

**NATIONAL SUMMIT ON HIGH TECHNOLOGY:
DAY TWO—EXPLORE**

HEARING

before the

**JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES**

ONE HUNDRED SIXTH CONGRESS

FIRST SESSION

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Part II
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NATIONAL SUMMIT ON HIGH TECHNOLOGY: DAY TWO—EXPLORE

Tuesday, June 15, 1999

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

The Committee met at 9:30 a.m., in Room SH-216 of the Hart Senate Office Building, the Honorable Connie Mack, Chairman of the Committee, presiding.

Senators present: Senators Mack, Bennett, Kennedy, Gorton, Abraham, Santorum, Frist, Allard, Burns, Grams, McConnell, Bingaman, Murray, Sessions, Reid, Bond, Robb, Hutchison, DeWine, and Craig.

Representatives present: Representatives Maloney, Ryan, Watt, Eshoo, Sanford, Etheridge, Stabenow, Inslee, Minge, and Doolittle.

Staff present: Shelley S. Hymes, Victor Wolski, James Gwartney, Chris Edwards, Kevin Doyle, Colleen J. Healy, Stephen Schultz, Lori Hodo, Lawrence Whitman, Howard Rosen, Daphne Clones and David Datelle.

OPENING STATEMENT OF SENATOR CONNIE MACK, CHAIRMAN

Senator Mack. Just a couple of brief comments before we start the hearing. As yesterday, I will try to have a good balance in the questioning process. I'm trying to keep things on time, so that may mean that sometimes some Members may not be able to ask questions on the first go.

When we go to the second panel, then that means that they would be recognized earlier. And again, I appreciate your cooperation.

We do have the questions limited to five minutes. After Mr. Gates speaks, we're going to go first to students in several different classrooms around the country.

It is appropriate that I also mention that in addition to our question time, we'll also be accepting questions via e-mail. Our e-mail address is: techsummit — that is, t-e-c-h-s-u-m-m-i-t — @jec.senate.gov. And over

So with that, Senator Gorton, I will turn to you and ask you to introduce Mr. Gates.

OPENING STATEMENT OF SENATOR SLADE GORTON

Senator Gorton. Mr. Chairman, yesterday, Alan Greenspan reported, as he has previously, that the immense success and increase in productivity of the economy of the United States was due to high-tech in general, and specifically, to our geniuses who have changed our lives through the development of hardware, software, and the biotechnology industry.

At the heart of the software industry obviously is Microsoft. Its limbs are thousands and thousands of entrepreneurs all across the United States in companies that started small and many of which have been successful and have become large.

The model for all of those companies is Microsoft. It began in a garage in Albuquerque, as I remember it, with Bill Gates and one high school friend.

The model for those entrepreneurs is Bill Gates, a constituent and a friend and I hereby introduce him to this Committee.

Senator Mack. Ms. Murray, would you like to make a comment?

OPENING STATEMENT OF SENATOR PATTY MURRAY

Senator Murray. Thank you, Mr. Chairman.

I join with my colleague, Senator Gorton, in welcoming Mr. Gates to the hearing this morning. We look forward to your testimony and certainly, as Senator Gorton said, the high-tech community has contributed dramatically to the economy in this country and obviously will continue to for many years.

Our constituent, Mr. Gates, has really made a difference at home in Washington State and we appreciate his being here to not only talk about the impact there, but around the world.

Thank you very much.

Senator Mack. Thank you. Mr. Gates, again, welcome. We look forward to your comments.

PANEL I

STATEMENT OF BILL GATES, CHAIRMAN AND CEO, MICROSOFT CORPORATION

Mr. Gates. Are we set?

Senator Mack. We're set. You're on.

Mr. Gates. Well, thank you, Mr. Chairman, and Members of Congress. It's a great honor to be with you.

Mr. Chairman, I know that we're also joined today by a number of

students. I'd like to extend my greeting to them and also to note how different things are today for them than when I was in school.

Today's students have access to powerful computers and a sea of information through the Internet that I could only dream of when I was a teenager.

This is truly an amazing time.

The Information Age is opening up new possibilities for all of us, for our children and for the entire nation.

The advances in education and research, even in the way we conduct government, I think will exceed peoples' expectations.

It is the greatest time of innovation in history. It's less than 25 years since the personal computer evolved from a hobbyist's tool to a tool that sold over 100 million units per year and a tool that Americans are very dependent on in doing their jobs.

The power of these machines, both the hardware and software, has doubled every 18 months. The price has come down and the use at home and schools and in offices has been really quite fantastic.

I know that many of you on this Committee are technology enthusiasts and can personally appreciate the significance of this change.

As the Information Age advances, we understand better the central role of these incredible tools in advancing the new prosperity the country is experiencing today.

It's accelerating economic development throughout the world. The digital economy is a vibrant economy and it's kicking off the information age in a very positive way.

I know that yesterday, Chairman Greenspan was here before this Committee, and I think he has been very clear that these innovations really make a big difference.

He said the newest innovations, which we label information technologies, have begun to alter the manner in which we do business and create value often in ways not readily foreseeable five years ago.

I'd like to reinforce Chairman Greenspan's points by telling you about some new findings from a study of the digital economy carried out by the Business Software Alliance (BSA).

This is an organization that represents most of the nation's large software developers. The study will be released tomorrow and I will ask that when it is released, its contents be entered into the record of this Committee.

The results of this study again confirm that the strong economic growth in this country can in some large measure be traced to the competitive and fast-growing use of computer technology.

That sector alone has created more jobs than any other part of the economy. In fact, one of our big challenges is finding enough skilled workers to fill these jobs.

Today, we can predict that by the year 2000, the software industry's contribution to the U.S. economy will be greater than the contribution of any other type of manufacturing.

This is quite extraordinary for a business that is less than 30 years old.

Today, America not only sells more cars than Japan. We also lead the world by a huge margin in software development. I can't think of any critical new industry that's been dominated by one country like software export is by the United States.

Last year, the sector grew by more than 15 percent and is growing at four times the rate of the economy.

The industry has contributed more than 13 billion dollars of surplus to the U.S. balance of trade and that's going to rise dramatically in the years ahead.

And so, this strong technology sector has spurred the renewal of industries old and new across America.

These new technology companies are being created every day. And the valuations they create in the stock market are really quite impressive. That's really fueling more entrepreneurs to come forward with their great new ideas.

The slew of recent mergers reminds us just how quickly the landscape of the high-tech market place is changing. That change will continue.

In this industry, in particular, the free market is working and working very well.

Mr. Chairman, I believe that here in Washington, D.C., there is a term for people who are incredibly interested in public policy.

They are known as policy wonks.

In my industry, people who have similar hard-core interests are called computer geeks. And I'm definitely one of those.

(Laughter.)

If you'll indulge me for a few more minutes, I'd like to share some of my enthusiasm for the developments yet to come.

I can say that we're really just at the beginning of the fantastic technology advances. The mission at Microsoft, when we got started, talked about a PC on every desktop and in every home.

That's driven our work for these last 25 years. It's created a tool to help people get things done.

Today, a majority of U.S. businesses and more than half of U.S. households have this PC. We can say that we're now advancing into a new era. The combination of advances in telecommunications, computers and consumer electronics, using the Internet standards, will create a universe of intelligent PCs and complementary devices that will deliver the power of the information age to anyone, anywhere, any time.

What this means is that we'll have the smart-connected devices, starting with the palm-size device with the beautiful color screen connected up to a wireless network, to a tablet computer that you can take to a meeting and as you do your handwriting, it will recognize the notes that you're taking.

We'll have smart TVs. We'll have cell phones that connect up to the Web and give you the latest information.

All the information you care about—your schedule, your address book, your files—will automatically be available. And, as you travel, you'll be able to book an appointment or look at your stock portfolio wherever you go.

Wherever you are, you'll be able to access your own digital dashboard—the set of information that you care about on any screen, from a PC to that small pocket device.

Microsoft and thousands of other companies are advancing the software that makes this possible. We'll spend next year about three billion dollars on research and development.

One day, in the not-too-distant future, that software will allow computers to see, to listen, and to speak. At home, or in the office, you'll be able to talk to your PC, to dictate a document or to simply ask for the information that you care about.

It will automatically back up your information and synchronize it with all the other devices and everybody else that's contributing information.

It will even have a color screen notepad on your refrigerator that will show the family schedule and allow you scribble notes that will automatically be shared with everyone else in the family.

For people here, when Congress is in session, a wireless network will allow you to stay in touch with your office as you move around from meeting to meeting.

I don't need to tell the Members of this Committee how important mobility is as you move between your State and District and the Nation's Capital.

As technology becomes more flexible and more powerful, it can be

a tremendous tool in terms of creating efficiency and instant communication.

One aspect that we need to keep in mind is that the PC also holds the potential to make government itself more efficient and more responsive. We see the beginning of this with government web sites that offer a wealth of information.

But as government increasingly incorporates technology into its operations, it will make information flow even more openly and efficiently.

At Microsoft, we've used technology to eliminate all paper forms. And so, any information that you want to share, you're doing purely electronically.

And I can say from first-hand experience that the efficiency that this provides is a wonderful thing.

Technology can also let the public get more involved, not only in seeing information but engaging in a two-way dialogue on the important issues and challenges we face.

The rapid growth in the Internet will power this information revolution along with these incredible devices.

Five years ago, who would have imagined that we'd be shopping for automobiles, home loans, airline tickets, or even clothing, on the Web. Electronic commerce has grown ten-fold in the last two years, by making it convenient now to purchase almost anything, any time, anywhere.

In the next few years, over 50 million Americans will be shopping on the Web.

There's endless speculation about which of the companies involved in e-commerce will be successful. But I think the answer of who the big winner is is already clear—it will be the consumer.

They'll see better prices, more information, more choices, and more opportunities to do the things they want to do.

As Chairman Greenspan has made clear, companies have already seen enormous benefits from the use of this technology. But there is much more to be done—like helping companies integrate their computing systems and create digital processes to perceive and react to competitive challenges and consumer needs.

By doing this, they will be able to extend the gains in productivity that are helping fuel our economic strength today.

One other area to touch on is what this all means for the most important investments we make—namely, the investments in education.

Education in the digital age will offer tremendous promise. Learning will be far more student-centered. Teachers, parents, and students will work collaboratively, and students will be prepared for a technology work place with the opportunity to engage in life-long learning.

