage company, and you can say, I've got these many people who want to fly for this price on this route.

What that means is probably the best success measurement is when something works for consumers, they talk about it.

We, in a year, in one year, have, for every person that uses Priceline, they tell 18 people. And while we think we've done a good job marketing with Mr. Shatner, we think there's something more fundamental going on, that people really find this to be a powerful mechanism where, for the very first time in 300 years, they're on the price elasticity curve.

And so, just to summarize, the demand collection system lets buyers express their commitment to buy. It provides an x-ray of demand above and below the set market price, or true demand.

It creates unique opportunities for sellers to manage that revenue stream.

It processes the demand to a point—again, this is databases and computers that make it possible—where we can match buyers and sellers.

And it binds it.

And lastly, I'd just like to say that we'd like to keep in mind because this has been discussed here, that while the Internet has many advantages—decentralized economies of scale, distribution, reduced second-copy costs—ultimately, we're all going to be measured on the same rigorous financial standards that regular businesses are measured by today.

And at Priceline, we are consciously looking at those every day and believe we're meeting those hurdle rates.

And on a separate topic, I'd just like to echo support for Esther's requests for the government support in educating consumers.

I sit, and Esther has advised us, on the board of the Internet Content Coalition, which is a representative group of major media companies such as Sony, Disney, Warner Brothers, as well as new media companies, such as Yahoo and Seanet. And we are working hand in hand with her and some of her organizations to essentially empower consumers and businesses to better understand and matrix their way into this future.

Thank you.

Senator Bennett. Thank you very much. You did not disappoint. It was fascinating.

I'm sure that Dr. Thurow would like to have you in one of his classes and then begin to discuss some of the economic implications of pure demand.

Unfortunately, we don't have the time to do all of that. The Members of the House had to leave. They have a vote. Senator Robb was summoned to another Committee to make a quorum.

We are still in the 18th Century in terms of the way we handle legislation around here. You must be physically in the room.

We do get to proxies every now and then.

But we're grateful to you all. Senator Mack?

Senator Mack. Thank you. I want to express my appreciation to this panel, plus the panel earlier this morning. I think we've had a very interesting three days in discussing the issues related to whether we refer to it as the information age, the knowledge age, or whatever.

I couldn't help but think with Mr. Binder here representing the biotech industry, that if we were to have one of these hearings ten years from now, that there would be a lot more people representing that segment of our economy. I have a sense that what is going to happen in biotechnology is that we're going to see an explosion take place in biotechnology similar to what we saw take place in the computer industry.

The opportunities seem to me to be unlimited.

I recently visited one of the private-sector companies engaged in mapping of the Gnome. And I don't know why it took me to getting to that particular place when it kind of hit me.

George Gilder wrote a book called Microcosm. It didn't hit me until I was out there at that Gnome company that this entire organization, with massive computer capabilities, information flows that they are

developing and that they will develop over time, is all about something that we can't see.

In fact, it's not about the cell. It's about what's inside the cell. And it's about DNA and it's about a particular segment of the DNA.

The future to me just looks unlimited.

So I take your caution with respect to price controls with respect to pharmaceuticals.

You're right. Nineteen-hundred-ninety-four was a disaster and it sent a shockwave through the capital structure, if you will, of the entire biotech industry.

So I appreciate your comments.

And the last thing I will say—I really don't have a question to ask this morning. Priceline.com really intrigued me. It does seem to me that it does change how consumers in the future are going to be able to flex their power.

I'd be interested, Dr. Thurow, if you have a comment on it. Will this, can this have an effect on holding down prices? Is it something that will play a role in our battle to maintain price stability?

Dr. Thurow. Oh, absolutely because, you see, I think you have a whole series of places where technology is pushing costs down.

Prices in the long run, and capitalism, follow costs. If you can push costs down, you're going to push prices down.

Some of the things are like Priceline. But if you take—why is oil near record low prices? Why is gold near record low prices?

In all of these areas, we have the infusion of these knowledge-based economies that are changing costs?

Like about agriculture where everything is at very low levels and it's going to get lower because we're going to make crops without pesticides, without fertilizers. Annual crops are going to become perennial crops, so you only plow the land once every ten years rather than once every year. And that pushes costs down.

It's only a slight exaggeration to say that one cow is going to provide the milk for the world.

In that kind of an environment, costs go down.

That doesn't mean that the government can't screw it up and create inflation. But what we've done is go from an inflationary-prone society in the 1970s to a deflationary-prone society in the 1990s.

And of course, energy costs are the greatest example. We're finding energy much faster than we're using it. And if it costs you nine dollars to find a barrel of oil and build the infrastructure, the answer is not for very long can OPEC even hold it at fifteen dollars. You add a little profit and it's going to sell for ten or eleven dollars.

And those curves are still going down.

And of course we all know about the computer and its fallen prices. And I think this business of falling costs in many of our industries in the retailing sector, Internet retailing is it, are going to have big impacts.

Now what we don't know is the sociology. What kinds of things are people going to want to buy just because they want to buy good stuff cheap, and where do they want to have the crowd effect, so to speak?

You go Christmas shopping partly because you like elbow and ribs. You like the excitement. You like the music. You like the noise.

You may not, Mr. Chairman, but other people do.

(Laughter.)

And that's why everybody in retailing, conventional retailing, talks about entertainment shopping. You're going to pay 20 percent more, but you're having fun.

Senator Mack. Yes?

Ms. Dyson. I'd like to just comment very briefly as someone who is also a venture capitalist and used to be a securities analyst.

I think there's a lot of misunderstanding about what all this Net friction-free economy is going to lead to.

I think it's going to be absolutely fantastic for consumers and for employees. But it's going to be very tough for businesses. It's going to be a much more competitive world.

I think that's good. But it does mean that it's going to be much harder for companies to simply rest on their laurels, get fat and happy. And I don't think that that's necessarily recognized, if you get into stock prices or into people's thinking about the progress of the economy.

Senator Mack. If my colleagues would indulge me just a second more to maybe raise one more.

The other thing that's been somewhat fascinating over these three days is hearing people say that their access to capital is much easier, that the barrier to getting to capital is much lower.

What is happening out there in the capital markets for both the small start-up entrepreneur and large companies?

I mentioned yesterday that I was in the banking business before I got involved in politics. The banking business in the mid-1960s, things have changed dramatically.

What's happening in the capital markets that's allowing these access to these funds? And will the cost of capital continue to decline?

Dr. Thurow. I think there are two things to answer that.

One is with these big run-ups in stock market values, this looks like a very attractive thing and it attracts capital, right?

The other thing to remember is that the rest of the world is in the middle of an economic disaster. And so a lot of capital that used to be used in Asia, used to be used in Japan, used to be used in Europe, can't be used there and it comes to the United States.

We saw it on the financial pages today because Nasdaq was in partnership with the Japanese capitalists to put a Nasdaq operation into Japan.

That wouldn't have happened ten years ago because Japanese capital was fully employed supporting Japanese companies, not employed supporting American companies.

Senator Mack. Let me just ask; are you suggesting, though, that the only thing that has changed at the present is that there is just more capital for America?

You don't see any change in the capital markets?

Dr. Thurow. I think there are two things. First of all, if you take like for example this big run-up in e-commerce stocks. Of course that attracts capital because that's playing the lottery and everybody wants to win the lottery.

But the other thing is the fact that the rest of the world is really in the economic doldrums. And so, we're tapping a lot of savings in the rest of the world that comes to America that ten years ago wouldn't have come to America.

Mr. Benerofe. I think Dr. Thurow is right and has hit on at least two or three of the trends.

I do think that some of the capital that's available, while certainly there's some lottery motivation right now, is actually smart and sincere capital, in the sense that we're all here because of discussing these huge transformations and possibilities and the concept of global distribution, the concept of putting buyers and sellers closer together, that there are people out there, and you've heard from probably 35 of them, who have

come up with brilliant ideas that have done a tremendous amount to bring and create value, products and services in the market place that have served people.

And I think, actually, we've only seen the first generation of them because, as brilliant as we all are, I think the problems and the issues out there are complex and we haven't always been able to see how you can use these tools, the enablement, the Internet, in unique and new ways.

I'm originally a media guy. It took a while to figure out what were those models for TV we take for granted.

I'm not equating prime-time dramas or soap operas or half-hour comedies with the equivalent of the importance of pharmaceuticals and drug inventions.

But it always takes a while for the human mind to really figure out how to use all these new tools at their disposal, not simply just port old models to new.

So I actually believe that while there will be some balancing effects because of these landscape issues, that actually, for really smart businessmen and entrepreneurs and women, there is a tremendous opportunity and we've only seen the beginning.

Senator Mack. Yes.

Ms. Dyson. I think the shortage is of the smart business men and women.

The capital is easily available. But I know lots of start-ups that can get ten million dollars and don't have a CEO. Right now, the availability of capital is based on, "we'll fund this company and we'll sell it to AOL for an inflated stock price."

This availability of capital, in one sense, is going to continue because the markets are becoming much more fluid.

But I think the returns to capital are going to be quite disappointing. The returns to brains, the returns to individuals, to employees, are going to be very high.

Anybody founding a company now knows you have to give five or ten points more, five or ten percent more in options and equity to the management than you used to.

Senator Bennett. It's tulip time.

Ms. Dyson. Yes.

Senator Bennett. Okay. Thank you.

Senator Robb?

OPENING STATEMENT OF SENATOR CHUCK ROBB

Senator Robb. Thank you, Mr. Chairman.

Let me just follow up on the last point with respect to capital. Dr. Thurow, or who was it that talked about it as sincere capital? Maybe it was Mr. Benerofe.

In any event, I assume that's the functional equivalent of patient capital, capital that is interested in the long term and is not impatient or footloose capital, whatever the case may be.

Ms. Dyson. It could mean gullible.

(Laughter.)

Senator Robb. Or gullible. That's right. It's with respect to just that situation. And Dr. Thurow did mention with respect to what's happening elsewhere, that that's also having an impact where capital flows at this particular point.

What happens if that changes? What happens if some of this less patient, less sincere capital has alternatives that appear more interesting, more attractive?

First of all, I'd like to know what might trigger that scenario in a significant way? And, secondly, I'd like your insights on what this change in the flow of capital would do to the whole technology structure, if you will, because you've got some price and earnings (P&E) ratios that are just absurd.

Some of the Initial Public Offerings (IPOs) just run off the charts and the income stream, you can't see it with the Hubbell telescope in terms of what it's going to do in the near-term, at least in terms of the kind of objective criteria that we would normally apply, or the value.

It may all be there, and in many instances, at least it has continued to produce, whether or not there's a certain amount of kiting going on.

It's a little hard to tell.

But what happens if some of this capital becomes impatient or if there appears to be a run on that question?

Those of you who think way ahead of us, as some of you on this panel do, tell us what we ought to be most worried about in that respect?

Dr. Thurow. Well, I think this is a tremendous long-run problem in the United States because we have a negative saving rate at the moment.

But what happens if some of this capital becomes impatient or if there appears to be a run on that question?

Those of you who think way ahead of us, as some of you on this panel do, tell us what we ought to be most worried about in that respect?

Dr. Thurow. Well, I think this is a tremendous long-run problem in the United States because we have a negative saving rate at the moment.

Not that's for persons. That's not for the nation. The nation as a whole saves about ten percent of its income. But Europeans are saving 20 to 25 and Asians, 30 to 40 percent.

In the long-run, we will not run a successful economy in the United States saving 10 percent of our income while the rest of the world saves two to four times that amount.

We can make it in the short-run because at the moment, they can't use that savings in the rest of the world because of their economic problems.

So I think there is an issue here.

But the other thing that's going on is in the 1920s, there were a hundred car companies in America.

Today there are two.

It took 30 years to get rid of most of them, we were down to three, and another 40 years to get rid of the third one.

If you take online brokerage companies at the moment, there are a hundred. In the end, there are going to be two and it isn't going to take 70 years to shake them out.

Of course, one of the problems you have is which are the two that are going to be left standing if you're looking at this whole operation?

For example, suppose in 1981, I had told you that God told me—I'm Moses—and in 1999, the world is going to make 100 million personal computers.

You'd have run out to buy Commodore, which, of course, isn't even in business today.

So the fact that the industry is going to succeed doesn't tell you that any particular company is particularly going to succeed.

And so, I think there is a long-run issue here basically on savings and investment in the United States. In the short-run, it isn't an issue because of the problems in places like Japan. But in the long-run, we're going to have to do something about that.

Dr. Thurow. It's obviously going to lead to less investment because that's the whole purpose of raising interest rates. If it didn't lead to less investment, you wouldn't do it because he's arguing in some sense that the economy is overheating and we should have less investment.

Now I think he's fundamentally wrong because the reason I mentioned, I think technology is driving prices down and there's no evidence of inflation in the American economy whatsoever.

I think you do those kinds of activities when you see something to be worried about rather than thinking about ghosts from the 1970s.

Senator Robb. Let me ask one other question that goes to the R&D tax credit that at least two or three of you mentioned, and every other panel or group from the last three days has mentioned in virtually every presentation.

And yet, despite this swell of support for the R&D tax credit, we continue to extend it one year at a time when we extend it and we go through this little charade. The vast majority, I believe, of the people that participate in this panel certainly are very much in favor of a permanent extension, as well as the investment in R&D generally.

Anybody got any thoughts, crass thoughts, perhaps, as to why we haven't made this permanent yet?

Dr. Thurow. Well, Mr. Binder is certainly right from an economic perspective. This credit is very different if you make it a permanent credit as opposed to temporarily renewing it every year.

It's just a different animal. And it doesn't make any sense to have this animal that you renew every year.

In some sense, you either ought to get rid of it or put it permanently on the books. Going on and off just doesn't make sense.

Senator Robb. I'm inviting a question as to why we act as we do on that.

Dr. Thurow. I think you have to answer that question.

Senator Bennett. I can tell you.

Senator Robb. I think I know, too, and I'm trying to get one of our witnesses to put it on the record for us.

Senator Bennett. Mr. Morgan, you feel free to jump in here, even though you're electronic.

Don't let the professor, just because he's in the classroom, intimidate you.

Come in here.

Mr. Morgan. He doesn't. It may have to do with the collection of money.

Senator Bennett. You got it. The Congressional Budget Office (CBO) won't score it the way we politicians want it scored.

And so we go through this charade. It's the breaking of the caps and it's a tax cut. And nobody wants to break the caps. And so we do it every year.