At Microsoft, we call this the connected learning community.

Taking education into the digital age is a challenge for all of us. Government at all levels, public/private partnerships, and philanthropy will all play critical roles in preparing students for tomorrow's work place.

Today, only 14 percent of teachers use the Internet as part of their instruction. At first, people believed the Internet was suitable only for quizzes or just for learning about technology itself.

Today, the educational community knows that the Internet can be a resource for allowing curious minds to learn in new ways about math, physics, philosophy, and every other subject that's being taught.

A New York school superintendent attending one of the educational conferences we hold, explained that the PC and Internet are encouraging his students to do more writing and more reading and less TV watching.

He said that, as a result, "I don't know" is fast becoming, "I don't know yet."

There are many exciting projects underway to give students the latest tools for learning. For example, we have a pilot project to provide 500 schools laptops for every student. And the results of this effort have been quite amazing in terms of increased learning.

Many other companies are involved in similar efforts, whether providing the latest technology for learning or providing scholarships for science excellence.

I've had an opportunity to learn a little bit about how Birmingham Seaholm High School and Pittsburgh Super-Computing Center College are using PC technology.

Juniors at Birmingham Seaholm are using computers in a very entrepreneurial fashion. They have built a cookie factory and next year they plan to develop a micro-robot that will take cookies off the cooling rack. Students in Pittsburgh are doing great work on improving high-speed networking performance and capabilities. These schools are to be commended for the work they've done to use technology as an important tool in improving education.

I look forward to talking to these students about how they've been using PCs. Unlike their parents, most of whom learned about computers

in adulthood, the information age is the only age these students have known. Their success will depend on how well we teach them.

When you look at the phenomenal economic growth produced by technology and the huge increase in demand for highly-skilled workers, it is clear that our ability to continue benefiting from technology will largely depend on how well we educate the next generation.

In closing, let me sum up why I'm excited to be here today and to be part of this high-tech summit.

At Microsoft, we make software. We make software for a simple reason—we want to provide tools that make people's lives better. And we're very excited about this future—the tremendous economic benefits that are coming. But even more important, the ability to help every individual in business, in schools, and in the home to lead more productive lives.

Thank you.

[The prepared statement of Mr. Gates and a study entitled, "Forecasting a Robust Future" appear in the Submissions for the Record.]

Senator Mack. Thank you very much. And I appreciate again your being here and your presentation this morning.

Now I will turn to Senator Abraham to introduce two different schools which will be video conferencing.

OPENING STATEMENT OF SENATOR SPENCER ABRAHAM

Senator Abraham. Well, Senator Mack, let me just begin by thanking you for holding this Summit.

I think that as we go through the next couple of days, yesterday through tomorrow, we'll really have a chance to see exactly what the potential is for us as a nation to strengthen our economy through the development of high technology.

And I want especially to thank and welcome Bill Gates here today. We very much appreciated working with you and the people at your company over the last year to put forward a number of legislative accomplishments, in no small measure thanks to the efforts of you and your team.

Today, I've got the pleasure of introducing two of the participating schools who are a part of this video conference. I'm sure that they will pose questions far better than any that we could come up with here because they really are on the front line with respect to determining how high tech and education merge to enhance our society.

So, without further adieu, let me begin by introducing first a group of students from Birmingham Seaholm High School in Birmingham, Michigan.

I believe, Bill, that you have already referenced them and some of the advances that they've already undertaken. I would hasten to add that they are in the forefront in terms of our state, in terms of utilizing computer technology in the school for educational and learning purposes, but also as an inspiration to develop their own creative skills even further.

And so, at this point, let me turn to a student from Birmingham to ask a question.

**VIDEO CONFERENCE PARTICIPANT: BIRMINGHAM
SEAHOLM HIGH SCHOOL, BIRMINGHAM, MICHIGAN**

Mr. Hedlick. Hi. My name is Ross Hedlick. This is directed towards Mr. Gates.

How are you developing your products to enhance the learning environment in our schools? And how are you making them more reliable to have up-time in our school and the stations?

Mr. Gates. Great. Well, the key to making the computer a better tool in education is to make it able to browse information and tap into the Internet no matter where you go.

And of course, on the Internet more and more, we have not just text information, but video and audio as well.

We'll be using more and more simulation capability with very advanced graphics.

What we see is that, eventually, you'll have a tablet-type device that will be literally the size of a tablet and schools will have a wireless network.

So the teacher will be able to pick some Internet sites for everybody to look at, or the student finds something that's interesting that can be shared with all the other students.

We also want to make it easy for the school on their website to have enough information so that you can come in, see what the homework assignment is, connect up to other sites, perhaps engage parents in the dialogue about what the assignments are like, and it really becomes something where it's not just that one student or that one school, but anybody out on the Internet who has the same interest, you'll be able to draw in.

So the demands of education are actually among the ones that are really driving the PC to evolve most rapidly.

Senator Abraham. I think at this time, we'll now turn to another of the schools in Michigan that is utilizing computer technology in a variety of very exciting ways. That's Madison Heights High School.

So we'll turn to them, a student from Madison Heights for the next question.

VIDEO CONFERENCE PARTICIPANT: MADISON HEIGHTS HIGH SCHOOL, MADISON HEIGHTS, MICHIGAN

Ms. Dodd. Hello. My name is Anita Dodd. My question is, What types of revolutionary problems of the equivalent of Y2K today may occur in the computers of tomorrow.

How can we foresee similar problems to Y2K and prevent them from occurring in the future?

Mr. Gates. Well, that's a very good question.

The increased dependence that we have on using computer systems means that making sure that that infrastructure is very, very reliable, even in the face of attacks on that infrastructure, even in the face of disasters that might take place, that is very, very critical to both business and government.

We're seeing not only the Y2K problem, but we're seeing virus attacks where people maliciously spreading around computer programs that cause wasted time and loss of information.

And so, we need to design our systems to be far more resilient to resist these types of virus attacks.

We also need to design the systems to be far more redundant so that when you connect up to a website, even if some of the communications lines have gone down, there's a way that things are routed around that and it's possible to have the connections there.

There's no problem exactly like Y2K ahead of us. The way that the dates are being solved now, people will be able to go tens of thousands of years without a particular date milestone coming in as a computer problem.

But there are other things like this virus problem that we need to get on top of in advance to minimize the disruption that those things cause.

Senator Mack. Senator Santorum, do you want to introduce the next school?

OPENING STATEMENT OF SENATOR RICK SANTORUM

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

I want to again join Senator Abraham, and Senator Bennett, who I know has been very active, also, in holding this hearing. And I, too, want to welcome you, Mr. Gates, and thank you for not just obviously your tremendous work within industry, but your participation here on the Hill in a variety of different subjects.

It's been very helpful.

And I also want to thank you for the kind words for the Pittsburgh Super-Computing Center. We're very proud of that in Pittsburgh.

I'm a native Pittsburgher, so I take special pride, even though I represent all of the State of Pennsylvania, in the Pittsburgh Super-Computing Center, which is run by Carnegie Mellon University with the participation, though, of the University of Pittsburgh, which is a neighboring campus and in fact, even though the Super-Computing Center—and you see the Carnegie Mellon sign there—there are actually students from both Carnegie Mellon and the University of Pittsburgh there to fire questions at you.

So I will turn it to them and welcome them to Washington via video conference, and look forward to your questions.

**VIDEO CONFERENCE PARTICIPANT: PITTSBURGH
SUPER-COMPUTING CENTER, PITTSBURGH, PENNSYLVANIA**

Question: Good morning, Bill. I work at the Pittsburgh Super-Computing Center. I'm a junior at the University of Pittsburgh.

My questions are: "What role, if any, should government take in the development of the Internet as a business tool? And, how can one properly balance that role and the realities of the Internet as a public resource that empowers the individual?"

Mr. Gates. I think it's pretty amazing the complementary role that work in universities and work in the private sector have played in the development of the Internet.

Obviously, the initial design in the early network itself was built largely with government funding in the university environment. It was the proving ground for many students like myself to get exposed to advanced computer networking. And then, of course, that flourished so strongly in the universities, it moved out into the private sector.

Today we have the positive situation that, based on those standard protocols, it's no longer necessary in terms of building out the basic Internet capacity for government to be funding that.

We have lots and lots of private companies running very high capacity fiber throughout this country that's going to keep up with the demand that's there.

And so, government has moved on to fund through the universities more advanced research like the work that you're doing.

And so, I think that the balance has been struck very, very well in terms of only moving to the very risky frontiers for the university contribution.

In terms of keeping the Internet extremely reliable, that is a challenge that neither government alone, nor business alone, can really tackle.

It's got to be a joint set of discussions about what possible disasters could take place and how would the resources of government and business come together to solve any of those problems that come up.

Some dialogue along those lines is beginning. But I think that that's an area that there needs to be more attention paid to.

Mr. Morin. Good morning. My name is Jeff Morin from the Pittsburgh Super-Computing Center.

I'd like to know what you see for the future of high-performance computers? How would distributive computing and ultra-fast networking come to play in the future?

Mr. Gates. Well, it's pretty fascinating that at every stage in the computer industry, there are people who wonder what we're going to do with all the power that's created. Even some people say, boy, do we really need all that power?

But, from my point of view, just the ability of the computer to understand speech, the ability of the computer to see what's going on, see when you come in, suggest to you things that you might be interested in, that basic capability is going to require somewhere between ten and 100 times the power that we have in the personal computer today.

And so, the investments in these high-speed chips that people like Intel are making are very, very important to us.

Now when you look at super-computers, the kinds of problems that are being solved there are even more challenging. Things like physical simulation, being able to do weather prediction, being able to model any physical phenomenon turns out to be incredibly difficult because of the nonlinearities from a computational point of view.

And so, we'll be able to take any extra power, particularly the break-throughs in parallel software development and the total power that comes out of that, we'll be able to use any increase that's there in the sciences, whether it's drug design for solving diseases or predicting weather to understand the impact of various things on the environment.

There's a lot of very positive results that will come out of the investment in super-computing that's being made by the universities and by the government.

Senator Mack. I wish we could go on and allow the students at the various schools to continue to raise their questions. They've done an excellent job.

But, again, because of the time limitations that we have, I want now to turn to some Members. So I will turn to Senator Robb for your questions.

OPENING STATEMENT OF SENATOR CHARLES S. ROBB

Senator Robb. Thank you, Mr. Chairman. And thank you, Mr. Gates, for joining us this morning.

One of the areas that continues to trouble policymakers or to challenge policymakers has to do with the proper role of government in working with industry, and particularly the technology industry.

And I wonder if you could just share briefly your thoughts on what the proper role of government with respect to your industry is, what specific areas you think that the government has been too intrusive or too restrictive in terms of your ability to expand and grow, and areas where you think the government ought to be doing or could be doing more without unduly interfering or inhibiting your ability to expand and compete.

Mr. Gates. Well, I think that the incredible success of this industry in the United States owes a lot to the light hand of government in the technology area.

The fact that people can take incredible risks and, if they're successful, they can have incredible rewards. That kind of risk-taking attitude is really unique to the United States.

In fact, as I go to other countries, I'm always asked—how do we create the same thing here? How do we have companies like you've got there because we really are the envy of the world in this respect.

One thing that government has done well is it's supported higher education. And the strength of our universities in allowing these advances to take place here can't be overstated.

Not only the Internet specifically, but the great students that Microsoft and others are able to go out and hire, come from the fact that we have the best universities in the world.

And again, that's something that people are very envious of.

I think not only the computer industry, but the biotechnology industry has benefitted from exactly that same focus.

There are some tricky issues that do come up where now there's a very important dialogue between technology companies and government.

For example, in things like immigration policy. That's one that we often talk about because we need even more skilled workers.

There's various taxation things relating to the R&D tax credit, things of that nature.

One issue that is particular to our industry has to do with the encryption export flexibility. I'll just take this chance to say that the industry is losing a lot of sales because the encryption technology that's widely available outside the United States, we uniquely are not allowed to export.

So countries like Canada, Switzerland, Germany, the companies there are taking more and more business away from us because of those limitations.

So we will get into particular issues like that that people need to really look into what the balance of merits are.

Overall, I'd say that the light hand is working very, very well. One of the tough issues today has to do with privacy. Consumers are very, very concerned about privacy and there are going to have to be industry guidelines and some dialogue with government about how we make sure the Internet is not held back by people feeling like their information is used in the wrong way.

There's a lot of tough issues about kids and online safety. And that's one area that we're putting a lot of effort into to make sure it's easy to configure machines so that kids have access to the good stuff and that's all they have access to.

So there will be a lot of issues, but I think the basic philosophy of letting the market place work has been vindicated.

Senator Robb. I think, for the most part, there is broad-based support in Congress for that approach. But trying to figure out exactly where and when to either intervene or regulate, without getting into the specifics of any pending litigation, let me just ask you about your view as to the role of government with respect to competition and antitrust, specifically.

Again, not us focusing on specific litigation.

Mr. Gates. Well, the framework we have in the United States encourages competition. It allows companies to enhance their products, add new capabilities.

That kind of freedom has been upheld again and again, whether it's for large companies or small companies.

And so, I feel that the framework we have today is a very good framework and we can see the results that come out of that.

Senator Robb. You would not advocate any change at this point?

Mr. Gates. Well, there are many people who would dive into that. But I think the laws, as they're currently written, are fine.

If somebody wants to tune those, probably has more expertise in it than I do.

But, certainly, everything that's gone on in the technology industry has come about because things like integrating new features is one of the freedoms that all companies have.

Senator Robb. My time just ran out, so I won't ask one last question.

Thank you, Mr. Chairman.

Senator Mack. Thank you.

Representative Maloney?

OPENING STATEMENT OF

REPRESENTATIVE CAROLYN B. MALONEY

Representative Maloney. Mr. Gates, it is a pleasure to have you before this Committee today. I have the honor of representing an area in New York that has Silicon Alley, a group of high-tech firms that have contributed greatly to the phenomenal economic growth based on technology.

Our paths almost crossed earlier this year at the Hague while I was at the United States delegation on the International Conference on Population and Development.

I did have an opportunity to work with and meet participants from your foundation. And I want to compliment you on the foundation, its goals and the fantastic group of people that are working on issues that we both consider important to our country.

A concern of many Americans is privacy in regards to information technology.

We hear stories daily of companies using what most of us would consider confidential, private information on individuals, gathered through computer use for their own marketing purposes or selling this information to other companies.

What are the practical steps that we could take to address these concerns?

Mr. Gates. Well, the industry, including Microsoft, has a lot of people who are focused full time on this effort.

One of the things that I think we've made incredible progress on is making it easy for websites to notify consumers exactly what their policies are.

If you go back six months ago, we'd made a lot of progress on the very popular websites, the ones that the big companies have.

Now we've come up with some tools that make it easier for small companies to include on their website their policy statements and how any purchasing information will be used, will that be sold to third parties or not.

I continue to believe that this is an area where a dialogue with industry will be very important because information, consumer information is often used on behalf of the consumer. That is, to help suggest to them things that they might be interested in.

So, really separating out the legitimate use of information, and proper use of information, I think a guiding principle is informing that consumer exactly what's going on.

We should be able to use the technology to do that in a good way without holding back the benefits.

Representative Maloney. Parents of young children that I talk to, and many of them contact me, and they are really of two minds regarding the Internet and computer software.

They're really very impressed with what the systems are able to do as an information tool for learning in schools. But they are extremely concerned that violent and pornographic materials arrive unfiltered on their children's computer screens.

What is both appropriate and possible to address these concerns?

Mr. Gates. Well, I think any parent today should want their child to have access to the Internet, whether it's a computer at home or going to the local library.

I think that is very, very important.

I also think that the parent should be involved in seeing what their children are going out and looking at, either by logging that information or spending some time with them as they use the computer and talking to them.

There are also ways of setting up the software so that it controls what sites you can go out to, so that you can either log where your kids are going, and if you have the familiarity with the computer, you can see, step through those things, and you can do that kind of blocking.

A lot of these online services, including our own, one of the ways that we compete is by making it clear to parents how we give them control—control over the electronic mail that their kids receive, control over the kind of content that's put forward there.

And so, there's a market place interest there that good technology is being created for.

So I think, on balance, what's going on is very, very good. I think there will be some stories from time to time that remind us how important it is to be more vigilant in this area.

Representative Maloney. My time is up. Thank you, Mr. Chairman.

Senator Mack. Thank you very much. And as I did yesterday, I'm going to try to keep this on time as best I can.

I'm going to just ask one question and then we're going to go to Secretary Riley, who has already arrived.

And the question is really kind of triggered by comments that you made this morning and tying them into what Chairman Greenspan said yesterday.

He gave us all the first warning that this productivity increase that has taken place as a result of technology making its way into business practice can't go on forever.

But in your statement this morning, you said, and I think this will be close—that we are just at the beginning of technology advances.

And also, in your book, you indicated that very few companies are using digital technology for new processes that radically improve how they function, that give them the full benefit of all their employees' capabilities, and that give them the speed and the response that they will need to compete in the emerging high-speed business world. So that kind of says to me that we can see productivity increases for many, many years to come.

Mr. Gates. We will absolutely see productivity increases coming out of the use of technology for many, many years to come.

We are very much at the beginning of what can be done with these devices.

If you just look at how bills are paid in the United States, if you look at the paperwork that goes on, if you look at workers and see, do they really have when they're trying to do customer service or they're trying to design a new product, do they have at their fingertips all the information they'd like? Can firms in different locations collaborate with each other easily to draw on the best skills of the different firms?

Those things, within the next five years, we will make radical progress in the business sector.

And so, I think that that's a very, very positive picture.

I think Chairman Greenspan is pointing out that some of the valuations may not continue to go up at the rate that they've gone up. And, certainly, if you take a long-term view of this thing, there are going to be some ups and downs in terms of the psychology of the valuations.

But underneath that, the actual efficiency and benefit to consumers will continue to advance year by year.

Senator Mack. Well, I thank you for that response and, again, we appreciate your being here this morning and for your presentation as well. Thank you.

Mr. Gates. Thank you.

Senator Mack. We'll give just a moment for the room to settle down and then we'll look to you, Mr. Secretary.

Mr. Secretary, we're delighted that you're here with us this morning and look forward to your comments.

PANEL II

STATEMENT OF RICHARD W. RILEY,

UNITED STATES SECRETARY OF EDUCATION

Secretary Riley. Thank you very much, Mr. Chairman, Members of the Joint Committee.

I have a longer statement that I'd like to submit for the record, if I might.

Senator Mack. Absolutely.

Secretary Riley. And we'll pass that in.

I want to thank the Committee for inviting me to address you today and focus on as important a subject as this—the impact of technology on the U.S. economy and all the issues surrounding that.

You've heard from Chairman Greenspan and a number of leaders in the field of information technology the impact that technology is having on the American economy.

I think it's important for me to direct my comments today to the underlying importance of education and its link with technology and with our economic success.

The urgency to address the shortage of information technology workers is also the urgency to focus on bringing high standards of learning into every American school.

Chairman Greenspan has on previous occasions attributed our continuing national prosperity to our thriving economy of ideas.

His point was that our nation's increasing wealth increasingly is being driven by ideas; intellectual, by human resources rather than by physical labor, and natural resources.

Today, it's education and technology that power our economy and empower our citizens.

But we are at a critical point, I think, in our history. We can be leaders in this area or we can fall from the top.

The outcome will depend largely on the investments and improvements that we are willing to make in our schools. The time and the energy, the effective resources that communities invest in building better schools and helping young people move from school to college and then into rewarding careers, will shape the future of our world.

Our colleges and universities are strong, but we must continue to

support them in their quest for quality and for access.

We need to focus, I think, on providing a strong grounding in the basics if we want strong skills in the world of technology.

We need rigorous course work and qualified and well-trained teachers in every classroom if we want students who can take on the challenges of the modern work place.

This education foundation is most important.

It's a point, I'm told, that speakers yesterday talked about and also the speaker before me.

The core of this effort to build a strong future and to create new opportunities for the next generation must be a renewed commitment in investing in higher standards for education and systems for teaching and learning that really do work.

We need, for example, to persuade many more bright young Americans to pursue study in math and science and technology so that they can build promising futures for themselves and for America.

This Administration has focused on increasing investments in education that can make a real difference in the quality of lives of Americans—from pre-school to post-graduate education.