But in the long-term projection, oh, no. We're meeting the caps by not having it on the scoring for the next four years.

Frankly, as a businessman, this is one of the things that drives me the craziest serving in the Congress, is to discover that CBO and its computers control everything we do.

I've sometimes said in complete facetiousness, the most significant thing we could do is all take up sledgehammers and storm the CBO and destroy the computers.

(Laughter.)

But that wouldn't be a smart thing to do. I apologize for intruding.

Senator Robb. The remarks of the Chairman should be interpreted as his own in that particular instance.

Senator Bennett. Yes.

(Laughter.)

Senator Robb. May I ask just one other specific question?

Senator Bennett. Sure.

Senator Robb. Ms. Dyson, if you could just clarify for me how competition will work with respect to domain name registration.

Just the mechanics of it. I'm aware of the fact that we used to have separate football leagues. We have separate boxing crowns. There's never a final resolution when you have competition in certain areas.

Are we going to get into a situation where your main registration takes place in one universe, but is not operable and not interoperable in the other?

Just a point of clarification for me.

Ms. Dyson. That kind of confusion is precisely what we want to avoid.

I just want to go back and say when I mentioned inflated stock prices from AOL, I wasn't picking on them. You could say Microsoft or Amazon.com or anybody.

It's simply people using stock to make acquisitions.

On ICANN—

Senator Robb. This probably won't be broadcast until the markets close, anyway.

Ms. Dyson. No, but—these things are sensitive.

What ICANN is doing is we are the consensus body that's supposed to set the rules. We're not competing with Network Solutions. We're trying to introduce competition into that business of registering domain names.

The first step is very clear: create competition for Network Solutions—which has a government-granted legitimate monopoly up to now, but that contract is expiring—so that other companies can come into that business and offer what we hope is going to be better, cheaper service because that's what competition produces.

Senator Robb. But you're looking to set up competition for the whole business, not just to set up a separate and parallel structure.

Ms. Dyson. The second issue is should there be additional domain names, such as .web or .store or possibly .xxx or .air for the airlines.

That's a very complicated question because, clearly, there are people who want to get into the business of selling domain names and registering them in competition with NSI, but outside of . com, .net and .org.

And we would like to encourage more names, more diversity.

There are two counter-issues here, though, that are quite important.

One is people who have trademarks on names; now they have to register in .com, .net, and .org. They're not very eager to go out and register in .web and .store and, who knows, maybe thousands more.

If we add more, there's a very obvious question—how many more should be added?

Second, is this going to create consumer confusion? It's bad enough trying to remember, was it Paragon Partners or Paragon Associates or Paragon Brothers?

And now you have the same thing with .com, .net, and .org.

And so, we have not made, ICANN has not made that decision yet. We're collecting input from the community, from you, from anybody who cares to comment.

But our first and clear task is simply in .com, .net, and .org.

And as you know, there are also other countries that have .hu for Hungary,.uk, and so forth.

All of these we're going to be looking at as time passes. But we're trying to—partly, we're waiting for an elected board to be put into place because that's more appropriate than having everything be decided by the initial board.

So our task is very much focused towards trying to determine what the consensus is. And in many cases, there is no consensus yet, so we cannot act.

Senator Robb. Thank you.

Ms. Dyson. I'd be happy to answer at much greater length. I don't think everybody wants to hear it.

Senator Robb. Thank you. I have exceeded my time as well.

Thank you, Mr. Chairman.

Senator Bennett. Thank you.

Senator Allard?

Senator Allard. We've had a lot of testimony about the workforce requirements in the high-tech area.

We have been reading in the last three to four days that there may be a request to the Congress to try and raise the immigration restrictions so that we can get people in here who will work in the high-tech area.

Why is it that we have people who are willing to leave their home country, their home families, to come to the United States to work in a totally foreign environment and we have Americans here at home that aren't moving into those jobs?

Is it because of the education of the American? Is it because they just simply aren't interested in those kinds of jobs? Or is it something else related to the work environment that they wouldn't be happy with that kind of a work environment?

I thought maybe Mr. Morgan might make a comment or two, and then maybe the panel can comment as well.

Mr. Morgan. Many of these high-tech workers here in the United States have a foreign background. So what we see is that they're very interested in developing their skills because it's an opportunity for them to really move themselves up, and they are outstanding students.

What we have in the U.S., I think, is a handicap by our K through 12 education and the interest that people have in the high-tech field because of it's really tough educational requirements.

And so, we're not getting the flow of students into the advanced degrees which are required to be successful in high technology.

Senator Bennett. Mr. Binder?

Mr. Binder. Well, I agree. It's basically education. I think we'd certainly hire somebody who lives here first because it costs a lot of money to move somebody from another country to move them over here.

If we could find, if you will, lower-cost hires, we'd certainly do it.

If we can't do that, our next choice is to do the research here where we want to do it and bring in people from other companies to do it.

Now if the government makes it impossible to do that, then the research lab is going to have to be over there where they are. And it would really be a shame if we were forced to build research labs in other countries because we couldn't bring in citizens of other countries to work in our laboratories here.

Ms. Dyson. You've heard this before, but there's a certain irony because many of these immigrants, or would-be immigrants, come here and take advantage not of our elementary school system, but of our extremely good university network.

And then, having invested in them, we send them home.

My perspective from the companies I deal with is it's usually not a question of cost. It is a question of availability.

There are lots of very precise technical talents. It's not do you or do you not have a PhD. It's do you have experience writing Java code or can you design some kind of semiconductor or something.

People are not fungible. It takes a long time to produce these educated people.

And so, for the health of America, I hope that we improve our educational system. But for the health of America also, I think these people are productive and we should employ them rather than educate them and send them back home.

Senator Allard. That's all I have. Thank you, Mr. Chairman.

Senator Bennett. One of the witnesses yesterday said that we're reaching the people where we should staple a green card to every PhD that we issue.

Mr. Larson?

Representative Larson. Thank you, Mr. Bennett.

Let me say the outset as well my thanks to you and Senator Mack and Representative Stark for hosting this. I'm not a member of the Committee, but someone said to me, you'd better get a life, because I've been watching this on TV the last couple of days.

It's the most exciting thing that I've seen since I've been in Congress.

My question was for Dr. Thurow, but I see he's—

Dr. Thurow. I'll stay and answer.

Representative Larson. You had mentioned before we had to leave for a vote in the House about the need, and it follows along the question of Mr. Allard, for a complete overhaul of our educational system.

I think you said refinancing—I call it an essential retooling that needs to be done within the education system, especially K through 12, if we're going to produce the work force of the future, and in fact, have facilities that are capable of retraining existing work force.

Could you comment? I know you mentioned financing.

Dr. Thurow. I don't think the key issue is financing. I think the key issue is restructuring.

We have a system that has 8000 independent school boards. If the system was working, somewhere in those 8000 independent school boards, there would be a lot of successes.

And there are no successes if you think about educating the bottom half of the American workforce. I think that says that you have to rethink.

Now we know the basic ingredients. We just have to decide to do it.

Anybody who has a high-quality high school has some kind of a tough exit standard like the French baccalaureate or the German arbiteur.

You can't learn in 180 days in America what you learn in 230 days in Germany.

You can't learn in six hours in school what you learn in eight hours in France.

You can't get a high-quality teacher for $32,000. There are a whole set of things we know and of course, if you go back to something that is as Jeffersonian as elected school boards, how do you get elected to the school board and flunk your neighbor's kids?

That's a fundamental problem in the American system.

And local school boards are just not going to set high-quality standards. That's the fundamental bottom line.

And of course, we have this other belief that isn't true that families out there are panting for higher quality education.

It isn't true. The average family doesn't know what their kids ought to know 30 years from now. And if you take places that have these no-pass/no-play rules like Texas, they don't get enforced because the families don't want them enforced.

Having the kids in the band or on the football team is more important than getting good grades in school.

And so, we have a lot of myths about schools and we have an ancient traditional in schools that simply where part of our population isn't working today. And I think that's where the restructuring is necessary.

And it's just like taking a company that's producing a low-quality product and saying, we've got to restructure it so it produces a high-quality product.

We may need some investment and some money in the end, but it doesn't pay off unless you're willing to do the restructuring.

Representative Larson. Are we in danger as well of being—thank you, Dr. Thurow.

Are we in danger as well of being leap-frogged in terms of having the technology at our disposal to individualize instructions for teachers in the classroom to be more diagnostic?

We've seen countries like Costa Rica introduce education across the board where every single student has a laptop at their desk and teachers can go to an electronic blackboard and point and conduct distance learning at the touch of a hand.

And here in our own country, we seem to be mired in this confusion over where to go with our education system.

Ms. Dyson. I'd like to address your question, but also disagree respectfully to a small extent with Dr. Thurow.

And that is, I think parents care tremendously about their children's education. They know it's important. They don't know what to do about it.

They don't know how good their schools are. As somebody said earlier, they don't know what that B plus means. As for the impact of the Internet on an education—kids are really smart. They can figure out how to use the Internet.

I don't think that's as important as getting information about the schools to the parents.

I'd like to see a program for parent-teacher e-mail so that the parents can tell the teachers and the teachers can tell the parents how the kids are doing, what they should be doing, what's going on in school.

That's one aspect of it.

The second is we have ratings for colleges. Let's have ratings for schools. Let's publish this information on the Net. Let's have test scores.

Again, there's going to be information that people don't like out there. It's certainly going to cause political problems. Not only are you flunking your neighbor's kids, but now it's known.

But if there were a market not of money, but of information about schools, I think we'd see improvements.

It works in every other field.

Representative Larson. Thank you.

Senator Mack. We're going to let you all go in just a second. And Senator Bennett will be back in a moment.

I want to go back to Gordon Binder for just a moment.

I think at one time you said that every biotech drug available today was started by an American, or maybe started in America might be a better way to stay it.

Mr. Binder. Well, that was true of the first 20 drugs, Senator Mack. There are about 50 out there now. I can't say they're all 50 American, but I bet it's at least 48 or 49.

Senator Mack. Is there something happening out there that would change that?

Are we doing things that are undermining the strength of the industry?

I know what your fear is. But what is happening that could affect that?

Mr. Binder. What's happening is very healthy. And to go back to your earlier comments, there has been a technological revolution in this industry. It's occurred within the last ten years.

And because it takes on the order of ten to 12 years for start of research to sell a product, all of the products coming out of this technological revolution are still in the pipeline. There's not one on the market yet.

So, today, there are 200 new biotech drugs in human testing. 200 different ones. And 80 of the 200 are in phase three testing.

We only have 50 on the market. There's going to be a flood of these things coming out of the pipeline in the next few years.

I think if anybody's ever going to solve the problem of the cost of medical care, it's going to be R&D that's going to solve it, with much, much more effective new products.

And I think some of these are coming through the system. One drug we're working on, the only competitor it will have is surgery. There's no drug on the market today that it will even compete with.

Those are the kinds of breakthroughs that we need to solve the cost problem and to make our citizens healthier.

And I think the system is working very well. The U.S. has the best intellectual property protection of any country in the world and probably does more university research than all the rest of the world put together.

It educates a huge percentage of the world's scientists. Our income tax laws, although we all complain about taxes, are a lot better than they are in a lot of countries.

One reason a lot of these people want to come here is all of these things.

We dominate the Internet. We dominate all of the new high technologies.

Senator Mack. A thought just occurred to me.

We've heard two statements over the last three days which I think was directed to the electronic or Internet or computer fields, that they could employ 350,000 to 400,000 more people.

I would assume that you all are experiencing the same kinds of difficulties in filling positions.

Mr. Binder. Well, not as much, actually. Biostatisticians, medicinal chemists, there are several really specialized fields where there is a real shortage.

But our industry is older in a sense and we've been through that. And the universities have geared up and they're turning out the people we need pretty well.

Senator Mack. Mr. Morgan, you've been very patient with us watching and listening from a distance. And there have been a lot of questions.

Is there any particular comment or any point that you would like to make because we are about ready to wrap up?

I'm going to turn to Senator Bennett in a moment and let him wrap this up.

So I want to give you an opportunity to speak.

Mr. Morgan. Thank you, Senator Mack.

I really think the main thing for us to focus on is that we have a real opportunity here to extend this stream of economic and educational success in the sense of adapting to sort of the new world.

And that requires us to accept both the globalization of it, which we occasionally see backtracking in the Congress on, which I think is a terrible mistake because it's going to happen whether we participate or not.

In the issue of technology, the ability of organizations to be more flexible, to change because of the time things, the idea of decisions being made by the government is critical to us.

And of course, I think everybody's talked enough about the very specific areas that are important to the development of the information age, and the success of these economies.

If you think about it, the number of companies and the amount of employment and the increased tax base that that has provided has grown from this information age just in the 20-some years that I've been a CEO, is just spectacular as far as what's happening.

It's really just in its infancy.

So I think we ought to look at the things that have been successful and stay with them and be very careful about the steps we take that would impede the progress of globalization or impede the progress of the information age.

Senator Mack. All right. And thank you very much.

My last comment before I turn back to you is that I want to thank the staff of the Joint Economic Committee who have worked diligently and I think very creatively in putting together these three days of hearings.

Particularly Shelley Hymes and Michael Gaines. Michael has been handling the technical side of this and I think he's done a great job.

So I just wanted to express my appreciation to all of you.

Bob?

Senator Bennett. Thank you. We've just been called to another vote, so this is a good time to quit.

Let me just make this one observation.

Dr. Thurow is not here, but, frankly, I've been sufficiently impressed with him that I'm going to try and be in touch with him and continue the dialogue.

He talks about wealth, all wealth being physical, coming from the ground—gold, oil, whatever.

There is no wealth coming from the ground until human ingenuity does something with it.

We were all hunter-gatherers living off the land, and not very well and not very long, until somebody came up with the first arrowhead and took a rock that had no intrinsic value and sharpened it into a point, so that he could kill an animal that could give him some protein.

And so on, the plow, et cetera, et cetera, et cetera.

All wealth ultimately come from human ingenuity applied to the physical things that come from the ground. And that truth still holds even if we're talking about a piece of silicon that has been melted down and turned into a chip.

And all of you and the people before you in the hearings today we've had have contributed mightily to the Congress' understanding of the challenge that's here.

And we're grateful to you all.

The Committee will stand adjourned.

(Whereupon, at 12:55 p.m., the hearing was adjourned.)