Our proposal on the reauthorization of the Elementary and Secondary Education Act will benefit our nation's K through 12 students. This critical piece of legislation will reinforce and enhance the importance of high standards and the need to provide every child—I want to emphasize every child—the opportunity to get a quality education.

If we set high expectations, demand real accountability of results from schools and use technology in a creative way to improve learning, we can make a difference.

We want to expand the pipeline for IT workers. We have to begin by expanding the pipeline of success in our schools.

And how do we do this?

I think research shows that young people who have taken gateway courses like algebra 1, geometry and chemistry, go on to college at nearly twice the rate of those who do not.

The difference is more striking for low-income students. These students are almost three times as likely to attend college if they take this rigorous series of courses early.

I should also note one more resource that can make all the difference—a qualified, well-prepared, fully-engaged teacher.

Unfortunately, while there are many talented, dedicated teachers today, there are far too many teachers who are teaching out-of-field, without a major or even a minor in their subject area, and teachers who

are teaching on emergency certificates.

I'm especially excited about our creation of a National Commission on Mathematics and Science Teaching for the 21st Century, and I am delighted that former Senator John Glenn has agreed—indeed, was eager—to serve as Chair of this Commission as his next mission for this country.

Technology is not a substitute for solid teaching and learning. It is a tool for helping teachers teach and for helping students learn at the highest levels.

It's one of a comprehensive quality learning experience at its very core that involves the concept of teaching people to think and to continue to learn throughout their lifetime so that they can benefit from change.

Robert Hutchins, the great educator and former President of the University of Chicago, wrote: "The object of education is to prepare the young people to educate themselves throughout their lives."

Technology, as all of you know, is a wonderful, powerful new way to excite and stimulate people to keep on learning. That's why the Federal Government has placed a strong emphasis on investing in educational technology. And while we provide just under seven percent of the budget nationally for education, we provide 25 percent of funding for the innovative use of technology in schools.

We're helping to create the cutting edge when it comes to technology education.

Mr. Chairman, in my longer statement, I've got a listing of all of those things that we have together supported in the technology field and I think it's a very impressive list.

Not everyone can be a high-tech CEO or an inventor of some new technology. But without a competent, educated labor force to bring life to great ideas, the successes that we are now achieving will indeed wither.

I also want to highlight one of the most important aspects of technology—the promise that it offers in terms of increased accessibility to quality education for many who have traditionally been denied that access.

For instance, many students who live in rural areas have been able to link up with world-class libraries and museums and participate in distance learning programs.

Our Star Schools Program, for example, is a great demonstration program that has helped in that area.

Many disabled students have used learning technologies to open doors to resources that might otherwise have been closed to them.

Unfortunately, we are in the midst of a severe digital divide, a gap between those who have access to computers and the Internet and those who do not.

It's a divide centered largely on racial, economic, and demographic lines. And I'm pleased that the e-rate, for which Vice President Gore has provided leadership, is helping to make a real difference in leveling this playing field when it comes to the wealth of technological learning tools on the Internet.

In part, because of the e-rate, 89 percent of our nation's schools and 51 percent of its classrooms are now wired to the Internet. If the funding stays at the current level, every classroom should be wired by the end of the year 2000.

Schools which just a few years ago did not even imagine having these kinds of technological opportunities are getting them today.

Let me also point out that giving all of our young people a broad and diverse but high-quality education should be seen as something that is both promising and supported by the technology industry.

A story I think is in order.

A good friend of mine in my home State of South Carolina, Larry Wilson, is a CEO of a large corporation there called Policy Management Systems Corporation. Larry Wilson hires a number of college graduates every year and he's very careful about going out and trying to find good quality people to work in his high-tech software company that's in the insurance industry.

He says to me, and he says to others that his best recruits in his high-tech software company are music majors. There's a strong support for the Governor's School for the Arts and a strong accountability in the public schools.

He thinks that's very important.

This Administration is continuing to push for a broad range of initiatives, from recruitment and training of quality teachers to helping communities build and modernize schools to strengthening quality learning opportunities in the earliest years and opening the doors to higher education.

In closing, Mr. Chairman, let me give very briefly four broad recommendations.

First, I urge the Committee to focus its attention not simply on technology, but on technology as one critical piece of education of our nation.

Second, I believe we need to increase our investment in research and development in technology as a tool for learning.

We know, for instance, that there are significant links between the use of learning technology and achievement in traditional subject matter. But we are far enough along in the technological revolution and its application to learning that it's time for a systematic review and analysis of what works best.

And I urge Congress to address this. Title III of the Elementary and Secondary Education Act, I think is a good advance in doing that.

Third, I encourage all leaders of the technology community to invest in education. Develop partnerships with local schools.

I urge you to work with the education community and experts on learning to help design the next generation of technology applications for learning.

And finally, and perhaps most importantly, we need to maintain and expand the focus on strengthening equity in education generally, and in access to learning technologies in particular.

Our newest tools for learning give us the power to close that divide that often exists based upon race and economics and gender and other factors.

But we must seize and not shirk this responsibility and this opportunity through important and sensible policies like the E-rate.

It's time to break the cycle of technological inequity, not perpetuate it.

Members of the Committee, if used effectively, the learning tool of technology can be an extraordinarily positive force for improvement in our schools, as well as for increased economic success and productivity of our work places.

So let us use this tool wisely. To paraphrase a wise old man in "Star Wars," may the force be with you.

And the force I'm talking about is the powerful, combined force of education and technology joined with the force of good citizenship.

Thank you.

[The prepared statement of Secretary Riley appear in the Submissions for the Record.]

Senator Mack. Thank you, Mr. Secretary. And again, I would say to Members, because of time, obviously, not everyone is going to get to raise a question at this point.

I would briefly like to recognize Ms. Stabenow to, I think, make a comment about the schools in Michigan.

OPENING STATEMENT OF REPRESENTATIVE DEBBIE STABENOW

Representative Stabenow. Yes. Senator, thank you so much for holding this hearing today. I did also want to bring greetings to our students from Birmingham Seaholm and Madison and Clawson high schools and their teacher, Mike Pierno.

We're so proud of the efforts going on in Michigan and so pleased that they're included today.

Thank you.

Senator Mack. Thank you.

Senator Bennett?

OPENING STATEMENT OF SENATOR ROBERT F. BENNETT

Senator Bennett. Thank you. Mr. Secretary, I appreciate your being here.

I don't know if you followed the conversation yesterday when we had witnesses who talked about education as being the number-one challenge to the future of the high-tech industry and high-tech revolution in this country, saying that there was not only a question of not having enough workers, but that it was fundamental to what was going on with respect to the information age.

One of the issues that was raised again and again by the witnesses yesterday with respect to education was the question of accountability, and how educational performance is measured and, by implication, how it would be rewarded.

I want to explore that with you a little further because the information age gives us tools with which we can measure student performance to a degree of accuracy that was never possible before.

Report cards sometimes are expressions of individual bias on the part of a teacher.

If I may, I remember a teacher who, for whatever reason—I think, looking back on it, he was probably right—he liked girls a whole lot better than he did boys.

(Laughter.)

And when the grades were issued, all the girls got A's and all the boys got B's. None of our final papers were ever read by that particular teacher.

That was just his standard.

In the Information Age, with the kinds of tools that we have, that obviously is not acceptable.

However, one of the biases that I have found in education, and, frankly, I find a little bit of it in your statement today, is that we measure inputs rather than outcomes.

I wonder if you would address that. As we talk about the information age and education, are we going to be satisfied by measuring the number of computers and the numbers of schools wired?

Or are we in fact going to start to hold schools accountable for how well their students learn and how well their students perform?

Could you address that for us?

Secretary Riley. Well, I think that that is a very appropriate question for these times.

Senator, I have always been a strong supporter of measuring results. When you do that, you look at what's causing results and if you back that up you can then make some very good, sound policy judgments.

But, as you know, we're proposing in the Elementary and Secondary Education Act to do away with social promotion, not to have a retention policy, but to have a policy of identifying—and technology can be a very good tool in doing that—students who need special help in after-school and summer school and small classes and all to help them through, help them raise their level of learning.

So I think the identification of low-performing schools, all of the other efforts towards accountability—report cards, as you mentioned—are accountability features. Those are looking at things, looking at results.

Now when we talk about technology challenge grants, for example, those are competitive grants that bring out all kinds of innovation, that really have done so much to bring communities together with technology to do things differently.

Those kinds of inputs are very helpful to bring out creative use of technology.

But I am a very strong believer in high standards, as you know, and assessment linked to those standards. Yes, technology can help that in a very important way. And then we need to have that systemic reform in place to make sure those standards are adhered to and that kids from kindergarten on reach those high standards and are measured accordingly.

Senator Bennett. We'll have this discussion further in another forum.

Thank you very much.

Secretary Riley. Thank you.

Senator Mack. Senator Kennedy?

**OPENING STATEMENT OF
SENATOR EDWARD M. KENNEDY**

Senator Kennedy. Thank you. Thank you, Mr. Secretary.

Specifically, do you have any recommendations for us in the Congress about how the technology community and the education community can work more closely together in terms of the education process and system in our country?

And also, how the technology community and, let's say, the training aspects of the programs, both Federal and state, can work more closely together so that we achieve that well-trained workforce that is going to be necessary in order to see the industry grow and flourish in the future?

Secretary Riley. Senator, we've seen some very positive things in that regard, and many from the high-tech world have gotten very much involved.

I think they realize the importance of education and the importance of their contribution to it.

The contribution of hardware, of software. You see that all around the country, different technology forces coming in to supply and provide additional software and hardware.

Things like Net Day, all over this country, having working people working with execs and educators to wire schools and see that they were moved forward.

They can be a big help in designing technologies for learning. Practical things that are helpful to teachers and principals and educators, help us, all of us, make wise use of technology dollars.

I think all of us realize we've got to do more in that regard, and we're doing a right good bit now in relation to where we were.

But to make wise use of additional expenditures in the technology field as it relates to education can be very helpful.

So I think the very important help that the technology industry can be to education is apparent.

Senator Kennedy. Thank you very much.

Thank you, Mr. Chairman.

Senator Mack. Thank you, Senator Kennedy.

Mr. Secretary, thank you for coming this morning. Again, because of time, we're going to continue to move on.