Statement
of
Scott G. McNealy
Chairman of the Board and Chief Executive Officer,
Sun Microsystems, Inc.

before the
Joint Economic Committee

June 16, 1999

National Summit on High Technology

I. Introduction

Mr. Chairman, and distinguished Members of the Committee, I appreciate the opportunity to testify before you today to discuss the critical role the high-technology industry plays in the US economy, and to share my views on what the world of computing will look like in the future. On the eve of the 21st century, high technology has created a powerful new Net economy that is vital to America's growth.

According to the Department of Commerce's report, "The Emerging Digital Economy", the information technology industry has been responsible for nearly 35 percent of the real economic growth in America over the past three years. Much of this growth has been driven by the convergence of the telecommunications, software, content and computer industries. As the technologies used to create, store and convey information converge, the potential benefits for users increase dramatically. But so does the potential for the concentration of power in a few hands -- a counterproductive outcome that would deny the public at large the full benefits of the digital revolution. Before discussing these issues further, I will briefly discuss the history of Sun Microsystems, Inc., because it demonstrates a long term commitment to open systems and the freedom of innovation.

II. Sun's history and vision

Sun Microsystems, Inc. is an American success story. Founded seventeen years ago, Sun has been challenging the "mainstream" computer industry and creating new technologies ever since. The company was started by people who envisioned a powerful desktop computer that would meet the needs of the technical community, but at a fraction of the cost of much larger machines. Sun's founders believed that the computers we produced should be based on open interfaces. This approach, unique at the time, allowed customers to mix and match Sun systems with products made by other vendors, and freed them from a proprietary lock-in to one company. We believed then, as we do today, that open interfaces support competition and encourage innovation by enabling anyone to develop new and different implementations. This leaves the consumer free to decide which products are best.

Today Sun offers a wide array of products, technologies and services that enable enterprises to compete in a new net economy defined by the Internet and network-centric computing. Our vision is to provide access to information by anyone, from anywhere, at anytime, on any device. Sun's Java(TM) technology is an example of our commitment to open network computing. Java enables the WebTone, the 21st century equivalent of the telephone dial tone. Like the dial tone, the WebTone is always there, making the network and its array of information and services always available to the user.

III. Convergence: The Service-Driven Network of the Future

As the technologies we use to create, store and distribute information converge, information and services will travel across multiple networks (like the Internet) to the user, who will be able to receive it on a variety of devices. In this new digital world, the Internet becomes a service-driven

network, where service providers offer a wide variety of content and services to network users.

Five years from now, for example, company managers won't buy much software. They'll outsource their software needs to service providers, and save money in the process. E-mail is another example. E-mail is e-mail. Most e-mail applications are standard, and they won't provide companies with a competitive advantage. Thanks to the Internet, they can outsource it to a service provider, who can handle it more cost-effectively. And it will free company managers to focus on what will matter in the future: making their companies more agile and more able to compete in the new Net economy.

This explains why almost overnight, the Internet has changed the way we shop, travel, share information, enjoy entertainment -- in short, the way we live our lives. However, we must take precautions to ensure the healthy development of the new digital society. We need strong, exportable encryption to protect information in the global marketplace. Export control policies for computers must keep pace with rapid technological advances. Failure to update controls this year will force both the U.S. government and industry to devote considerable resources to policing the export of tens of thousands of systems that are available from foreign competitors. The result -- U.S. computer companies will lose sales with no gain in security. This will eventually limit the ability of these companies to shape the future of the Internet era. This will also limit the ability of these companies to supply our armed forces with the cutting edge technologies they need to maintain the advantage on the battlefield. Only by being allowed to run faster and remain competitive, can U.S. computer firms play their role in helping to protect our nation.

We must also have free and open competition among the companies that will provide access to the Internet and all it has to offer. It is inevitable that some companies may attempt to control all the levers in this new paradigm, but no single company should be permitted to do it all. Any model premised on one giant company trying to capture all the business is ultimately harmful to consumers. Finally, we must make sure that we preserve the openness of the Internet by safeguarding the open interfaces that permit one system or program to work seamlessly with another. It is only through these open systems that we can enable a service-driven network that is available to everyone.

IV. Java Technology and WebTone

WebTone is a prime example of a new digital technology that can foster innovation and competition in the face of this inevitable convergence. The Internet caused the focus of computing technology to shift to a fundamentally new, point-and-click way to access information and services. This paradigm shift launched the computer industry into a period of unprecedented growth -- and brought the world's companies into a new "dot-com" economy.

As the company that powers the Net, Sun's products and services are key to doing business in the network age. By using open interfaces, Internet standards and platform-independent Java technologies, Sun enables companies of all sizes to deliver a broad range of services across traditional industrial, geographic, political, and linguistic boundaries. At the heart of it all is Java technology, which grew out of Sun's commitment to open network computing. Java combines

the WebTone -- namely highly reliable, always available network computing -- with a universal, "Write Once, Run Anywhere"(TM) software platform. Because Java is truly platform-independent, developers can create applications on a single platform and deploy them to multiple different platforms from one central location. This lowers system administration expenses and results in a greatly reduced overall cost of ownership.

Java brings the power of network computing to the general public because it enables the networked consumer. Java extends the Net and its services to a wide array of non-PC devices like smart cards, phones, digital set-top boxes, pagers and other appliances, ushering in a whole new world of interaction. WebTone, with its constant availability, ties it all together. Like the dial tone, it is simple to use, always available, and accessible from any device. It is essential to providing users with services such as e-commerce, e-mail, and other services that are at the heart of the service-driven network.

But it takes open technologies to make it happen. Jini, for example, is a Sun technology that enables different computers and other digital devices to plug together to quickly form impromptu, networked communities. In essence, Jini provides interfaces that enable networked devices to be represented as ``services'' accessible by other devices connected to the network. Think of it as ``plug-and-play'' for network-aware devices.

It's all part of the Net -- highly reliable and always available networks designed to keep us and our organizations and businesses connected, informed, and productive as we move forward into the next century. To accomplish all this, we need to continue to promote and enforce open standards for Java technology. Java-based technologies are removing the barriers to competition and enabling a variety of industries to reach markets that were unimaginable just a short while ago.

Java technology is spawning a multibillion-dollar "dot-com" industry which will innovate and compete to provide services and content across the service-driven Internet to millions and ultimately billions of customers worldwide. A principal concern, however, is perhaps best expressed in an article that appeared in the December 1997 issue of Red Herring Magazine. ``Java potentially strikes at the heart of Microsoft business by offering an alternative platform to Windows, and Microsoft has seen fit to retaliate in every way possible by creating Windows-only extensions to Java and by threatening not to ship the updated version of Java.'' This type of anti-competitive behavior corrupts the ability of Java to function fully as a cross-platform technology, and will leave consumers locked in to the old proprietary standards of the PC era of computing.

As we enter this new, post-PC era of "invisible computing," where the Net extends from home to work to school to wherever we are, it is essential that we continue to support the open standards that will foster innovation and competition, and that will enable our industry and our nation to thrive.

V. Policy Recommendations

To fully realize this seamlessly networked, digital future, however, we must ensure that markets work properly and that competition based on innovation is vibrant. This is where we in the industry must count on you in government to safeguard the road we must travel to reach that future. Congress, and in particular the Judiciary Committee, given its unique authority, must continue to monitor the state of competition in the high technology industries. While it would be inappropriate for the antitrust enforcement agencies to micromanage the economy, they should nevertheless act decisively to enforce the law when the need arises. Then, when a decision to bring enforcement action is made, it is crucial to act vigorously and quickly. I thus suppport the Justice Department's case against Microsoft because it will help to protect the new technologies that will shape the post PC era I have just discussed.

Let me be clear. Microsoft operates beyond the constraints of market discipline, and thus harms every competitor who seeks to bring products to market. This environment also harms consumers. How? In the current environment, where certain innovative and competitive products are blocked from the market, consumers lose their right to choose. It is as simple as that.

The United States' anti-trust laws have provided for the most successful, vibrant economy in the world for over 100 years. They still serve us very well, and will continue to serve us well as the technology industry takes its place at the forefront of the US economy. In this context, putting Microsoft under market discipline is not a question of regulation. It is a question of law enforcement. The appropriate and effective laws already exist. What is required is to have those laws enforced. At Sun, we want to compete. Fairly. Where success is won on the merits of our products and services rather than through the exertion of a chokehold on the market.

It is clear that Microsoft is a monopoly. I believe the Justice Department has very clearly shown that Microsoft has abused that monopoly power. As a result, law enforcement is called for. The government now must be creative, persistent and judicious in using its power to define remedies that will successfully restore competition to the industry.

There are several conduct remedies being discussed, and Sun supports a number of them. For example, I agree that Microsoft must be forbidden from entering into exclusive or preclusive agreements. I support the proposal that Microsoft must be required to make their pricing policies public, so the price of Windows operating systems -- a must-have product for so many hardware companies — cannot be used as leverage to control those hardware companies.

I also believe that Microsoft's cash hoard is a competition killer. The government must find creative ways to prohibit Microsoft from buying into new markets or improperly securing customers with their cash. The danger is very real that Microsoft will use the power and cash they have garnered from their current monopoly to create a new monopoly -- or several new monopolies -- in the post PC world. In fact, they have already started off down that path. This must be checked. They must not be allowed to destroy competition in any new markets.

Lastly, the government needs to level the playing field in the software industry so that any company can build products that will successfully interoperate with Microsoft's operating systems and products. This solution would require Microsoft to publish their programming interfaces

openly and freely. An independent oversight body would ensure that Microsoft neither uses secret interfaces in their products nor holds back interfaces from the rest of the technology community in an effort to improperly squelch competition.

I believe that a creative combination of remedies such as these will level the playing field for the technology industry as a whole, and put Microsoft under appropriate market discipline. Then we can do what we do best -- compete.

I urge each of you to lend your support to the Justice Department and to the promise of this vibrant new technology economy.

Thank you for your time.

Testimony of

Morton Bahr

President

Communications Workers of America

Before the Joint Economic Committee

June 16, 1999

Remarks of Morton Bahr, President
Communications Workers of America
Joint Economic Committee of Congress
Washington, D.C. - June 16, 1999

Good Morning, Mr. Chairman:

Thank you for this opportunity to offer the views of my union and organized labor on some of the significant issues involving the rapid introduction of technology in America's workplaces.

The Communications Workers of America represents 620,000 men and women employed in telecommunications, broadcasting, cable tv, newspapers, publishing, law enforcement, higher education, government and in numerous other professional, technical and administrative jobs that are most affected by new technologies.

Our members have worked at the frontiers of technological change since the introduction of the dial telephone more than 50 years ago. We have embraced new technologies and tried to make it work for us.

If the U.S. is to be successful in the global economy of the 21st Century, we must develop an economy that encourages high performance - high skill workplaces.

The challenge to us is that such workplaces require employees who receive continuous skills training, become capable of working with evolving technologies, make decisions on the floor and can work in teams.

This may seem a simple concept. But, unfortunately, relatively few frontline workers receive education benefits from their employers to prepare themselves for the future.

I served as chairman of the Kellogg Foundation's National Commission for Lifelong Learning. For two years, we examined adult learning in the U.S. We issued our recommendations in November 1997. An astounding 75 percent of the current workforce will still be in the workforce of 2010, and will need significant retraining to meet the requirements of their jobs.

I am pleased that the Administration and the Congress acted on a number of the Commission's recommendations. They include extension of Section 127 of the IRS code to make employer-paid education tuition non-taxable. The President urged permanent legislation.

Congress, however, only extended it until this year, so we need to revisit that again. We have solid evidence to prove that when employer-paid tuition is taxed, enrollment drops sharply. Tax free tuition should be made permanent, and Congress should look to extend it to post graduate work as well.

Mr. Chairman, if we are to realize the full economic benefits of future technology, ongoing skills improvement and expanded educational opportunities for all workers are a critical mission for our nation. Organized labor plays a very valuable role in meeting this challenge. Through the collective bargaining process, we have worked with our employers in the telecommunications industry to develop a wide range of educational opportunities for our members.

In 1986, we established the Alliance for Employee Growth and Development with AT&T; the first non-profit, jointly owned education and training corporation in the telecommunications industry. Workers receive fully paid tuition to train for new jobs in the company or to prepare themselves for entirely new careers outside the company. In its first ten full years of operation, the Alliance served more than 100,000 employees. Similar joint programs exist with all the telephone companies and Lucent Technologies.

Last year, we created a labor-management coalition to respond to the potential skills shortage in the U.S. The National Advisory Coalition for Telecommunications Education and Learning (NACTEL) was formed to train network technicians in the telecommunications industry.

Bell Atlantic, GTE, SBC, U S WEST and the International Brotherhood of Electrical Workers are part of the coalition. The Sloan Foundation gave us $1.2 million to help us get started. We intend to create a talent pool of trained U.S. workers that our employers can tap to fill good paying telecommunications jobs.

These are substantial pools of untapped resources in our country. Last January, CISCO Systems and CWA joined in a partnership with the military to train outgoing service personnel in telecommunications technology.

CISCO provides the equipment, and the union does the training and placing of new technicians.

CWA's apprenticeship program with U S WEST provides for school-to-work opportunities for high school students who move into skilled positions.

These are just a few examples of how a partnership of labor and management can work toward upgrading the skills of Americans, and fill the jobs of the future.

Instead, we hear demands to allow more foreign workers into the U.S. under the H-1(b) program. Just last month, the INS reported details of widespread abuse and fraud in the H-1(b) program to a House subcommittee. The INS also said that it is understaffed, ill-equipped and unable to deal with the problem.

Organized labor will present its views in detail on this issue when it comes before Congress.

We reject a future economy that is based on part-time, free lance, temporary or contracted-out employment. Last year, several young high tech workers came to see me. They were active members of the so-called Free Agent Nation that we hear so much about.

They didn't mind working as perma-temps. They didn't mind working 60 or 70-hour weeks, for months. They are exempt from overtime pay, but they didn't care. They had fun.

But something happened to them. They got older. They got married. They had children. Suddenly, mundane things such as mandatory long work weeks, pensions, health insurance, sick leave, vacations, job stress and a permanent place to live became very important to them. They asked if CWA could help.

We formed a new organization called the Washington Alliance of Technology Workers based in Seattle, Washington. We can't do collective bargaining because neither the agencies nor the companies they are contracted to want to claim them as employees, which is a serious weakness in labor law.

But Wash-Tech provides them with an organized voice to make their concerns known, to exchange information and to gain access to some benefits.

Indeed, the most threatening aspect of the New Economy is the creation of a contingent workforce that the Department of Labor calls a "social time bomb" that will go off in the next 15 or 20 years, when these workers discover they have meager pensions, unaffordable health care, little job protection and outdated skills.

Education and training is just one area where organized labor is uniquely suited to meet the demands of the new workforce. We can negotiate multi-employer health care plans, create industry-wide talent pools, develop portable pension plans, engage in employee participation processes and experiment with other programs that respond to both the needs of workers and industry.

We are already implementing many of these innovations in telecommunications. But this vision will never become reality in a union-free America. Review the testimony you have heard over the past three days. Only organized labor gives voice to the people-issues that concern working Americans about our technological future.

The future of technology holds the power to improve our lives - - on the job; in our communities and at home. Technology also has the power to de-skill, disenfranchise and de-value work. Our union is committed to make future technology work for our members, our employers and our communities. We invite all those who share our values to join with us.

Mr. Chairman, thank you for the opportunity to present our views.

Testimony

of

Alfred R. Berkeley, III
President
The Nasdaq Stock Market, Inc.

before the

Joint Economic Committee
at the

National Summit on High Technology

June 16, 1999

I am Alfred R. Berkeley, III, President of The Nasdaq Stock Market, Inc. The Nasdaq Stock Market and our parent, the National Association of Securities Dealers, Inc. (NASD®), would like to thank the Joint Committee for this opportunity to testify on the role technology plays in our economy, specifically in the securities market.

NASD

First, let me briefly outline the role of the NASD in the regulation and operation of our securities markets. Established under authority granted by the 1938 Maloney Act Amendments to the Securities Exchange Act of 1934, the NASD is the largest self-regulatory organization for the securities industry in the world. Virtually every broker/dealer in the U.S. that conducts a securities business with the public is required by law to be a member of the NASD. The NASD's membership comprises 5,600 securities firms that operate in excess of 71,000 branch offices and employ more than 589,000 registered securities professionals.

The NASD is the parent company of The Nasdaq Stock Market, Inc., the American Stock Exchange, Inc., and NASD Regulation, Inc. (NASDR℠). These wholly-owned subsidiaries operate under delegated

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authority from the parent, which retains overall responsibility for ensuring that the organization's statutory and self-regulatory functions and obligations are fulfilled. The NASD is governed by a 27-member Board of Governors, a majority of whom are non-securities industry affiliated. Board members are drawn from leaders of industry, academia, and the public. Among many other responsibilities, the Board, through a series of standing and select committees, monitors trends in the industry and promulgates rules, guidelines, and policies to protect investors and ensure market integrity.

The Nasdaq Stock Market®

In keeping with the NASD's mission of facilitating capital formation for the ultimate benefit of investors, The Nasdaq Stock Market develops and operates a variety of market systems and services. The Nasdaq Stock Market is the largest electronic, screen-based market in the world, capable of handling trading levels of at least one-and-a-half billion shares a day. Founded in 1971, Nasdaq today accounts for more than one-half of all equity shares traded in the nation and, since January of this year, is also the largest stock market in the world in terms of share volume and dollar volume traded. It lists the securities of 5,068 domestic and foreign companies, more than all other U.S. stock markets combined.

American Stock Exchange®

The American Stock Exchange is the nation's second largest floor-based securities exchange, listing 770 companies, and is the only U.S. securities exchange that is both a primary market for listed equity securities as well as a market for equity options, index options, and equity derivatives. Amex has been the nation's foremost innovator in structured derivative securities and index share securities. The latter are registered investment companies that permit an indexed equity investment, as do index mutual funds, but afford investors the opportunity to purchase or sell on the Exchange at any time during the trading day.

NASD Regulation®

NASD Regulation is responsible for the registration, education, testing, and examination of member firms and their employees. In addition, it oversees and regulates our members' market-making activities and trading practices in securities, including those that are listed on The Nasdaq Stock Market and those that are not listed on any exchange.

NASDR carries out its mandate from its Washington headquarters and 14 district offices located in major cities throughout the country. Through close cooperation with federal and state authorities and other self-

regulators, overlap and duplication is minimized, freeing governmental resources to focus on other areas of securities regulation.

NASDR has examination responsibilities for all of the NASD's 5,600 members. In addition to special cause investigations that address customer complaints and terminations of brokers for regulatory reasons, NASDR conducts a comprehensive routine cycle examination program.

Nasdaq Fuels Economic Growth

Nasdaq has driven the country's growth by providing capital to finance entrepreneurs' ideas. We have raised about $160 billion for entrepreneurs since the beginning of the decade, averaging roughly 520 initial public offerings (IPO's) each year for the last five years.

If one looks at our share of these businesses, or IPOs, across industries, one will find that Nasdaq has a large number of technology and software-related companies, and a substantial number of telecommunications companies. We have a definite affinity for high-tech companies and a large percentage of the companies that go public in the United States have been founded on the backs of the semi-conductor revolution, the telecommunications revolution, or the biotech revolution. Nasdaq has provided financing for almost all of these companies, and today most of them are Nasdaq companies.

Nasdaq continues to be the premier market for Silicon Valley and the technology industry—with 94 percent market share of software companies; 88.8 percent of computer manufacturers; 86.8 percent of communications equipment makers; 81.9 percent of electronic components; and 87 percent of biotechnology companies.

These companies have created jobs and given us products and services that have raised our standard of living. Our companies' growth has driven Nasdaq's growth. We reinvest what we earn in lowering the costs to trade, principally by investing in the technology that our own companies have created. In short, Nasdaq gives entrepreneurs in all industries a place to raise the capital they need. It is a freely competitive market—and repeatedly one of these start up companies grows up to be an MCI WorldCom, an Intel, or a Microsoft.

The Stock Market of Tomorrow

It has often been said that the future will be what you make it. At Nasdaq, we plan to create the stock market of tomorrow by aggressively employing technology, understanding investor needs, and serving as an agent of change.

We believe that tomorrow's market will be huge. Growth will continue regardless of the market's ups and downs. At Nasdaq, we utilize

technology to accommodate, manage, and even propel that growth. Virtually every aspect of tomorrow's stock market—its size, efficiency, safety, and sophistication—will be shaped by technology. The impact of the Internet, however, will stand alone in its far-reaching influence over markets and the securities industry.

Impact of the Internet

The Internet's ascendance has made information about investing and investments significantly more accessible to individuals than ever before. On our own Nasdaq-Amex Web site (www.nasdaq-amex.com), for example, investors can find everything from analysts' stock recommendations to company news releases, earnings reports, historical charts, and mutual fund reviews. Information that was once the privilege of securities professionals is now making its way to the World Wide Web—some of it for a price, but most of it free. Investors seem to like our Web site; we average more than 20 million hits per day. Nasdaq-Amex.com is one of the five most popular financial Web site in the world.

According to some predictions, overall Internet use worldwide will grow by 60 percent on English-language sites by next year, and will double in non-English sites, to a total of more than 160 million users worldwide.

This surge of information has helped unveil securities investing to the general public, attracting new investors to the market.

It is no secret that online trading is the fastest-growing form of trading. Today, about 15 percent of retail stock trades are made by online investors, and the number of online brokerage accounts will soon top 10 million. The number of online investors in the U.S. is likely to more than quadruple by 2002, to almost 23 million investors.

Full-service brokers may well feel threatened by this online boom and will need to adapt to maintain their share of business. Virtually all of the large, traditional brokerage firms now offer online trading to their customers. We will begin to see full service brokers adapt their roles, placing more emphasis on being financial advisors. Meanwhile, new firms, created specifically to be online brokers, are springing up.

As the Internet continues to grow, Nasdaq must facilitate and regulate trading in this new computerized environment. Our "sister" organization and regulatory unit, NASD Regulation, is in the midst of spending more than $100 million to enhance its systems for market surveillance and to increase examination, surveillance, enforcement, and internal audit capabilities. Much of that spending has been on technology to protect investors through initiatives such as an order audit trail system and a

customized "web crawler" that will be able to look through information on the Internet, flagging suspicious catch phrases for questionable practices that regulators might be interested in looking at more closely.

New Investors Mean Growth

Meanwhile, there are a growing number of first-time investors entering the market. As I stated before, we believe that many are lured by the ease of online investing and even more by a new level of comfort attained through the broad base of information about investments and investing available on the Internet. According to a 1997 study conducted for Nasdaq, the overall number of investors doubled in the previous seven years to 43 percent of all American adults—it has surely grown since then—and the country's investor base has diversified drastically, to "look more like America." A majority of investors are under the age of 50, almost half are women, half are not college graduates, and 10 percent describe themselves as "homemakers."

The trend in personal finance is moving away from saving, toward investing, and baby boomers are leading the way. Not long ago, "ordinary" Americans deposited their money in traditional institutions like banks. They perceived investing, particularly in the stock market, as risky ventures undertaken by wealthy individuals and large corporations. That perception

has faded and today this money is moving into our markets. As these middle-aged baby boomers—generally those born between 1946 and 1964—move toward and into retirement, the age by which they will have accumulated maximum savings, they will become clearly the dominant group of investors. With their investment capital, controlling considerable wealth, they will have a major impact on the market for years to come.

The growth in trading volume will continue with the succeeding generations—which we call "Generation X" and "Generation Y." More technologically savvy and skeptical about Social Security as a retirement safety net, Generation X-ers and Y-ers are also more likely than their parents to begin trading actively and investing early. They will have a significant impact on the market over the next 20 years.

Trading volume has been increasing, and this will likely continue. Three years ago at Nasdaq we were averaging 650 million shares a day; today it is up to about one billion. It is not hard to predict continued growth in trading volume—the real challenge is in dealing with it. Technology has enabled this growth and we will utilize technology to meet the challenges of continued growth through increased system capacity and further automation.

The challenge of matching capacity with the market's growth will continue well into the next century. To date, our highest volume day was just over 1.4 billion shares, in April of this year. We are adding capacity that will give us the ability to handle four billion, and then eight billion, shares a day.

We are going to need that capacity to be prepared for the growth that we see as the market becomes increasingly open and accessible to more people—not just in the United States, but around the world.

Globalization and Worldwide Access

Global demand for investment capital has continued to grow. Purchases of U.S. securities from outside the United States nearly quadrupled from $4 trillion in 1990 to $15 trillion in 1998. In the same way, American purchases of foreign securities have nearly quintupled during the same period, from less than $1 trillion in 1990 to almost $5 trillion in 1998.

This trend in globalization will call for a worldwide electronic network of inter-linked securities markets offering investors maximum access and the opportunity to invest in companies anywhere in the world. In the next decade we will see more "cross-listings"—companies being listed on American markets as well as on their own countries' markets. Nasdaq-

Amex has an arrangement with the Stock Exchange of Hong Kong to promote cross listings. It is likely to be just the first of many such cross-listing initiatives

Extended trading hours will complement market globalization—likely in the form of a separate evening session from 5:30 p.m. to about 9:00 or 10:00 p.m. While we are excited about the access this will provide investors in widespread time zones, we plan to move forward responsibly in a coordinated industry-wide effort that will ensure this added trading time is also safe, fair, and efficient for all involved. If this venture proves successful, round-the-clock trading may not be far away.

Nasdaq, which has been a computer-based, "floorless" market from its inception, is well suited to operate in tomorrow's globally linked, around-the-clock market environment. Open access to markets will not be limited to investors. We believe that issuers—the public companies that list their stocks on markets like Nasdaq—should have an unfettered choice among the markets, driven only by free and fair competition for their listings and supported by technology. Last year, the NASD was encouraged by the New York Stock Exchange's first moves to eliminate its Rule 500, which tightly constrains companies wishing to change markets. We believe the future lies in an open market, even among markets, and that anti-

competitive practices will be torn down by the people who want change. Investors will benefit from free and fair competition among markets.

Investing in Our Future

As millions of new investors enter the market, volume grows, and access to trading opens up around the world and around the clock, it will be more critical than ever for markets to reinvest in themselves. Right now, we are working with a variety of partners to create systems capable of meeting the expectations of investors well into the next century.

Along with the need for greater capacity comes the need for more sophisticated capabilities in trade execution. This summer, Nasdaq will integrate an electronic equity trading process into its system that will offer investors a "third dimension" to their trading criteria. Instead of being able to enter orders at only one price and size, investors will be able to indicate, across a range of prices and sizes, their preferences with respect to a particular trade. The supercomputer-powered OptiMark system, which uses patented algorithms, matches buying and selling desires in a manner that maximizes the mutual satisfaction. OptiMark Technologies will also give investors the ability to trade stocks anonymously. This is one example of how technology will continue to enable more sophisticated stock trading.

With the boom in electronic markets, we are often asked the fate of traditional floor-based markets like the American Stock Exchange. The NASD acquired the Amex® last year in our first step toward creating a "Market of Markets℠," which brings together two systems under one corporate roof to offer better choices and opportunities to all market participants.

One aspect of last year's merger was to leverage the strength of Nasdaq's technology throughout the enterprise. For example, in September, the newest version of the Amex's electronic order book will be put in place, making orders more transparent and giving order makers even more visibility into the market. Everything about the Amex options market is already fully electronic, but now we are expanding that technology into member firms' offices, where they will be able to access the market more efficiently. The floor still has its place in the trading world, but because of technology enhancements, the exchange is moving in a direction where "upstairs brokers," the representatives who take orders from the public, have better direct access to the trading floor.

Conclusion

The NASD thanks the Joint Committee for this opportunity to testify, and for its interest in the role technology plays in our economy. America's

equity markets are the envy of the world. Nasdaq is now the largest equity market in the world. Even with this success, we must change with the technological change around us. We welcome change as we welcome investors and entrepreneurs. We are willing to change everything except our belief in the simple, elegant power of competition.

Frank Carlucci's Testimony
Joint Economic Committee's High-tech Summit
June 16, 1999

Good morning, Mr. Chairman and Members of the Committee. I am Frank Carlucci, Chairman of the Board of Nortel Networks, and I greatly appreciate being invited to speak at this very timely and important high-tech hearing.

Nortel Networks is one of the world's largest suppliers of digital network solutions, and the most broadly diversified developer of high capacity switching and optics technology. We have over 100 years experience in building communications equipment. And we are at the heart of the Internet. In fact, over 75 percent of all Internet traffic travels over Nortel Networks infrastructure. We are a global company with a presence in over 150 countries where we work with customers to build and deliver communications and IP (Internet Protocol)-optimized products and networks or what we call "Unified Networks." No other company in the world can deliver global applications and services that merge new and existing networking elements and technologies into a seamless open network. The Unified Networks approach gives our customers distinct advantages while simplifying network operations and reducing costs.