I would say to the students who are participating, that I will try to get to you as quickly as I can. Mr. Secretary, thank you for being here.

Mr. Robert Holleyman, who is President and CEO of Business Software Alliance (BSA), has a short statement to make. I do not intend

to ask any questions of Mr. Holleyman.

And then we will go to the third panel at that time.

But, again, I would say to the students, be patient. I will try to get to you. We have lots of Members here this morning as well. So we'll do the best we can.

Mr. Holleyman?

PRESENTATION

STATEMENT OF ROBERT W. HOLLEYMAN II, PRESIDENT AND CEO, BUSINESS SOFTWARE ALLIANCE (BSA)

Mr. Holleyman. Mr. Chairman and Members of the Committee, it's a great pleasure for me as the President of the Business Software Alliance to be able to introduce five of the CEOs of our member companies who will be participating in this National High Technology Summit.

These CEOs have each both personally and through their companies played a pivotal role in the creation of the U.S. software industry and in the transformation of the American economy that Chairman Greenspan testified to yesterday.

In addition to Mr. Gates, from whom you have already heard this morning, BSA CEOs who are participating today include: Jeff Papows of Lotus Development; Bill Larson of Network Associates; Eric Schmidt of Novell; and Jeremy Jaech of Visio.

Together, with seven of their other colleagues, they are in Washington this week to both participate in the BSA's fourth annual CEO Forum, and secondly, to release a new economic report tomorrow which will show the broad impact of the U.S. software industry on the American economy.

The agenda of the BSA CEO Forum can be summed up in four specific goals.

First, to advance the potential for electronic commerce for all Americans and for the American economy.

Secondly, to promote technological innovation through strong international copyright protection for software.

Three, to create more and better American jobs through new trade opportunities.

And fourth, to ensure that overall legislative principles and proposals before this Congress advance a net-friendly economic policy.

Let me note that policy issues before this Congress and your predecessors have had and are having a real direct impact on the bottom line of American software companies. I'd like to give you one specific example in the area of software piracy.

Congress armed the United States Trade Representative with a powerful tool—Special 301—that has allowed the U.S. to identify and take actions against nations which engage in rampant piracy of U.S. copyrighted works.

Similarly, as recently as the last Congress, Congress has taken steps to strengthen the U.S. copyright laws in an effort to reduce piracy within this country.

As a direct result of this action taken by Congress, the BSA in 1998 alone was able to initiate more than 12,000 anti-piracy actions worldwide.

These actions have had a dramatic effect in reducing rates of worldwide piracy.

To be specific, if I were to look at just eight markets in the world in 1998, we can show that through this combination of stronger laws and enforcement, reduced rates of piracy from the levels that they were in 1992 meant that the industry and industry workers were able to achieve nearly four billion dollars in additional legal software sales in only those eight markets because of rates of piracy going down.

So sound governmental policy initiatives have provided the American software industry with the tools that we've needed to reduce piracy internationally. There's more work to be done. But with the help of this Congress and our trade partners, we can continue to make progress because it means jobs for American software workers. Indeed, American business application software comprise nearly three out of every four software applications pirated around the world.

Through American ingenuity, technological innovation, and sound public policy, the software industry and the companies testifying today have become true global leaders.

That has meant increased prosperity for all Americans. On behalf of the BSA, our CEOs who are testifying today and our other member companies, we want to thank you for this opportunity.

Thank you, Mr. Chairman.

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

Senator Mack. Thank you very much for being here and for your statement. We will now call the executives to the table.

Mr. William Larson, President, CEO, and Chairman of the Board of Network Associates.

Dr. Eric Schmidt, Chairman of the Board and CEO of Novell, Incorporated.

Dr. Jeff Papows, President and CEO of Lotus Development Corporation.

Mr. Jeremy Jaech, CEO of Visio Corporation.

And Dr. Charles Vest, President, Massachusetts Institute of Technology.

I think we have everybody properly lined up behind the name tags—at least I hope we do.

(Laughter.)

Mr. Larson, let's begin with you.

PANEL III

STATEMENT OF WILLIAM LARSON, PRESIDENT, CEO, AND CHAIRMAN OF THE BOARD, NETWORK ASSOCIATES

Mr. Larson. Thank you very much, Mr. Chairman, and Members of the Committee. It is a great honor to appear before you on behalf today of Network Associates.

I want to thank you very much for the invitation.

Before I begin, I would also like to thank the Members of the Committee for their great work in the last Congress on behalf of the high-tech industry.

Your efforts in the area of the H1B visas, intellectual property protection, and uniform standards for securities litigation are vital to our industry and greatly appreciated.

Network Associates is a member of the Business Software Alliance, which represents the world's leading software developers.

I am in Washington today as part of the BSA's fourth annual CEO forum, during which we will meet with congressional leaders and the Administration to discuss policies of particular importance to the U.S. software industry.

Tomorrow, we will release the results of a new study commissioned by the BSA detailing our industry's impressive contributions to the economy, particularly in terms of the number of high-skilled jobs and high-wage jobs that we create here in the United States.

Business Software Alliance's policy agenda this year focuses on promoting the continued, rapid growth of electronic commerce, ensuring strong copyright protection, both in the United States and internationally, creating increased opportunities through trade liberalization and a number of related priorities relating to the Congress, including the need for strong American encryption technologies, solutions to resolve the Y2K challenge, and ensuring America's leadership role in innovation.

Many of you may not be familiar with the name of Network Associates. But you are familiar with our products.

Network Associates makes McAfee VirusScan, Pretty Good Privacy encryption, Gauntlet firewalls, and the CyberCop line of intrusion detection products.

Many of these products are being used right now in your offices on Capitol Hill.

We are the third largest PC software company in the world, and the world's largest maker of security software.

Last year, we had revenues totaling one billion dollars and we employ over 3000 people in 44 locations around the globe.

Today, my colleagues and I are talking about the key role that software companies play in the U.S. economy. The facts are very hard to dispute.

Our industry creates jobs, better, higher-paying jobs than other manufacturers. And we are continuing to grow and to employ. Our industry now employs over 800,000 people and that employment is growing at the rate of over 13 percent, compared with a total private industry rate of growth of 2.5 percent.

At this rate, there will be over 1.3 million workers in the software industry by the year 2008.

The U.S. software industry is dominant globally, as Mr. Gates pointed out earlier today. Our industry alone has created a thirteen billion dollar trade surplus in 1997.

However, in one very important sector, the sector of security software, that dominance is threatened by some misguided U.S. policies.

The security software market is booming, exceeding 50 percent growth annually. In 1999, the non-U.S. market for security software is projected to be over a billion dollars.

This growth in a relatively new market sector emphasizes the fact that security is an essential element to the continued development of the information infrastructure and the growth of e-commerce, and potential customers worldwide are recognizing this.

Without robust security systems, consumers and businesses will not develop the trust necessary for the transition from traditional commercial activities to electronic commerce and online communication.

Our customers, which include financial institutions, manufacturers, governments, and other organizations, have recognized this new reality and are now procuring the technology necessary to ensure that the networks are secure.

This technology includes firewalls, virtual private networks, intrusion detection, and desktop encryption.

To promote the U.S. software industry's lead in these important technologies, it is essential that U.S. export controls on encryption products be re-evaluated.

Here are some real-life examples of how our company, Network Associates and others like us, are losing sales of these key product areas to foreign competitors due to U.S. export controls.

Network Associates had secured a deal with Chrysler Corporation for desktop encryption prior to the acquisition of Chrysler by Daimler Benz.

U.S. laws allow for liberalized export to foreign offices of U.S.-owned companies, but not to foreign-owned companies.

Daimler-Chrysler is now looking to a German company, Utimaco, which can supply strong encryption to all of its offices worldwide, and its suppliers worldwide as well.

This is a seven-figure deal that we are likely to lose based on the current policy.

Network Associates is in competition with Checkpoint—an Israeli software company—for a contract worth over a half million dollars with the Orient Overseas Container Corporation in Hong Kong.

However, the customer is looking for strong encryption for its virtual private networking, which we cannot today provide them due to export controls.

For these and other international customers, choosing a security solution is somewhat like installing plumbing in a building under construction—once customers select a foreign supplier of security software and build their networks around them, there will be no opportunity for U.S. corporations to regain the leadership that would be lost.

The time to act is now as companies and organizations are building and rebuilding their networks to enable online communications and the new world of e-commerce.

In our surveys of the market, we found over 750 non-U.S. suppliers that compete directly with U.S. suppliers of security software. This number is growing as U.S. companies are forced to cede their leadership role to these competitors.

I would like to leave the Committee with one thought.

We have discussed the importance of the software industry to the U.S. economy, and how important security software is to the growth of e-commerce and the information infrastructure. Wouldn't it be better for all of us if U.S. companies such as those represented at this table be the dominant force in the international market for these key technologies?

Or is it preferable for the U.S. to cede this strategic market to foreign competitors, leaving U.S. companies and government agencies reliant upon foreign-made encryption products to meet their security needs?

I thank the Committee for the opportunity to come before you today and I look forward to your questions.

Thank you.

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

Senator Mack. Thank you very much, Mr. Larson. I would just ask the four of you remaining if you would to try to be within the time because we have lots of people and I do understand the constraints.

Dr. Schmidt?

**STATEMENT OF DR. ERIC SCHMIDT,
CHAIRMAN OF THE BOARD AND CEO, NOVELL, INC.**

Dr. Schmidt. Mr. Chairman and Members of the Committee, my name is Eric Schmidt and I am the Chairman and CEO of Novell, which is the world's largest provider of directory-enabled network software.

I want to thank you, Mr. Chairman, for holding the meeting and I want to add a very special note of thanks to Senator Bennett from Utah, and where we have our headquarters, who has been so instrumental in making this all happen.

And a special note of thanks also to Anna Eshoo, who represents me so ably in California.

As you have heard from previous witnesses, the U.S. high-tech sector is an extraordinary phenomenon. Hearings such as this one keep the lines of communication open between Washington, D.C. and Silicon Valley.

And in my comments, what I'd like to do is discuss the evolution of the Internet and note some of the major public policy issues that we all face.

Now, when discussing this new networked economy, I firmly believe that we are at the beginning, not at the end, of something very, very big.