We are a global company. And while we have a Canadian heritage, our U.S. presence has been steadily increasing over the past 25 years and we have had more employees here than anywhere else for years. And since our merger with Bay Networks of Santa Clara, California last fall, we are an even stronger U.S. company. We continue to have more employees in the U.S. than in any other country. About 35,000 of our 75,000 worldwide employees work in our U.S. facilities. These 35,000 employees contribute to annual global U.S. exports of over $2 billion. Nortel Networks has an invested base in the U.S. of $10 billion, and growing. And all four of our business units are based here. Nortel Networks is traded on the New York Stock Exchange and other major stock exchanges around the world.

Nortel Networks has state-of-the-art centers, including research and development, manufacturing, semiconductor and software engineering facilities in California, Colorado, Connecticut, Florida, Georgia, Illinois, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Carolina, Tennessee, Texas and Virginia.

On the first two days of this high-tech summit, you heard about the high-tech industry's impact on the U.S. economy and about numerous high-tech issues. Today, I decided to use the tried, true and ever-popular show and tell method to provide a glimpse of the future.

I am going to show you the payphone of the future. Nortel Networks unveiled the NetVenue e-commerce kiosk on June 8. NetVenue enables consumers at airports and other public places to access the Internet, send and receive e-mail, purchase a concert or airline ticket or make a telephone call from an interactive public multimedia kiosk. As you can see, the kiosk includes a touch screen and phone. It also has a printer to provide consumers with a receipt for a purchase or reservation or directions to their destination. It allows consumers to efficiently conduct business transactions that in the past would have required a trip across town and a long wait in line.

The Demonstration

For this demonstration we have set up applications appropriate for the airport. When not in use, the Nortel Networks NetVenue kiosk displays messages designed to draw the user to the device. Once at the terminal, the user touches the screen to start the device. The user is then presented with a number of applications. These applications can range from information gathering, web browsing to E-commerce.

For instance, I am at the airport when I realize that I have forgotten to buy a present for my wife for our anniversary. Using NetVenue, I can send flowers to her by simply touching the screen. I will be prompted through an E-Commerce transaction in minutes.

In this example I have a choice of bouquets, and accompanying cards. At this point I enter my wife's name, address and message. The selections are then confirmed, including the total cost of the flowers.

At this point the Nortel Networks E-commerce engine prompts the user to select a method of payment. I choose to use my visa card and swipe it through the card reader. The credit card is verified through an online credit card validation service. If the card is valid, the transaction is completed and as you see here, a receipt is provided. The flowers are scheduled for delivery. At any time throughout the transaction, I can call the flower shop through the use of the integrated telephony feature by simply touching a button on the screen.

Having taken care of my wife, I now use NetVenue to book a hotel reservation. In this example I am connected to a web-based hotel reservation service that allows me to search, find and book a hotel room.

Once my hotel reservation has been made, I then decide to take a shuttle service to the hotel using a specially designed application. I select the number of tickets I need and the transaction is completed with the payment of the tickets using my credit card. My credit card is verified and at the end of the transaction a ticket is printed that will allow me to board the shuttle.

By combining several applications, we provide greater value to the user. And, for those of us who are accused of never stopping to ask for directions, we can get them from the machine, print them out and no one would be the wiser. In this case, because NetVenue knows that I just bought a shuttle ticket, I can be directed to the mapping application to help me locate the shuttle pick-up area. Then, before boarding the plane, I access my e-mail and read and respond to my messages.

The terminal can also function as a public pay telephone and works by simply lifting the receiver or pressing the payphone button on the screen. I can then place a call to an 800 number or use a calling card, credit card, or a smart card to make a long distance call.

NetVenue is different from other kiosks because it uses a non-proprietary open-platform which allows service providers to easily create their own content and specialized e-commerce applications. The types of web-based applications that could be provided are restricted only by your imagination and the ability to set-up business agreements with service providers.

Conclusion

Nortel Networks NetVenue is just one example of the many exciting and innovative technologies that are changing the way we do business, the way we socialize and the way we live. To ensure that we remain on the cutting edge, we invest in the future by spending 14 percent of our revenues on R&D, one of the highest percentages in the high tech industry.

There are three key things that you as leaders of this nation can do to invest in the future of this country and ensure that the United States remains a high-tech world leader.

1) R&D Tax Credit: Please make this permanent. The retroactive temporary extension of this credit that has been going on for 8 years and is simply not responsive to the environment in which we are working. R&D is *not* a nine-month or one-year project. It is an ongoing, critically important aspect of high-tech growth. It is in the best interest of high-tech companies to have a credit they can depend on so they can plan accordingly. And it is in the best interest of the U.S. to have a permanent R&D tax credit so they are in a good competitive situation with other countries that attempt to woo R&D by offering permanent credits.

2) Y2K Legislation: Please adopt legislation. The greatest threat to Nortel Networks is not that our technology will not be Y2K compliant. We have spent hundreds of millions of dollars to ensure that we are compliant and that our customers have the software they need to ensure they are compliant. We have no problem with our technology. What we are threatened by is the prospect of frivolous lawsuits. We fear that our high-tech competitiveness will be significantly harmed by the drain of R&D and other resources from the potential explosion of Y2K litigation. I urge you to adopt legislation which will, at a minimum, ensure that corporations who have made the very best effort possible to ensure they are Y2K compliant will be able to address Y2K issues in a reasonable manner before they are sued. We have identified four essential ingredients of Y2K legislation:

--**Duty to Mitigate**: Damages awarded to any Y2K claim should exclude compensation for injuries when the plaintiff could reasonably have avoided the injury not just based on information that was communicated to the plaintiff by the defendant, but also based on information of which the plaintiff was aware or reasonably should have been aware. We live in an information age and plaintiffs should not be rewarded for putting their heads in the sand.

--**Defense of Reasonableness**: The law should clearly recognize a defendant's good faith actions to address the Y2K issue in its products as a defense. In a contract-based Y2K claim, this would mean allowing, as a basis for limiting or eliminating liability, evidence that the defendant's performance or efforts to perform the contract were reasonable under the circumstances. In a tort-based Y2K claim, this would mean allowing, as a basis for eliminating liability, evidence that the defendant acted in good faith and took all reasonable measures to prevent the Y2K problem which caused the injury.

--**Proportional Liability**: Proportional liability should be established under which a defendant would be liable only for the portion of a judgment that corresponds to such defendant's proportional responsibility for a Y2K-caused injury, provided that such defendant took reasonable steps to seek to avert the Y2K-caused injury.

--**Cooling Off Period**: Nortel Networks supports the concept of a 90 day cooling off period to allow the parties to a Y2K-based dispute to seek a mutually agreed upon solution before a lawsuit is filed.

3) Export Controls: Please be careful in your deliberations on export controls. To place broad export controls on technologies which are simply not controllable or which are available

everywhere else in the world would threaten our high tech leadership position. We need to precisely identify categories of new technologies that we are confident have important military uses and then seek agreement by our partners multilaterally to control these categories.

Mr. Chairman and Members of the Committee, I have attached documents to the testimony for the record, which expand on these policy issues. Thank you for the opportunity to present today. I would be pleased to take any questions you may have.

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May 26, 1999

The Honorable Trent Lott
United States Senate
487 Russell Senate Office Building
Washington, DC 20510

Dear Mr. Majority Leader:

The U.S. high tech industry has dedicated substantial resources to resolving the Y2K issue in computer-based products. Yet, the threat of extensive Y2K litigation has the potential to damage large and small U.S. technology businesses, the national economy and U.S. competitiveness. If Y2K liability legislation is not enacted, we fear frivolous lawsuits will drain the technical resources of high tech companies like Nortel Networks, sapping critical R&D resources necessary for U.S. high tech companies to remain on the cutting edge. The U.S. is the most litigious country in the world. And the opportunity for frivolous lawsuits is endless under present law. That puts the U.S. at greater risk -- of draining critical and limited technical resources into nonproductive litigation response activities -- than any other country, all of which are less litigious.

Nortel Networks takes Y2K seriously. We are spending hundreds of millions of dollars on an aggressive and comprehensive readiness program to make our internal systems Y2K ready and to assess, remediate and verify the Y2K readiness of our products. An important part of this program is to communicate the requirements for product Y2K readiness to our customers, either directly or through distributors. We believe that we have taken all reasonable steps to make Y2K upgrades available to our customers so they can bridge successfully to the millennium. We are confident that we have met the Y2K preparedness challenge both internally and for our customers.

What we are powerless to avoid, however, is the impact of frivolous lawsuits. The New Year is not yet here but already about 100 Y2K lawsuits have been filed against numerous companies, many of them class actions involving potentially thousands of plaintiffs. Defense of frivolous lawsuits entails diversion of valuable technical and business resources from productive work. Multiply this by thousands of unmeritorious lawsuits filed against thousands of high tech companies and you can begin to imagine the impact on the U.S. economy in terms of lost productivity and lost R&D activities. Without comprehensive and ongoing R&D investment, the high-tech leadership position the U.S. currently enjoys will be in jeopardy.

We believe there is real overall social benefit to enacting Y2K liability reform to reduce the diversion of limited resources in defending unmeritorious Y2K lawsuits. After careful analysis, Nortel Networks has determined that, at a minimum, the following needs to be included in legislation if we are to have any hope of discouraging unmeritorious lawsuits:

- Duty to Mitigate: Damages awarded for any Y2K claim should exclude compensation for injuries when the plaintiff could reasonably have avoided the injury not just based on information that was communicated to the plaintiff by the defendant, but also based on information of which the plaintiff was aware or reasonably should have been aware. We live in an information age and plaintiffs should not be rewarded for putting their heads in the sand.

- Defense of Reasonableness: The law should clearly recognize a defendant's good faith actions to address the Y2K issue in its products as a defense. In a contract-based Y2K claim, this would mean allowing, as a basis for limiting or eliminating liability, evidence that the defendant's performance or efforts to perform the contract were reasonable under the circumstances. In a tort-based Y2K claim, this would mean allowing, as a basis for eliminating liability, evidence that the defendant acted in good faith, and took all reasonable measures to prevent the Y2K problem which caused the injury.

- Proportionate Liability: Proportionate liability should be established under which a defendant would be liable only for the portion of a judgment that corresponds to such defendant's proportional responsibility for a Y2K-caused injury, provided that such defendant took reasonable steps to seek to avert the Y2K-caused injury.

- Cooling Off Period: Nortel Networks supports the concept of a 90 day cooling off period to allow the parties to a Y2K-based dispute to seek a mutually agreed upon solution before a lawsuit is filed.

I am grateful for all of the hard work already exerted toward this legislation by so many Members of Congress and Administration officials, and I know our input has been late in coming. I am glad to do anything I can to help enact bipartisan legislation, which truly provides relief to businesses that have fulfilled their responsibilities in addressing the Y2K issue in their products. Please do not hesitate to contact me if you have any questions or wish additional information. Nortel Networks believes such legislation is essential to the long-term competitiveness of the U.S. high-tech industry.

I greatly appreciate your involvement in this critical issue.

Sincerely yours,

F. William Conner
Executive Vice President

The Honorable Frank Carlucci, Chairman, Nortel Networks
Testimony before the Senate Banking, Housing and Urban Affairs Committee on Export Controls
June 16, 1999

Mr. Chairman, and distinguished Members of the Committee. It is a pleasure to have been invited to appear before you today. I am Frank Carlucci. I have been a member of the board of directors of Nortel Networks since 1989 and became the Chairman of the Board in April of this year. I joined the Carlyle Group in 1989 where I am now Chairman. From 1987 to 1989, I was the Secretary of Defense and previously served as President Reagan's National Security Advisor in 1987. In my capacity as both Secretary of Defense and National Security Advisor I dealt with our countries export control laws and regulations.

I was asked to address how export control policy should be applied to "emerging" or "new" technologies. My comments will be made from the perspective of Nortel Networks, a world leader in the developing technologies for telephone and Internet protocol-based data, wireline, and wireless networking services.

Nortel Networks is one of the world's largest suppliers of digital network solutions. And it is the most broadly diversified developer of high capacity switching and optics technology. We are at the heart of the Internet. Over 75 percent of all Internet traffic travels over Nortel Networks infrastructure. We are a global company with a presence in over 150 countries where we work with customers to build and deliver communications and IP (Internet Protocol)-optimized products and networks or what we call "Unified Networks." No other company in the world can deliver global applications and services that merge new and existing networking elements and technologies into a seamless open network.

While we have a Canadian heritage, our U.S. presence has been steadily increasing over the past 25 years and we have had more employees here than anywhere else for years. Since our merger with Bay Networks of Santa Clara, California last fall, we are an even stronger U.S. company. About 35,000 of our 75,000 worldwide employees work in our U.S. facilities. Nortel Networks has an invested base in the U.S. of $10 billion, and growing. Fifty-six percent of our 1998 revenues were generated in the U.S. We export over $2 billion from the U.S. each year. All four of our business units are based here.

I want to emphasize that notwithstanding the end of the Cold War, there remain important threats to U.S. and world security. It is clear that we still need export controls for various categories of commercial, dual-use products. But the parameters of export control policy have changed considerably since I was the Secretary of Defense.

First, with very few exceptions, our enemies are no longer obvious or unified. That is why we presently are not able to maintain a strong and comprehensive multilateral system of export controls.

As a practical matter, it is very difficult to restrict effectively exports of commercial products to countries with which we have normal trade relations. We may sometimes be uncomfortable with our former adversaries, but we are fully engaged with them economically, and it is in no one's best interest to increase tensions unnecessarily by disengaging from them – especially if we are acting alone. Moreover, if we act alone, we are unable to fulfill our policy objective, since the technologies usually can be provided by other countries. The end result is that only U.S. industry is harmed.

Second, the sources of new technologies have shifted. In the past, much of the important technology was created by the military, or by private industry under contract to the military, and commercial uses for those technologies were developed later. Today, most of the exciting new technologies are being created by private industry for commercial purposes, without involvement of the government. Many of the new technologies, especially those relating to communications and the Internet, have become tightly integrated into the way in which commerce is now conducted. Although those commercial products in some instances may be capable of adaptation for military purposes, it will become increasingly difficult for the government to keep abreast of new developments and to control the direction of development.