And even though these are still the very early days of this phenomenon, it's clear to me that the network is becoming the centerpiece of every unique computing activity.

The first phase of this Internet explosion, which has been lots of fun for everyone involved, was all about getting Internet-connected.

It was a hook-up and infrastructure wave. Once people overcame this problem of getting connected, the growth of the network exploded.

The only problem was that no one could find anything. This created a critical need to manage the profiles of the people, devices and objects on the network.

Senator Mack. Dr. Schmidt, pull that microphone a little bit closer to you, if you would.

Dr. Schmidt. Sure. The second wave of the Internet is all around managing the relationships of the people that we're now putting on top of these networks.

Now think about it. Every time you register with a website, whether you buy books on Amazon or travel reservations on SABRE, you're creating a relationship with an outside organization. But in doing so, you're providing information about your life, quite a bit of it personal, to be quite honest.

At the very least, for online enrollment forms, they want your name, your street address, your e-mail address, your telephone number.

They want a credit card number. Do you prefer window or aisle? Do you like mysteries or romance? Manual transmission or automatic? What is your shoe size? Can we have your social security number, too?

Do you take any prescription medicines? And do you have any pre-existing medical conditions?

When you visit a website, it's really visiting you. And that's an important concept here.

The trail of data that individuals leave behind when they're using this Internet, which are known as digital fingerprints, is a rich source of information about people's habits and preferences. And it's often collected, by the way, by accident, and these things are piling up.

Disclosing this information to a variety of online organizations, you're establishing a digital identity, a virtual you on this virtual world of the Internet.

But who manages this relationship?

The stark answer, unfortunately, is no one. There's no IT manager acting on your behalf.

If anyone should manage this relationship, it should be yourself. That's the position that the industry is taking and it also happens to be an issue that my company is taking very seriously.

Our mission is to provide people with a coherent way to manage everything that they do on the Net.

This explosion of Internet identities and the need for managing them has powerful public policy implications. The debate about online privacy, which is underway now, is very serious, and you're all aware of that.

So, from my perspective, it's only through a clear understanding of genuine consumer needs that the private sector's ability to meet them, that we'll be able to craft appropriate policies.

The last thing that Congress should do is rush to judgment about the need to regulate this new medium.

We have examples of self-governance. There are organizations such as the Better Business Bureau Online, Trustee, and Online Privacy Association.

We believe market mechanisms will largely work. We can enforce existing fraud and deceptive trade practices, laws which are already on the books.

And only if all of those things fail do we need some sort of new regulatory body or structure which is going to slow everything down, in my personal opinion.

There is a role and a place for government in this and it's a very important one. And it has to do with the role in funding compelling fundamental research.

The ideas and the concepts that I've been talking about were all originally funded by our government acting years ago with great foresight.

I'm a scientist by training. I'm keenly aware of the tremendous power of research. It is thanks to this funding that we have what we have today.

I was myself supported on one of these grants.

And I don't want you all to get the impression that we don't value that. We wouldn't be here if it didn't exist.

So, to finish up, phase one took the Internet very much by surprise—took people by surprise.

The second wave will be just as dynamic. It's all around—people and relationships and privacy and content and using the tremendous power of this new medium.

I'm very optimistic about what we're building. It has tremendous opportunities for all of us.

Thank you very much.

[The prepared statement of Dr. Schmidt appears in the Submissions for the Record.]

Senator Mack. Dr. Schmidt, thank you.

Mr. Papows?

**STATEMENT OF JEFFERY PAPOWS, PRESIDENT AND CEO,
LOTUS DEVELOPMENT CORPORATION**

Mr. Papows. Good morning, Mr. Chairman, and Members of the Committee, as well as students.

My name is Jeff Papows. I'm the President and Chief Executive Officer of Lotus Development Corporation.

Like my colleagues, I'm in Washington today as part of the BSA's annual CEO forum to discuss policy issues of particular interest and importance to the U.S. software industry.

In fact, as Bill said, we'll release the results of a new study that I think you'll all find economically very compelling tomorrow.

The policy for the BSA focus this year has been well articulated this morning. I'm not going to cover that again in the interest of time.

I'm pleased and honored to have the opportunity, however, to address a few of the specific issues we feel are critical to the continued advances of our industry.

Mr. Chairman, I commend you and your colleagues for the leadership you've demonstrated in holding these proceedings. The U.S. software industry has materialized as one of the fastest growing and most innovative sectors of the U.S. economy.

Since 1994, U.S. software sales have grown at a continuous rate of 15.4 percent, in contrast to a continuous rate of 5.4 percent for the overall gross domestic product.

And in fact, the U.S. software industry is growing almost four times faster than the economy as a whole.

It just makes sense to sit down annually at least to take stock of what we need to do to keep this on track.

Lotus Development Corporation, an independent subsidiary of IBM Corporation, is based in Cambridge, Massachusetts, and has about 8500 employees worldwide.

Founded in '82, Lotus popularized the electronic spreadsheet and launched the personal computer business software industry with Lotus 1-2-3.

In more recent years, more prevalent to our points today, Lotus is the leading supplier of the software that lets you send e-mail around the world, conduct electronic commerce over the Internet, and share information across web-based networks.

These products, Lotus Notes and Lotus Domino, are referred to as messaging and groupware solutions. These technologies represent in some substantial part the new foundation of our industry and the exploding Electronic Commerce marketplace over the Internet.

As we began this decade of the '90s, few people used e-mail as a means of communications.

In 1999, however, it's important to understand 2.7 trillion e-mail messages will traverse the Internet in the United States alone this year, more than four times the volume of traditionally delivered postal-based mail.

Internet commerce is doubling every hundred days.

The Internet, like the railroads of the 1800s, has forever changed the way we communicate, collaborate and conduct business.

As the engine that drives the Internet, the software industry is truly global. 65 percent of Lotus's revenues are generated offshore, as is true of probably most of my colleagues, and these are without doubt our largest and most prevalent high-growth markets.

The total worldwide market for software alone is predicted to double between 1996 and the year 2001 from \$105 billion to \$203 billion.

But our ability to continue to create innovative products and to sell those products in markets overseas is being significantly challenged by issues that the Congress needs to address.

We need to be vigilant of trade barriers both within and outside our country if we are to keep strong growth on track.

A key indicator of the growth and the importance of this is the U.S. trade balance. The software industry contributed \$13 billion of surplus in U.S. goods and services to the economic trade balance this last year.

Clearly, the industry must remain competitive in export markets to continue to be vital.

Export restrictions increasingly, however, are crippling our industry's ability to supply secure American-made systems to foreign companies. And it's not just companies like Mr. Larson's who are in the business of making those products and services. It's products like ours that enable e-mail, collaboration, and Internet commerce which must use those products and technologies if they are to be trusted and if they are to remain competitive.

Now, fortunately, Congress is taking some serious efforts to bring down some of these self-imposed trade barriers and to bring our export policies in line with the current-day market realities.

This is in fact the modern-day equivalent of asking the high technology industry to put the genie back in the bottle when we think from our perspective about the current export restrictions with regard to encryption.

However, in the House today, H.R. 850, the Security and Freedom Through Encryption Act, or SAFE, introduced by Representatives Bob Goodlatte and Zoe Lofgren, would ensure that all Americans may use and sell encryption domestically and provide much needed export relief to our industry.

The bill, with over 250 co-sponsors, passed the House Judiciary Committee in March and is currently moving through the Permanent Select Committee on Intelligence, Armed Services, International Relations and Commerce.

In closing, in addition to the tremendous work that you have all done with respect to piracy and other issues that continue to affect our industry and that have been well articulated today, I would ask us to consider this work seriously and get legislation to the White House this year that will continue to allow us to compete in the global markets that we so aptly compete in today.

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

Senator Mack. Thank you very much.

Mr. Jaech?

STATEMENT OF JEREMY JAECH, CEO, VISIO CORPORATION

Mr. Jaech. Good morning, Mr. Chairman, and Committee. My name is Jeremy Jaech. I'm the president and CEO of Visio Corporation. I'm honored to be here. Thanks for inviting me.

Visio is a Seattle-based company and we develop, market and sell drawing and diagramming software for enterprise-wide use by businesses, primarily.

Founded in 1990 with just a handful of employees, we now have over 600 people and we have been pioneering the category of business-drawing software in the personal computer space.

Our products are sold in more than 45 countries and sales outside the U.S. represent about 40 percent of our business today.

Our mission is to become the single standard for creating, storing, and exchanging drawings in business.

And I'm pleased to report that we're steadily achieving that goal.

Technology and innovation are clearly critical to Visio's success. What is less obvious, perhaps, is the critical role that the Federal science policy has played and will continue to play in our nation's continued technological achievements and the corresponding economic rewards that all Americans will enjoy.

The history of Visio and of our industry perfectly illustrates the critical role of Federal policy in supporting and empowering technological advancements that result in new companies with enormous impacts on the U.S. economy.

Most Americans probably don't realize that many of today's most exciting technological breakthroughs are the result of Federally-supported research, much of it conducted at our nation's universities.

During the past decade, Federal investments in information technologies enabled fundamental advances that have been a major factor in the continued leadership of the United States.

For example, the Defense Advanced Research Projects Agency, DARPA, fueled the development of the computer-aided design software industry by supporting early university-based research in integrated circuit layout, simulation and synthesis tools.

Visio has built upon computer-aided design software programs to create a new and distinct market category—computer-based drawing and diagramming for general business users, not drafts people.

We have gone beyond traditional design software to create an entirely new market in drawing and diagramming for business users.

Today, we are the leading company in that product category, our products are the industry standard, and we are extending our core technology into new segments.

Just as research and development was critical to the birth of the computer-aided design industry, R&D continues to play a central role in Visio's growth. Our ability to constantly innovate and transform those innovations into new products and services is unquestionably our lifeblood.

And I think any technology company would agree with that.

It's no exaggeration to say that R&D is one of the largest contributing factors to the past, present and future economic growth of the technology industries and of the U.S. economy as a whole.

The American economy reaps the rewards of the Federal and industry investment in R&D in numerous ways—through the creation of jobs, increased productivity, more effective communications.

In short, our nation's investment in innovation has paid tremendous dividends through the development of entirely new industries and a communications revolution.

The information technology industries accounted for one-third of U.S. economic growth from 1995 to 1997, and today these industries are growing at more than twice the rate of the rest of the economy.

These industries are supporting high-quality jobs for American workers. The average worker in information technology and IT-related jobs earned 64 percent more than the average private-sector wage.

Perhaps most importantly, advances in technology have significantly improved the quality of life for all Americans. We at Visio are proud of the small part we are doing to contribute to the growth in efficiency and productivity, new ways of doing business, and tremendous advances in our ability to communicate with each other.

Unfortunately, the American investment in basic research has declined in the past decade and is threatened by continued budgetary pressures. The Council on Competitiveness reports that Federal funding for research decreased at an average annual constant dollar rate of 2.6 percent per year from 1987 to 1995.

To keep America's economy growing into the next century, government and industry must work together to reverse this trend.

We've got to make a joint commitment to increasing investment in R&D.

The Federal role should be to ensure consistent increases in funding for basic science, engineering and technology research.

As the February, 1999 report of the President's Information Technology Advisory Committee points out, the Federal role is irreplaceable in ensuring sufficient investment in critical, long-term research for which no market advantages are foreseen.

And I see I'm running out of time here, so I'll just say, this is a very critical issue for us as a company and for our industry, that R&D continues to be funded at high levels and that we make those tax credits permanent, as opposed to sunseting and being renewed every few years.

So thank you very much for your attention.

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

Senator Mack. Thank you.

Dr. Vest?

**STATEMENT OF DR. CHARLES VEST, PRESIDENT,
MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

Dr. Vest. Mr. Chairman, I want to emphasize five points this morning.

First, complacency is the enemy. Our economy is riding high. Some even believe that we are in a new economy.

But in any event, this is the age of knowledge and innovation. Companies are fast-paced, knowledge-based, electronically-interconnected, global, and spawned by entrepreneurs.

This means that continued success depends on new knowledge and appropriately educated and trained people.

Yet, the knowledge driving today's industries has been accumulated during the past 40 years of Federal and industrial support of long-term research.

Are we doing the right things to generate the knowledge that will drive the future economic success?

No.

As has been said, we are reducing our investments. We're going in the wrong direction.

In 1985, Federal R&D was about 1.2 percent of the U.S. GDP. In '97, it was 0.8 percent.

Federal spending on basic and applied research fell by 12 percent as a share of GDP between 1993 and '97.

Are we attracting increasing fractions of our bright young men and women into science, mathematics and engineering and creating broad technical literacy?

No.

And this situation is most acute among minorities and women. We cannot be complacent. We must turn these situations around.

Second, the U.S. innovation system must be understood.

In this country, we have a loosely-coupled innovation system of industry, government and academia. It generates new knowledge and new technologies through research, and it educates men and women to use this knowledge to create new products, processes and services and move them into the commercial sector.

The shock of the Japanese challenge compelled our manufacturing industries to level the playing field of world competition by dramatically improving manufacturing and reducing product cycle times.

However, this came at a price.

In most large companies, this involved a dramatic change in the R&D function.

However, most corporations cut back very substantially on fundamental, long-term research. Coupled with declining Federal support, this does not bode well for future U.S. innovation.

Indeed, Michael Porter of Harvard and Scott Stern of MIT have constructed an innovation index of nations that involves analysis of six economic and policy factors. Their results show that the U.S. may indeed be living off historical assets that are now being renewed.

We are still near the top, but the gap with other nations is becoming increasingly small and projections to the future show that we

may well drop below several other countries by 2005, largely because of R&D cut-backs, emergence of shortages in the talent pool, and slowing of policy innovation.

Third, the most vulnerable parts of our innovation system are education and long-term research.

As many have said, much of our public K through 12 system is a disgrace. In higher education, there are both positive and negative trends in science, engineering and mathematics.

Just five percent of U.S. 24 year-olds have earned natural science or engineering degrees. This compares with 6.4 percent in Japan, 7.6 percent in Korea, 8.5 percent in the United Kingdom.

One decade ago, we led all of these countries in this metric.

United States bachelor degrees in natural science declined from '76 to '90, but are again growing and have increased somewhat since 1990.

Bachelor's degrees in engineering declined from '86 to '90, and have been steady since then.

United States doctoral degrees awarded in science and engineering were stable, from '75 to '85, but are once again growing. Engineering, math and computer science account for most of this growth.

However, in 1986, about 30 percent of our natural science and engineering PhD degrees were awarded to non-U.S. citizens. By '95, this figure had risen to 50 percent.

Universities are the largest performers of basic research in the U.S., conducting over 50 percent of all basic research, the research that truly generates the new ideas that define our future.

And universities help to drive the economy.

The stake in research universities is high. For example, a 1997 study by Bank Boston showed that graduates of MIT alone had founded or co-founded over 4000 companies currently employing 1.1 million people with revenues of \$232 billion.

In the field of biotechnology alone, there are at least 45 such companies, employing 10,000 people, with revenues of three billion dollars.

I'm confident that many other universities can tell similar success stories.

Fourth, the many areas of science and technology are important and interrelated, and they are evolving in unpredictable ways. Biology will soon become the fourth science underlying engineering, and the seamlessness of science and technology and the interrelation of their subfields is demonstrated every day.

Every Federal agency has a vital role. For example, the Department of Defense supports over half of all engineering and computer science research conducted at our nation's public and private universities.

And finally, there is an essential role for the Federal Government in supporting research in education. There's a growing bipartisan understanding in this Congress that support of basic research is an essential function of the Federal Government in the 21st Century.

What is missing is a sense of urgency.

The information technology represented by the entrepreneurs and leaders at this table exists primarily because of strong Department of Defense investment in university research 30 years ago, and we must continue that advance.

In closing, I particularly ask your leadership in accomplishing four objectives.

First, give your highest possible priority to stable and substantial Federal funding of fundamental research.

Second, invest in fundamental research across the full spectrum of scientific, engineering and mathematical disciplines.

Third, increase focus on partnerships, university-industry partnerships, and industry-government-university partnerships.

And fourth, improve the policy environment for both private sector and public sector research. Make the R&D tax credit strong and permanent.

Thank you very much for this opportunity.

[The prepared statement of Dr. Vest appears in the Submissions for the Record.]

Senator Mack. Thank you very much for your input as well. I thank all of the panelists.

Let me kind of set the stage here for at least the next few minute.

It will be my intention to have the first question go to Carnegie Mellon University and then follow that up with Senator Allard, then Mr. Minge, then back to Senator Sessions, and then to Senator Bingaman.

And with that, if the folks at Carnegie Mellon University have a question for the panel, we'd like to hear it. And if there's a specific panel member that you'd like to address it to, please state that as well.

Go ahead.

Ms. Morris. Hello. My name is Beth Lynn Morris. I am from Pittsburgh Super-Computing. And I have a question for the President of MIT.

Senator Mack. Please go ahead.

Ms. Morris. My question is, is there a concern for the number of women and minorities in high technology fields?

In particular, what can be done to make sure that women and minorities are encouraged to pursue degrees in technology fields?

Dr. Vest. That is a very important question. I appreciate your asking it.

The fact of the matter is that, in U.S. culture, science and engineering for many decades were virtually totally dominated by men. Fortunately, that is beginning to change.

At MIT, over 40 percent of our undergraduate students are now women. About 18 percent are members of under-represented minority groups.

That's the good news.

The bad news is that at our institution and most others, that percentage drops off by nearly a factor of two when you get to graduate school. And by the time you get to today's faculties, those numbers look more like ten or 12 percent.

So we have a lot of work to do with both women and minorities to attract them into this enormously important and rapidly-growing field.

I believe that the answer to your question exists primarily in our homes, in our K through 12 schools, in the role models we project to the world of entertainment, and we must all, as I know my colleagues at the table do, in our own businesses and institutions, do all that we can to provide welcoming environments and assure people that the brains and creativity of women and minorities are going to be very, very important drivers of our economy in the years ahead.

Senator Mack. Senator Allard?

OPENING STATEMENT OF SENATOR WAYNE ALLARD

Senator Allard. Thank you, Mr. Chairman.

My question also goes to the workforce problems that they apparently are having in the high-tech industry.

I read today's paper that there's going to be a need to perhaps raise the immigration limits, people coming into the United States, workers for your industry.

And my question is this—is this because we're failing to educate Americans to assume these jobs, or is it simply not an interest in Americans to get jobs in your industry?

Or is it that working conditions are not paying enough to attract Americans?

And I'd like to have several members of the panel address that question.

Senator Mack. Hop in, whoever wants to.

Mr. Papows. Let me begin. The metric that drives that requirement is that there's about 400,000 unfilled jobs in the high-tech sector as we would define it today in this country, and it's a by-product, obviously, of a lot of things.

Partly the insatiable growth of our industry, which is outstripping the supply of our education systems to the point of some of Dr. Vest's comments.

But our education system in many respects competitively is keeping up. It's a question of the combination of those deficiencies which exist to some degree, and the extraordinary growth.

Our industry, on average, it was mentioned here today, pays about 60-odd percent more than other industries by comparison. So it's not a lack of economic catalyst clearly that is failing to draw people to our industry.

But, remember, 94 percent of all software exports in the world emanate from the United States. We are the world's dominant supplier in an extraordinarily illustrated sense.

So I don't think that any of this should surprise us. It's going to require us to have the ability to continue to import talent, as well as to continue to improve the talent we grow within the country to keep the leadership reins that have been ours for decades to this point.

Dr. Schmidt. We need to continue to grow, headcount and train people both inside the United States and also bring additional people in.

All the forecasts for labor needs for the next ten to 20 years show an immense gap in this particular area. And this is part of the reason why the market rewards them with higher-than-average salaries.

Senator Mack. Representative Minge?

OPENING STATEMENT OF REPRESENTATIVE DAVID MINGE

Representative Minge. Thank you. I'd like to direct this question to both Dr. Vest and to Dr. Schmidt because you both touched on this topic during your comments.

I'd like to preface my question with the observation that we have spent the last decade trying to balance the budget and we are now completing that task.

At the same time, there has been a call for dramatic tax cuts in the years ahead.

In the past few years, there have been calls for dramatic cut-backs in Federal spending in a whole range of areas. We're looking at trying to make the R&D tax credit permanent.

The concern that I have is that, often, undergraduate research is one of the victims in this struggle as to how we balance the budget, cutbacks in Federal funding for education, including undergraduate education through the National Science Foundation.