Third, the pace of technological change and development has greatly accelerated. This has happened not just for computers and software, but for all forms of high technology products, including communications equipment. "Moore's law", first formulated in 1965, states that the capacity of computer chips will double every 18 months; we are finding that the pace of improvements in our business is actually faster than that today. Export controls that are pegged to quantitative limitations such as speed and capacity will quickly become outdated.

Fourth, users are demanding higher levels of interoperability, so that they can use any manufacturer's products with any other's. This means products in many cases must be designed with "open architectures," so that unrelated companies can design their products to be compatible with each other. This, in turn, will make it even easier for a foreign purchaser to buy third country products if U.S. products are not available because of export control restrictions.

Fifth, the advent of new types of communications technologies, such as the Internet, has led to the decentralization of technology development. Companies and individuals from all over the world can share ideas quickly and effortlessly because the Internet is a world without boundaries. Many companies, such as Nortel Networks, rely heavily on these technologies to increase our own productivity and creativity.

Indeed, it is this desire for increased productivity that drives the market for Nortel Networks' products and services. In today's world "global economy" means "global technology". We can't escape it.

Given these changed parameters, we need to view the role of export controls in a different way.

While mindful of the dangers of proliferation of weapons of mass destruction in the hands of renegade states, we should acknowledge that the U.S. benefits greatly from being able to export cutting edge technology products, both because we use them ourselves and because there is an enormous and still growing market for the purchase of such products abroad. We believe Nortel Networks is now one of the world's technology leaders, but we also know that if we slow our pace of new product development, or are unreasonably constrained in our efforts to grow in foreign markets, we will quickly be left far behind by our foreign competitors and become a weaker company. So export control policy must recognize that, now more than ever before, unintentionally interfering with legitimate export activities of U.S. companies not only harms the U.S. economy, but also U.S. technology leadership.

In that connection, the Pentagon's Revolution in Military Affairs (RMA) is highly dependent on commercial technology, particularly in the information technology area. More specifically, let me explain that the RMA is based on the premise that in order to achieve victory in a conflict, the victor must have incorporated new technology, evolved his organization and revolutionized his operating doctrine to the extent that victory is attained in the immediate instance. Without the adoption of robust technology, the revolutions that have led to countless wartime victories would never have happened.

We also need to acknowledge that many categories of products and technologies are becoming less and less susceptible to control. What this suggests is that we should focus our export control efforts on those categories that have important military uses, and which we can actually control with some effectiveness. At the same time, there should be an enhanced partnership between government and industry, so that government fully understands the capability of the technologies, and industry understands the concerns of the government.

Today's threat to our security is beyond a doubt a high tech threat. The Cox Report makes this point graphically. Whether it is the Tae-Po-Dong missile from North Korea or Sadam's nuclear program, we need to staunch the flow of technology to those who would harm us. But we should do only that which has an effect, not that which simply makes us feel good. Many technologies are uncontrollable given the access of the Internet; others can and will be supplied by our competitors. Our job – or better said – your job with advice from us and the Executive is to strike the right balance – don't help our enemies but at the same time allow innovation and research to flourish.

It is a tough task. We at Nortel Networks stand ready to help. I want to again thank the Committee for inviting me to appear before you, and I would be pleased to answer any of your questions to the best of my ability.

PREPARED STATEMENT OF JAMES C. MORGAN, CHAIRMAN AND CEO, APPLIED MATERIALS

Good morning. Mr. Chairmen, members of the committee, my name is Jim Morgan and I am the chairman and chief executive officer of Applied Materials, a global company headquartered in Santa Clara, California. Thank you for inviting me to take part in this "summit" today. Hopefully, by taking the time to examine the emerging industries of the new economy, we will be able to forge some "high-tech" policies more conducive to the high-growth, high-return industries that are helping to lead America's economy into the 21st Century from a position of strength

. Applied Materials is the world's largest maker of semiconductor manufacturing equipment. We develop and manufacture the multi-million-dollar sophisticated systems that are used around the world to produce semiconductor chips. These systems take thin wafers of silicon and perform the complex processes and steps necessary to create the millions of microscopic structures that make up semiconductors. These wafers are then sliced up into small pieces to become individual semiconductor chips. We conduct nearly all of our R&D and manufacturing here in the United States — and export about two-thirds of everything we make.

At Applied Materials, our business involves complex processes like epitaxial deposition, chemical vapor deposition, dry plasma etching and a host of other processes whose names you've probably never heard of. Our systems perform delicate recipes in strictly controlled environments, some at 2,000° Celsius others at deep-space vacuum, all of them pushing the limits of physics, chemistry, materials science and the toughest subjects they offer at MIT, Cornell and Berkeley.

For our purposes here, it's easier to remember that Applied Materials makes the systems, that make the chips, that make the products, that change the world. Nearly every chip in the world passes through a piece of Applied Materials equipment during the manufacturing process, so you can say that every time you log onto a computer, surf the web or place a call from a cellular telephone, you benefit from technology created by Applied Materials. Without the advances in chip technology over the decades, many of the conveniences we take for granted today, like buying baseball cards on eBay or connecting Silicon Valley and Washington by video conference, just would not be possible or practical.

By providing key enabling technology, Applied Materials has figured in some of the most significant breakthroughs of the Information Age. Aided by Applied Materials' achievements in process technology, Moore's Law of doubling chip capacity has held true for decades. The microprocessor alone has improved its performance 7,000 times in 25 years.

Right now, we are working on the manufacturing solutions that the world's leading chipmakers will put into practice several years from now. Just this past week, you might have heard of the latest generational change that our industry is launching. For the past half-dozen years, the standard for chipmaking has been a 200mm silicon wafer. Hundreds of fabs around the world are processing thousands of these wafers even as we speak to make the logic and memory chips that drive Information Age products from coffee pots to supercomputers. Now the standard is shifting to a 300mm wafer. Basically the whole industry will advance from a salad plate to a dinner plate-sized silicon wafer. Why do it? Basic economics. You can get two and a half times the chips on the bigger wafer. What do you have to change on the technology side? Just about everything. At Applied Materials, we have been working for several years in our own labs and with our customers to develop a full line of 300mm systems that will allow our customers to switch rapidly and confidently to the new larger wafers. It took a massive investment in R&D from us — last year alone we spent over a half billion dollars — and we are only one company. And what will be the result for you and me? Cheaper, more powerful chips that can be more efficiently manufactured by American companies like Intel, Motorola, IBM and Micron. This is merely one example of the kinds of transformational change that takes place all the time in the semiconductor industry.

Which of Applied Materials' current breakthroughs will open the door to the future? No one knows for sure, but by leading the industry in the development of critical new capabilities such as 300mm wafer processing, 0.18 micron technology for making tiny circuit lines hundreds of time finer than a human hair, and developing integratable process solutions to make chip manufacturing more cost-effective, Applied Materials remains clearly focused on the future. What will be the technology that launches the next revolution? Will it be an aid to multi-layer devices, or copper deposition for speed or system-level integration of memory and CPU? No one can know for sure, but at Applied Materials, we have teams that dedicate their time every day to dream these dreams.

In technology, progress is a process of connecting known things to one another to achieve new outcomes, and the semiconductor itself is the child of many innovations. So is the Internet. The Internet is a technology of technologies. As the product of everything we have been working on in Silicon Valley for the past 30 years, the Internet stands as the culmination of a generation's worth of work in high technology up and down the food chain — from Yahoo to Cisco, from Intel to Applied Materials. Thanks to the Internet and its derivatives, our global economy is changing. There is no regional advantage, no time-zone edge, no intellectual leg-up any more. In this new world, where capital, information and goods flow more rapidly, the old rules of the physical economy apply less and less.

What does it take to succeed in this environment? Being a global leader of change, not a follower. And in a world being transformed, change comes in many forms: emerging technologies, evolving business practices, and new relationships with customers, suppliers, employees and the community.

Leading with Technology

First, we must lead with superior technology. As the world's industrial and developing economies gear up to compete in the Internet economy, competitiveness will depend more and more on the ability to capitalize on innovation. Over the past two decades, a new generation of semiconductor chops has been created every two to three years. To remain the leader, America must be at the forefront of developing technologies to create these chips. I can tell you, even for a company whose business is built on speed and adaptability, this is a relentless task. It requires anticipating new technologies before they arrive and working closely with customers to drive innovations. Maintaining a competitive advantage in the Information Age requires a strong commitment to research and development, and we must encourage basic research and private R&D investment through tax, accounting and regulatory policy. The Internet that we take for granted today is based on government investments that go back decades. Let's make certain that our national investment priorities share that same sense of vision. And as technology advances, government leaders need to fully understand the trade-off between export controls and export opportunities. The U.S. had little monopoly on technology, so we must select the few areas of technology that are critical for national defense and let the others develop into open commercial applications.

Global Infrastructure and Open Access

Second, we must capitalize on global infrastructure. One of the most enduring — and often most forgotten – lessons of the digital age is that technology is not enough. Companies must be structured to deal with the full implications of doing business in a worldwide marketplace, including a multi-ethnic workforce, variable laws and governments, and diverse local cultures. Information Age companies must invest in creating the global infrastructure needed to respond quickly to customer requirements around the world. Here in the U.S., access to the best talent from around the world is a critical component for our future competitiveness and long-term global success. Because the speed of introduction of new products is essential in an environment where product life-cycles are measured in months, we must insist on clear access in all key economies so that new products can get to the global market quickly and effective protection of intellectual property once they get there.

Flexible Regulatory Environment That Enables Change

Finally, the new economy demands a new millennium company. In the years ahead, you'll want to work for, partner with and invest in companies with the ability to change, adapt and grow — leveraging their fundamental strengths to take advantage of the new economy. Leadership companies in the new millennium will take everything we already know about business and speed it up. These companies will succeed because they foster a culture of resilience and reward success. To be global leaders, we need a regulatory environment that allows for us to keep pace with the changing workplace, to attract, retain and compensate employees, and to compete with companies around the world.

As we approach a new century, change is the only constant. At Applied Materials, we believe that change is the medium of opportunity and growth. We manage change first by anticipating it, then by leading with superior technology, by building a global infrastructure to support customers and by making a strong commitment to employees, communities and the environment. As we look toward the future, the rate of change is expected to accelerate, and the challenges and opportunities will be great. The new economy offers our companies both unparalleled market opportunity and risk. As Asia's boom and gloom have shown us, the global market can be rich and volatile. Driven by the instant

information of the Internet, the global economy rewards speed, resilience, and most of all courage. I hope this summit is a positive step that helps to prepare ourselves, our economy and our nation to meet the challenges and leverage the opportunities offered by the Information Age well into the next century.

Thank you.

PREPARED STATEMENT OF GORDON M. BINDER, CHAIRMAN AND CEO, AMGEN, INC.

Thank you, Mr. Chairman.

My name is Gordon Binder. I am Chairman and Chief Executive Officer of Amgen, the nation's largest biotechnology company and one of its premier high technology enterprises.

Amgen's story is in many ways typical of the entire story of high technology's role in America's economic growth. So, with your permission, I'll take a moment to sketch it out.

Amgen began operations in 1981. We shipped our first drug in 1989. In the eight years in between, we had to do two things—pursue our research and development program and raise the capital that kept that program going.

Raising capital, funding research, that is the heart of the high-tech story—and the heart of a good deal our nation's economic story in the last two decades.

For example, from that 1982 standing start, Amgen now has nearly $3 billion in revenues and more than 5,000 employees. Nationwide, biotechnology employment has grown almost 400 percent in 13 years—to over 150,000 people with salaries that average $50,000 each.

And that's not the industry's only economic impact.

This little bottle contains a single does of EPOGEN®, the product that we first shipped a decade ago. Well-functioning kidneys produce this protein naturally, which stimulates bone marrow to make red blood cells. Without enough red blood cells, you're anemic. If you are a kidney patient, chances are that you can't produce enough of this protein, so you can't produce enough red blood cells.

It used to be that kidney patients received frequent transfusions, which are expensive and carry risks. Even so, many remained anemic. Some cut back on work. Some had to quit jobs altogether and go on public assistance. EPOGEN lest the body create red blood cells again, and gives people back their energy for work and for quality life.

In other words, in the past decade this small vial has helped millions to remain productive. It has cut transfusions in the United States by nearly one-fifth—that's one in five. And fewer people have contracted blood-borne diseases, which has also saved healthcare money.

So on top of creating tens of thousands of jobs and billions of dollars of national wealth, biotechnological innovations like this are cutting the cost of disease—not just the out-of-pocket costs that insurers pay but the total cost to society and patients.

But biotechnological innovations do not come cheaply. It takes on average $500 million and 15 years to develop a new drug. And only one in three will produce profits that cover their after-tax R&D costs.

High costs and long odds are the realities of biotechnology innovation and they lead to the two policy recommendations I want to focus on today.

The first has to do with the R&D tax credit. The credit is a good idea. It reduces the after-tax cost of R&D. This mean that innovators have more money to invest in more new medicines, which increases the odds that a company will end up with a successful new product.

But R&D investment is not an on-again, off-again thing. It's a long-term commitment—and to have the greatest macro-economic effect, the government's commitment to this tax credit should be long-term, too.

In the last 17 years, the credit has lapsed nine times, including last July. Each time it's been renewed or extended, and not the President proposes to extend it for another year. That's good. But put yourself in the shoes of biotechnology innovators. Can they count on the credit or not? Beyond a year, they can't—so we are reluctant to factor more than a year of it into planning. In policy terms, this means less innovation bang for the tax-credit buck. It is wasteful.

So this is policy recommendation number one: maximize the impact of the R&D tax credit; make the tax credit permanent.

Recommendation number two: in this session, there will be a number of proposals directly or indirectly to impose price controls on

pharmaceuticals. Innovation is expensive, risky and therefore fragile. Price controls—even the threat of price controls—discourage it, badly.

I have here a chart of total pharmaceutical company R&D spending in the U.S. during each year of the last decade (see attachment). You can see that, in time, the climb was steady-with one exception. In 1994 it almost stopped. What happened in 1994? The President put forward his healthcare program and it included price controls.

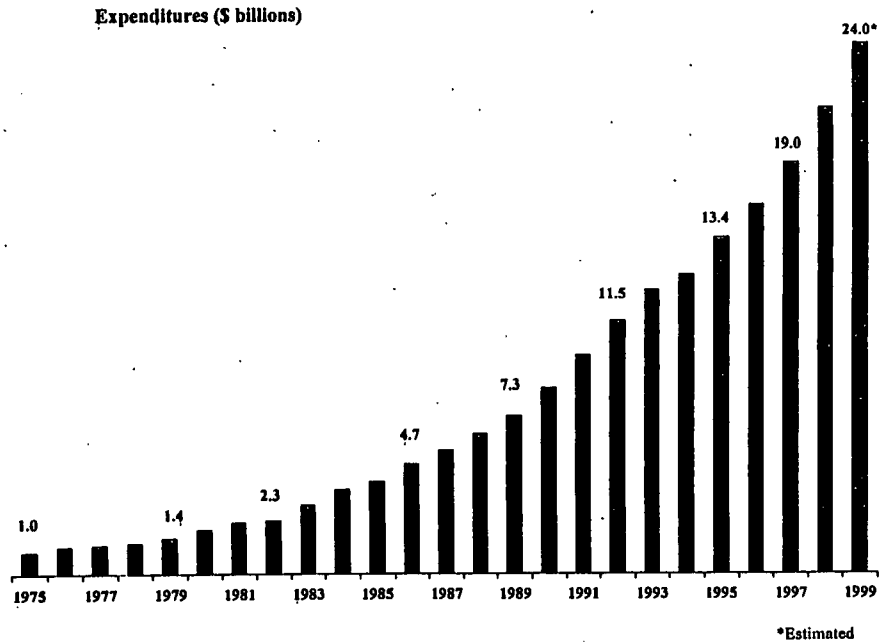
This is a simple fact: all policies to advance the biotechnology and the development of pharmaceuticals and encourage industry growth into the next century will be far less successful if Congress imposes any form of price controls on pharmaceuticals.

My time is short today and I am sure you will hear from other speakers about the need for strengthened global intellectual-property protections, for innovation-friendly regulatory environments, for better treatment of capital gains and for day-for-day compensation for delays at the Patent and Trademark Office that are out of the control of the patent applicant.

So let me keep my message to this: make tax incentives predictable, allow the market to determine prices and thereby decide the rewards of innovation, and America's best bio-tech and pharmaceutical innovators will continue making medical and economic miracles.

Thank you. I look forward to our discussion.

R&D Investments by Research-Based Pharmaceutical Companies



Source: PhRMA Annual Survey, 1999

ATTACHMENT 1

EDVENTURE HOLDINGS INC.
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16 June 1999

Testimony of Esther Dyson

Chairman, EDventure Holdings;

Interim chairman,

Internet Corporation for Assigned Names and Numbers (ICANN)

Good morning, etc.

I would like briefly to address two topics today: The first is the role of the government on the Internet. The second is the role of the *non*-government organization I currently chair, the Internet Corporation for Assigned Names and Numbers (ICANN).

The glorious future

Over the past couple of days, you have heard a lot about the glories of the high-tech world, and particularly about the promise of the Internet. Indeed, I have written an entire book on that topic, **Release 2.1: A design for living in the digital age.** (Many of you have received copies, and is easily available – including at Amazon.com, of course!)

The premise of the book (and of much of my thinking) is that the Internet pre-sents us not just with opportunities but also with responsibilities. It gives each individual much greater choice over his or her life; it allows each of us access to what amounts to the world's greatest real-time research library; it lets us communicate with friends, business partners and strangers at low cost and with high convenience. It changes the balance of power – mostly by equalizing access to information and the ability to *spread* information – in favor of consumers against corporations, small companies against big ones, employees versus employers, citizens against their governments, audiences versus mass media. More than that, it removes the advantages of economy of scale, and empowers individuals not just as consumers but as producers – enabling them to set up in business with little more than a Website and a product or service to sell. It gives people power over their own lives without giving them power over one another; generally, the Net erodes power rather than transfers it to some other center.

But there's a downside to all this (even for people who don't find the devolution of power to individuals troubling!): Many individuals will find the profusion of choices and opportunities confusing. Who determines whether the individual with his own news service is telling the truth? Can you trust Alice's home-baked pies to be fresh and healthful when you order over the Net? Will they arrive at all? What about the proliferation of information and misinformation on the financial trading sites? Is Juan in the diabetes chat room really an MD, or just a charlatan promoting a cure in which he has an interest?

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I'm speaking to you today as government officials, wondering about the appropriate role of government in all this.

Trust the people, but educate them first

The basic answer is the traditional American one: Trust the people!

The American approach is generally to leave as much up to the market as possible. On the Internet especially, that means not just the commercial sector, but the basic notion of individual choice. There are information markets (information shared "free") as well as commercial markets. People can choose for themselves, whether it's information sources or suitcases, schools or health clubs, churches or temples.

(Parenthetically, I believe the government can probably do far more for education by giving parents information about and communications channels with their schools through the Net, than by giving kids access to the Net.)

Thus, I don't think government needs to get deeply involved in the administration of the Internet. It seems to be doing fine by itself! But in order for the Net to reach its potential for its users and the communities they live in, those people must be educated and informed. That is a proper role for government: It does need to help its citizens get educated, both so that they can manage their own increasingly complex lives, and so that they can have the capability of filling the increasingly knowledge-based jobs that will result from the Internet's growth.

That doesn't mean teaching kids how to use the Internet (which they can figure out for themselves!), but teaching them how to read, write, calculate...and to think for themselves. I don't really want the Federal government telling people what to read, watch or buy – but I don't want to leave that choice to Microsoft or AOL either. The Net gives us great freedom, but we have to have the will and the knowledge to exercise it.

In most of the troubling issues raised above – everything from offensive content to truth-in-advertising – the best response is often disclosure and consumer choice. But I'm hopeful that the disclosure can happen mostly as the result of educated consumer demand, rather than rigid regulations that adapt poorly to the rapidly evolving Internet.

So, if the government does have a role, it's primarily education, both in schools and elsewhere. The recent experience with personal privacy protection has been instructive and illustrative.

Personal data control as an example

In very short form, the Net-based marketing industry is moving towards policies and practices that will give consumers choice and control over the use of their personal data. Some call this self-regulation. I prefer to call it *consumer* regulation – wherein the forces of informed consumer demand and market competition gently push vendors to fulfill consumer preferences.

Sometimes, this doesn't happen entirely smoothly. In this case, let's be candid, industry needed a little push – the *threat* of government regulation. Labeling/enforcement services such as TRUSTe and BBBOnline had trouble attracting licensees without the threat

of government regulation. But the outcome now before us – a lively market in data *practices* rather than rigid, one-size-fits-all policies – looks likely to afford the maximum in consumer satisfaction, following varied personal privacy preferences and leading to maximum marketing efficiency within the constraints of consumer desires.

That makes a lot of sense, because individuals have different preferences: Juan may want to keep his medical condition private but doesn't care about having his income disclosed; Alice doesn't want phone calls from anyone. Personally, I **want** British Airways to know how much I fly with American, but I'd prefer to keep my exact destinations private.

But there's one aspect to all this that's still just underway – the need for consumer education and personal tools to control the use of their data. It's not enough simply to make the choices and the information available; it needs to be easy for consumers to learn about, to understand and to exercise those choices. Again, the market should work, as companies come to see disclosure and personal-data management as a business opportunity rather than as a duty. That is beginning to happen; privacy tools are a hot category in Silicon Valley and elsewhere (including in my own portfolio). I would welcome questions on this topic.

And now, all about ICANN....

Now, I would like to turn my attention to ICANN, the Internet Corporation for Assigned Names and Numbers. (I have included as part of my written testimony two documents concerning ICANN. One is my response to a recent letter of concern about ICANN from Ralph Nader, which outlines the political realities we face. The other is a more detail-oriented, internally focused progress report to the US Department of Commerce.)

ICANN is an important initiative fostered – in the right way – by the US Government. The Government wisely decided that the time had come to turn administration of the Internet's technical infrastructure over to a private, not-for-profit, international corporation that would be subject to public oversight – in fact, to oversight from the many Internet-based communities that it serves.

Previously, these technical issues – the Domain Name system, the IP address system (those numbers you sometimes see hiding behind the user-friendly names on the Internet), the Internet protocols that enable any computer to talk to any other computer on the Internet, the root server system that ties it all together – had been handled by an individual called Jon Postel and by a private, for-profit corporation called Network Solutions. Although both were operating under government contract, neither had in place predictable formal policies for managing disputes, for responding to public oversight, or for adapting to the Internet's astonishing growth and rapid scale-up. (Unfortunately, Dr. Postel died unexpectedly last September, or he would now be a key part of ICANN.) And Network Solutions, the monopoly operator that until now handled all domain name registrations in .com, .org and .net under a lucrative government contract... Network Solutions is alive and well, although it is understandably resisting ICANN's efforts to introduce competition into what was previously its exclusive turf.

In addition, some parties fear that we will become some kind of world government. I can assure you that this is a role that we do not want, and that most of those who have

watched our self-organizing creation, including the US Government, will not allow. On the other hand, there are other groups that *do* want us to become a world government – with themselves in charge.

But the time has come for change, sometimes disruptive change. ICANN is in charge of managing that change for the Internet's technical (not governance) infrastructure, and of setting up an organization to adapt to such change over time. That reality – of change and resistance to change - is behind many of the debates concerning ICANN's role.

However, there are many parties – including those of you here in this room - with a legitimate interest in ICANN's future, its structure, and the policies it adopts. We are eager to help them become more educated about the Net, and about ICANN and its technical role in helping the Net to run smoothly and reliably even as it doubles in size each year. We are trying to work with all of them and with you, and I welcome your questions about our goals and our progress towards meeting them.

STATUS REPORT TO THE DEPARTMENT OF COMMERCE

JUNE 15, 1999

On November 25, 1998, the United States Department of Commerce ("DOC") officially recognized the Internet Corporation for Assigned Names and Numbers ("ICANN") as the global, non-profit consensus organization designed to carry on various administrative functions for the Internet name and address system that it had called upon the Internet community to create in its White Paper issued in June, 1998. Approximately six months have now passed since the signing of the Memorandum of Understanding between DOC and ICANN; this document constitutes a status report on both progress made and issues remaining to be solved.

I. STANDARDS AND CRITERIA FOR EVALUATING PROGRESS

The process of establishing ICANN has understandably been a difficult and contentious one from the beginning. The creation of a worldwide, non-profit, private consensus organization to manage various aspects of a global resource is a unique undertaking; there are no models for such a non-governmental entity with similar responsibilities. We have sought consensus from a necessarily diverse set of actors, ranging from academics to businesses to infrastructure providers to engineers; consensus is frequently elusive even in more homogeneous groups. There were inevitably many different views about how to accomplish the goal, not to mention a variety of opinions as to whether the goal was desirable at all.

In this environment, it is hardly surprising that there remains today a diversity of views on what has been done, what should be done, and how things could be done. It is also almost certainly true that there is no single right way to move toward the stated goal; there are likely to be several paths that could be followed to an acceptable outcome. On the other hand, there is a set of standards and criteria against which the work of the last six months can reasonably be measured: the standards and criteria set forth by the US Government in the White Paper.

While the White Paper may not be the equivalent of the Magna Carta, it did set forth a series of guiding principles (subsequently adopted essentially verbatim in the MOU) that seemed at the time to have wide-spread support within the Internet community from both private and public commenters. The core principles articulated in the White Paper were as follows:

1. Stability: "During the transition and thereafter, the stability of the Internet should be the first priority of any DNS management system."

2. Competition: "Where possible, market mechanisms that support competition and consumer choice should drive the management of the Internet because they will lower costs, promote innovation, encourage diversity, and enhance user choice and satisfaction."

3. Private Sector, Bottom-Up Coordination: "A private coordinating process is likely to be more flexible than government and to move rapidly enough to meet the changing needs of the Internet and of Internet users. The private process should, as far as possible, reflect the bottom-up governance that has characterized development of the Internet to date."

4. Representation: "Management structures should reflect the functional and geographic diversity of the Internet and its users. Mechanisms should be established to ensure international participation in decision making."

These principles formed the basis of the MOU, and have dictated ICANN's policy decisions to date. They are the standards which the ICANN Initial Board has used to guide its policy development efforts, and against which the results of those efforts should be measured.

In addition to these core principles, the White Paper went on to discuss:

funding: the White Paper assumed that the new corporation would be funded by "domain name registries, regional IP registries, or other entities identified by the Board;"

staff: the White Paper assumed that the new corporation would absorb the IANA staff that had been carrying out many of these functions pursuant to government contracts;

incorporation: the White Paper assumed that the new entity would be incorporated in the United States, but have a Board made up of members from around the world;

governance: the White Paper called for a "sound and transparent decision-making process;" and

operations: the White Paper stated that processes should be "fair, open and pro-competitive."

In addition, the White Paper suggested a **structure** that was "balanced to equitably represent the interests of IP number registries, domain name registries, domain name registrars, the technical community, Internet service providers (ISPs), and Internet users (commercial, not-for-profit, and individuals) from around the world." The White Paper went on to declare that the new corporation should take the following early actions:

1. "appoint, on an interim basis, an initial Board of Directors," which would serve "until the Board of Directors is elected and installed."

2. "establish a system for electing a Board of Directors . . . that insures that the new corporation's Board of Directors reflects the geographical and functional diversity of the Internet, and is sufficiently flexible to permit evolution to reflect changes in the constituency of Internet stakeholders," while preserving, "as much as possible, the tradition of bottom-up governance;" Directors "should be elected from membership or other associations open to all or through other mechanisms that ensure broad representation and participation in the election process."

3. "develop policies for the addition of TLDs, and establish the qualifications for domain name registries and domain name registrars within the system."

4. "restrict official government representation on the Board of Directors without precluding governments and intergovernmental organizations from participating as Internet users or in a non-voting advisory capacity."

The White Paper also set forth views on **intellectual property** issues, including that (1) all interested parties "should have access to searchable databases of registered domain names;" (2) domain name registrants should be required to "pay registration fees at the time of registration or renewal;" (3) domain name registrants would agree to "submit to and be bound by alternative dispute resolution systems;" and (4) the new corporation would protect "certain famous trademarks from being used as domain names . . . except by the designated trademark holder."

Finally, the White Paper stated that the United States Government would itself take certain steps to "accomplish the objectives" set forth in the White Paper. These were identified as the following:

1. "ramp down the cooperative agreement with NSI with the objective of introducing competition into the domain name space."

2. "enter into agreement[s] with the new corporation under which it assumes responsibility for management of the domain name space."

3. ask WIPO to "convene an international process . . . to develop a set of recommendations for trademark/domain name dispute resolutions and other issues to be presented to the Interim Board for its consideration as soon as possible."

4. "consult with the international community, including other interested governments."

5. "undertake . . . a review of the root server system to recommend means to increase the security and professional management of the system."

While the transition process is still young, periodic evaluations of progress are desirable checks on both the direction and pace of the transition. This report attempts to provide such an evaluation.

II. IMPORTANT ACTIONS

The following list sets forth important actions and decisions by ICANN since the signing of the Memorandum of Understanding with DOC in November, 1998:

- Agreement signed with USC to absorb IANA functions
- Creation of Membership Advisory Committee
- Designation of ICANN as Newco under Amendment 11 to Cooperative Agreement with NSI
- Creation of Government Advisory Committee
- Creation of Root Server Advisory Committee
- First ICANN Board meeting in Singapore
- Adoption of registrar accreditation guidelines

- Accreditation of five testbed registrars
- Creation of Independent Review Advisory Committee
- Recognition of Domain Names Supporting Organization
- Receipt of WIPO recommendations
- Second ICANN Board meeting in Berlin
- Recognition of six out of seven initial DNSO constituency organizations
- Provisional accreditation of 37 post-testbed registrars
- Referral of WIPO recommendations to DNSO
- Receipt of MAC recommendations and referral to staff for implementation
- Provisional recognition of Protocol Supporting Organization

Follow-up action on many of these items will take place during the next ICANN Board meeting on August 24-26 in Santiago.

III. POINT-BY-POINT COMPARISON TO WHITE PAPER

The White Paper identified four overarching principles that should guide the formation and decisions of ICANN: stability, competition, private-sector bottom-up coordination, and functional and geographic representation:

1. **Stability.** The DNS has remained fully operational, notwithstanding increasing demand for domain-name services and the introduction of competition in the registration of names in the .com, .net and .org TLDs (as described below). This issue -- operational stability -- requires constant attention, especially given the less than enthusiastic cooperation that ICANN and DOC have received from NSI, the historical monopoly registry and registrar in these domains. There remain important steps to be taken in the transition process, including the introduction of fully-competitive name registration services, the full separation of NSI's

registry and registration services, and the ultimate transfer of root server administration/control to ICANN. ICANN and DOC will carefully manage these events with this primary objective in mind.

2. **Competition.** With the accreditation of five testbed registrars, and the beginning of competitive domain-name registration services by those registrars, the transition from monopoly to competition has begun. As has been true in every other transition from monopoly to competition, there have already been difficulties, and there will undoubtedly be others. In such situations, the incumbent monopolist has no particular incentive to do anything more, or quicker, than is absolutely required to expedite this transition, and our experience to date is that this situation will not prove to be an exception. Nevertheless, one of the testbed registrars is now operating and selling domain name services in competition with NSI; the other four testbed registrars are expected to begin competitive operations within the next two weeks; 37 other entities have been conditionally accredited to begin operating when the testbed phase is completed; and ICANN and DOC are continuing to seek appropriate cooperation from NSI to facilitate the transition to full and open competition.

3. **Private-Sector Bottom-Up Coordination.** The Initial Board has encouraged the self-organization of its constituent units through bottom-up efforts, rather than dictation of the organization, structure and membership from the top. This has predictably resulted in a somewhat chaotic process, and taken some time; bottom-up process has much to recommend it, but those benefits do not include efficiency and speed. Nevertheless, we have seen great progress: the Domain Names Supporting Organization is essentially formed, and has begun to function in its advisory role to the ICANN Board by taking under consideration various recommendations made to ICANN by WIPO, and referred by the ICANN Board to the DNSO for its recommendations. In addition, the Protocol Supporting Organization proposal was approved by the ICANN Board in its recent Berlin meeting, and we hope that this entity can be officially recognized soon. The final part of this puzzle, the Address Supporting Organization, is scheduled to submit a proposal to the ICANN Board for its review at its next meeting in Santiago in August.

4. **Representation.** With the three Supporting Organizations listed just above responsible for electing three members each to ICANN's 19-member Board, the functional diversity objective of the White Paper will be substantially met once those entities are formed and have provided Directors to the Board. ICANN will also require that those Directors be geographically diverse, as is true to a significant extent today with the Initial Board (which includes residents of three of the five ICANN-defined geographic regions). The more difficult effort, described in some detail below, is the design of the process for electing the nine At Large Directors called for by the ICANN Bylaws, but the process of defining an electorate and establishing Director election procedures consistent with the White Paper principles is well underway.

Thus, the four guiding principles of the White Paper have in fact been realized in ICANN's organizational and policy development process to date, as can be seen in somewhat more detail by the following focus on specific issues addressed in the White Paper

Incorporation and Initial Board. As suggested by the White Paper, ICANN was incorporated in the United States in October, 1998. Its Initial Board is broadly representative of the Internet community, with five Directors (including the Interim CEO) from the United States, three from Europe, one from Australia and one from Japan; their professional backgrounds include educational computing, telecommunications, Internet technical/academic interests, trade associations and Internet entrepreneurial activities.

Funding. The White Paper suggested that ICANN should be funded by name or address registries, presumably by allocation of a portion of the fee charged by those registries. Since ICANN is intended to be non-profit, and therefore revenues may only recover its costs, over time those fees will be adjusted to balance ICANN's specific funding needs, which are not yet clear. In the interim, ICANN has proposed to fund its future operations primarily from a fee of no greater than $1 annually per domain-name registration, an approach suggested (without a specific amount) by the White Paper, with the exact amount of that fee to be determined over time by ICANN's costs and the revenue generated by a particular fee level. Since ICANN is not yet fully functional, it has existed to date on private donations and credit, with some recent small amount of funds received from those seeking accreditation as registrars.

Staffing. As called for by the White Paper, most of the former IANA staff are now managed and compensated by ICANN, and have continued to carry out their technical and administrative responsibilities without interruption.

Governance and Operations. The White Paper called for an "open and transparent" decision-making process. As a result, the ICANN bylaws require a broad set of procedures to ensure that all points of view be considered before any decisions are taken. These include extensive notice and comment requirements before any decisions are made that "substantially affect the operation of the Internet or third parties, including the imposition of any fees or charges."

In addition, the ICANN Board has made it a practice to hold a public meeting immediately prior to our regular quarterly Board meetings, in which all matters on the Board agenda are discussed with participants. While Board meetings are not open to the public, to facilitate the candid and objective decision-making so critical at this stage of ICANN's development, the Board has adopted the practice of immediately publishing all Board decisions, making the text of resolutions public as quickly as possible, and holding a public press conference immediately following its meetings to explain its decisions and take questions about them.

Structure. The ICANN structure follows almost exactly the prescription of the White Paper. There is an Initial Board which will serve until a regularly elected Board is installed, but in any event not beyond October 2000. Since the latter will be composed of three persons elected by each of three Supporting Organizations (a total of nine), nine persons elected by the At Large membership, and the president of ICANN *ex officio*, the creation of the Supporting Organizations and the At Large membership is a necessary condition for the existence of a regularly elected Board.

Taking care to follow the principle of bottom-up coordination, the Initial Board has left to the communities involved the creation of the Supporting Organizations. These groups have, not surprisingly, moved at different paces, to the effect that the Domain Names SO is now close to full formation, and is likely to elect its three Directors by the end of 1999, while the Protocol SO and the Address SO are somewhat further from completion. Still, it does seem possible that the nine SO Directors could all be in place relatively early in 2000. The Initial Board's present intention is to simply add these Directors as elected to the Initial Board.

The nine At Large Directors scheduled to be elected by a membership present a more complicated problem. Despite a significant amount of work by a diverse Membership Advisory Committee, we still have not identified the specific process by which a broadly representative membership can be constituted, with due regard for the cultural and economic differences within the global user community and the need to protect against minority capture. The White Paper seemed to assume that Directors would be elected "from membership or other associations;" as presently contemplated, however, the nine At Large Directors are scheduled to be elected by individual members. This deviation from the White Paper prescription presents a number of serious practical and economic problems to be overcome before a process consistent with the stability that the White Paper described as the "first priority" of the transition can be established.

Nevertheless, the Membership Advisory Committee has recommended a set of policies to the Board, and the Board has directed staff and legal counsel to recommend before the Santiago meeting how those policies could be implemented. The fact that it is a very difficult problem to solve consistent with the White Paper principles does not mean that it is not necessary to solve this challenge; there must be a way for the users of the Internet, who will undoubtedly be affected by the policy decisions of ICANN, to have a role in influencing those policy decisions, and the Initial Board is committed to making that happen.

New TLDs. The White Paper assumed that the Initial Board would both address the possibility of a need for new TLDs, and establish a system of qualifications for DNS registries and registrars in current and any new TLDs. WIPO has now, pursuant to the invitation in the White Paper, made a series of recommendations relating to new TLDs, dispute resolution and related issues. We have referred those recommendations to the newly-established DNSO for its review and recommendations to the ICANN Board.

ICANN has developed a set of guidelines for the accreditation of registrars in the .com, .net and .org domains, and has accredited five registrars (the testbed registrars) and provisionally accredited 37 others who will begin operations following the completion of the testbed. It is developing guidelines for the accreditation of registries, and has begun discussions with both registry administrators and its Government Advisory Committee about the appropriateness of, and standards for, contractual relationships with registries and registrars for country code TLDs.

Relations with Governments. In order to meet the White Paper objective of facilitating input from national governments and international organizations while remaining a private, non-governmental organization, ICANN created the Government Advisory Committee. The GAC now comprises representatives of 33 national governments and international organizations, and functions as a vehicle for advising the ICANN Board of particular concerns of governmental entities relating to the domain name system and IP addresses and protocols. Consistent with the White Paper prescription, the GAC has no authority over ICANN or its policies; it exists to offer advice and to serve as a conduit for the transmission of the interests and concerns of governmental bodies to the ICANN Board and the public.

Concerning each of these specific issues or proposals identified in the White Paper, ICANN has acted consistently with the principles outlined in that document. In particular, ICANN agrees with the White Paper's assertions that "the stability of the Internet should be the first priority," that competition should "drive the management of the Internet," that the private coordinating process should, "as far as possible reflect . . . bottom-up governance," and that its structure and processes should reflect the "functional and geographic diversity of the Internet and its users." As the above description illustrates, the policies ICANN has adopted to date universally reflect the implementation of those principles.

IV. CURRENT CHALLENGES

There are a number of important issues that remain to be dealt with, including the creation of a workable At Large membership structure, the resolution of various issues relating to the relationship of intellectual property principles and the DNS, and the policies that will guide the relationship of ICANN with country code TLDs. Nonetheless, the most critical immediate challenge facing ICANN and the DOC remains the creation of a fully competitive environment for the registration of names in the global Top Level Domains -- in particular, .com., .net, and .org. The transition from monopoly to competition in these domains is necessary for the long-term success of the privatization approach endorsed by the White Paper, and at the moment the critical uncertain element is the cooperation of the current monopoly government contractor, Network Solutions, Inc. ("NSI").

NSI occupies a central role in the DNS process. It is the registry operator for the most important TLDs -- .com, .net and .org. It has until recently been the monopoly registrar for those domains, and it still remains by far the dominant registrar. It is responsible for the operation of the A root server, under the direction of DOC. And it is by far the most powerful entity in the

DNS environment. So long as NSI operates the .com registry, all new registrars must rely on NSI -- their principal competitor -- for access to that registry. Thus, in a very practical sense, NSI has a significant influence on the pace of progress toward the competitive environment envisioned by the White Paper.

NSI's cooperation with ICANN and DOC to date has been limited. Its principal responsibility under Amendment 11 to its Cooperative Agreement with DOC was to create a Shared Registration System interface for its registry so that competitive registrars could use the registry on the same terms as the NSI registrar. The SRS was supposed to be functional on April 26; in fact, the first competitive registrar was not able to begin offering competitive registrations until June 2. The other four testbed registrars are still trying to achieve workable interfaces. In addition, NSI's demands for overly broad intellectual property protection and various other restrictive license terms for the SRS have considerably slowed progress. The result has been the likely delay of the end of the testbed period and of the beginning of fully competitive registrations.

Perhaps even more importantly, at least for the short term, NSI has to date refused to accept the community-consensus registrar accreditation policies adopted by ICANN after public notice and comment, and has even asserted that it should not have to comply with the same accreditation standards that apply to all other registrars. Obviously, full and fair competition requires that all have the same opportunities, and to the extent that there are consumer protection or other requirements, that all meet them equally. Thus, it is critical to accomplishing the White Paper objective of maximizing competition that (1) NSI's registry and registrar functions be fully separated, so that NSI as a registrar does not have any structural advantage over its registrar competitors; (2) NSI accept community consensus policies relating to registrars, as reflected in ICANN's accreditation standards; and (3) the relationship between NSI as registry and all registrars does not allow NSI to impair or adversely affect the development of competition because of its continuing monopoly position as registry operator.

Both DOC and ICANN have stated that only accredited registrars will be permitted to carry out registration activities in the .com, .net and .org domains after the completion of the testbed phase; combined with NSI's current position, this obviously creates the potential for conflict between NSI and DOC/ICANN. In addition, NSI is required by Amendment 11 to fully separate its registry functions from its registrar functions, and to charge for its registry functions a fee that covers its costs and a reasonable return on its investment but no more. The amount of this fee obviously has competitive implications, especially if NSI continues as a registrar, and the fact that NSI and DOC have not yet reached an agreement on this key issue is also a basis for potential conflict.

Finally, as a general proposition, NSI has to date refused to accept the policy authority of ICANN, although it continues to "participate" in the creation of ICANN institutions and policies. It has funded and encouraged a variety of ICANN critics, including some whose only common cause with NSI would appear to be unhappiness with ICANN. In short, NSI has generally been an impediment, not a help, in the transition from government controlled monopoly to a private competitive DNS. While this is perhaps not surprising, if this approach continues, and depending on how it continues, it could have adverse implications for the short-run stability of the domain name system. Because of this possibility, ICANN and DOC are taking prudent steps necessary to be able to implement the White Paper objectives with or without the cooperation of NSI.

V. CONCLUSION

In summary, the first six months of ICANN's existence have been productive, albeit somewhat frenetic. There is much to do, and a cacophony of voices with a range of advice from "go slow" to "speed up," and everything in between. The volunteers who make up the Initial Board have been dismayed by the amount of work required, and tremendously impressed by the incredible willingness of people from all over the world to work with us to try to make this great experiment work. We have a difficult road in front of us, but our experience to date makes us even more confident that the job will get done.

Esther Dyson
Interim Chairman of the Board

Michael M. Roberts
Interim President and Chief Executive Officer

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