And I'd like to have you just sort of consider and comment briefly on the trade-offs that you see between, let's say, a more generalized tax cut and the hope that that would stimulate the economy and corporations using money that saved through such tax cuts for their own research. Or individuals using money for their own education.

As compared to, let's say, increasing funding for the National Science Foundation so that we can, through that program, provide more money for undergraduate research.

And I believe, Dr. Schmidt, you alluded to your own utilization of some Federal programs as an undergraduate. And Dr. Vest, you certainly are close to this in your capacity as president of MIT.

Dr. Schmidt, please go ahead.

Dr. Schmidt. Sure. Thank you very much for that.

My own view is that it's a question of economic leverage. That the money that is spent on R&D and research has over the lifetime of the value of that investment so much more economic leverage in terms of greater standard of living, more innovation, creation of new industries, greater wages and their concomitant high taxes for governments, et cetera, that if you had a single marginal dollar, which is your question, the first place you'd put it would be fundamental research, although you have to be very farsighted in order to see that.

And the beauty of our argument now is that you can see it. I and others here represent the credit of that.

I literally would not be in computer science if it were not for that funding.

That's how fundamental this is.

Representative Minge. Maybe more important than the tax cut from your perspective.

Dr. Schmidt. I think our general view is that both of these can be accommodated.

(Laughter.)

Representative Minge. That's a dream world, Dr. Schmidt.

(Laughter.)

Senator Mack. Sounds like a politician to me.

(Laughter.)

Representative Minge. Dr. Vest?

Dr. Vest. I think Dr. Schmidt has articulated the fundamental issues very nicely.

I would simply like to add to this that the way our system works today is really quite beautiful because when the Federal Government invests a dollar in supporting research at our universities, public or private, that dollar does double duty.

It first of all does in fact make possible the research results, the generation of knowledge, new technologies, and simultaneously educates the next generation of scientists, engineers and other leaders.

So it's a highly efficient and effective expenditure of funds. And of course, as we all know, there is no simple answer to the question of exactly where the dividing line is. But I think the government, just as us as individuals or those who are corporate leaders, have to make some balance between investment in the long term and being sure that we don't just burn up our capital for near-term purposes.

We must be creating new knowledge and assuring that we have a population that's going to be able to keep this economy strong in the future.

So as one thinks about that balance, I agree that the very first area that the dollar should go to is to support the creation of new knowledge and educated men and women.

Representative Minge. Thank you.

Senator Mack. Again, just to inform everyone, my intention after Senator Sessions and Senator Bingaman, would be to go back to one of the schools, to Madison Heights High School.

So you all might be getting ready for a question here in a few minutes. And then Ms. Eshoo, we'll be coming to you. Actually, we'll go to Senator Hutchinson first and then to you.

Senator Sessions?

OPENING STATEMENT OF SENATOR JEFF SESSIONS

Senator Sessions. Thank you, Mr. Chairman.

I know you've been a champion of research within this Senate and I've admired you for that because one good research idea can benefit the whole world in ways that we can never anticipate today.

And basic research is certainly important.

I have noticed in the defense budget that we are robbing basic research and applied research in a way that one expert told us was akin to eating our seed corn.

And I hope we do not make that error.

I appreciate the question that was just asked about the proper balance between tax incentives to private companies for the short-term,

intensive research that you're capable of doing, and the long-term research goals of the university.

I think that that's something that we're going to have to wrestle with. I'd like to see the National Science Foundation funding increased.

I think it is a good investment and I would be looking for ways to do that.

Let me ask, though, this question. It's extraordinary. We were told yesterday that there are 350,000 jobs awaiting people to fill them in the high-tech industry.

How is it that we have people who want to go to law school, I suppose, and sue one another—I'm a lawyer. I can say that. I see that Mr. Larson's a lawyer. Maybe all lawyers don't end up suing one another. Maybe they become CEOs sometimes.

I think one of the deans at Yale once said, we've got too many bright people in law school.

The problem is we don't have enough people involved in science and technology. And it must be starting early.

Can we invigorate them more? Do any of you have any ideas about how to have more people capture the possibility of human progress that comes with science in a way that maybe we're not selling correctly?

Mr. Papows. I'll offer one maybe out-of-the-box thought.

We're involved in a lot of work involving original research and some commercial efforts in distributed learning.

The use of the Internet in the vast network society that we now populate as an actual platform for distributing our precious education resources beyond the physical boundaries of bricks and mortar of any individual school, university. In fact, we've done it with high schools as an experiment. We're done it with universities, although, obviously, our target is primarily the professional staff development in the private sector.

We need to eat our own cooking here. We've got the best possible opportunity in this country as we continue through the tech corps and a lot of the other good philanthropic efforts to wire our school systems, to leverage those precious education resources in innovative ways that in and of themselves I think add a great catalyst to the students that we've encountered to get them excited about the use of this technology.

And the importance of fundamental disciplines like math and physics is a bedrock for those kinds of advances.

So if we just look to the technology as part of the answer, I think we can leverage a great deal of the education assets we have in some innovative ways that we haven't to date without the attendant costs that

are sometimes difficult with traditional systems.

Senator Sessions. Would the high-tech industry be willing to be more involved by using personnel to go to schools and make a connection between theory and actual exciting work in the future?

Do you think that that's a possibility?

Mr. Larson. I'd like to jump in as a born-again attorney who decided not to pursue suing people.

(Laughter.)

I think this is about education. I think the high-tech industry is very involved in education.

We give over two and one half million a year away in charitable contributions and most of that is directed to education. And that's real cash, as opposed to retail value of software grants. And then there's retail value of software as well.

But I think it goes beyond education to who we put up as our heroes in this society.

The people that we put up as heroes in this society as a result of the great expanse of technology are people who have prospered financially in the business sector as opposed to the technologists who made it happen.

I think we might rethink our understanding about how we reward and recognize people who contribute at the raw science level to building the Internet, people like Vint Cerf and others who actually made all this great expanse of economic benefit possible for people like myself who

are a little more narrow-minded in our managerial abilities and being able to actually create value from raw research.

Both sides are important in making the contribution. But I think we err too much in putting up on the pedestal the ability to achieve great economic success and we've not given raw science and the people who invest in raw science quite the same level of ability to achieve economic success.

That's something that we might rethink.

Dr. Vest. Two very quick additional points.

One is we generally teach science to youngsters in the most boring possible way—memorizing a bunch of facts from a boring textbook that's been written by a committee.

We need to teach science to youngsters as a hands-on discovery process.

Everything we know about learning says that that's the way to go. Second, we don't invest anything in serious research on how people

learn. If your industry, instead of investing 15, 20, sometimes more, percent in R&D, invested less than a tiny fraction of one percent, as education does in this country, you wouldn't be doing very well, either.

We need to learn more about learning and we need to make particularly the learning of science a hands-on, discovery-based process.

Senator Mack. Thank you very much. That was an excellent question and I think a terrific response.

Senator Bingaman?

OPENING STATEMENT OF SENATOR JEFF BINGAMAN.

Senator Bingaman. Thank you very much, Mr. Chairman, and than you all for being here.

Dr. Schmidt, I notice in your testimony where you talk about a digital identity and the loss of privacy that comes from going on the Internet.

Your conclusion is that, for now, government's role should be to encourage private-sector solutions, investigate and prosecute deceptive business practices, and monitor privacy abuses to determine the actual harm to consumers.

And you do make the point which I agree with that we shouldn't rush out to do something before we know what we're doing.

At the same time that we shouldn't rush out, I guess I'm concerned that there's no systematic or expert effort going forward that I'm aware of to do this monitoring of abuses or privacy on the Internet. And it's not quite enough for me to just tell people in my state who ask me about this, ask me what's being done about online privacy, to say that we're monitoring the abuses.

We need to give them more of an explanation than that and more of a plan of action than that.

Do you think it makes sense to have a panel of folks established to look into this question and determine if there are any policies that are appropriate?

I know your company is working on private-sector solutions and I commend that. I compliment you for that.

But I'm just concerned that this is an issue that we're going to hear more and more about here as more and more people go on the World Wide Web, and we just don't seem to have much handle on it or much plan for how to get a handle on it.

Dr. Schmidt. My own view is that this will sort itself out very quickly in the private sector because of the tremendous issues that are going to be raised by getting everyone online, as you so accurately pointed out.

There are some interesting statistics that 94 percent of the Web's 100 most popular Web sites have enforceable privacy policies, which is up from 70 percent last year.

There was an FTC study that found that 99 percent of the consumers' web traffic were represented by 364 dot com sites, of which two-thirds already had a privacy policy.

I don't think the gap is as large as it would initially appear. I think we can achieve this very quickly within the industry because of the initiatives that I mentioned in my earlier testimony.

So for those reasons, I think it's an area of further study. It's something that you, in your role as representing your citizens, should keep your eye on.

My sense is that we can get it done this year. And if we can't, then my sense is that government will need to respond.

But I think that all of us believe that private-sector solutions will occur very quickly.

There are a number of reasons for that also involving quality-of-service to customers.

Ultimately, consumers want the kind of privacy that I described and the market will adjust for them.

Mr. Larson. I would just like to second Dr. Schmidt's comments, if I may, as regards in particular the potential for consumer backlash for companies that do not engage in privacy policies on their Internet web sites.

And that's why you see so many of the larger web sites who really do have the traffic going pro-actively, on their own initiative, putting out those privacy policies.

Because the consumers do act back and they act back very quickly on the Internet. You get immediate feedback and the news groups start saying how you shouldn't go visit these sites. In fact, you should spam them back for how they are not implementing their own privacy policies.

So we're becoming very educated very quickly by the consumers.

And just one last comment.

Maybe it's because I come from the west and we're more oriented towards taking responsibility personally, but I think this is about personal empowerment. It's about us educating individuals that there are tools out there.

Our company makes some of those tools such as PGP, a personal privacy tool, or Guard Dog, an Internet security tool, for end-user consumers, so that they can control their own destiny.

It is up to the individual to take control in ensuring that their

desktops are encrypted, that they don't get what is called "cookied" by the web sites.

And it's important to educate consumers about how those tools exist, very affordable tools. They are under fifty dollars type tools for end-users to use to protect themselves.

That's going to be the much better economic solution in terms of efficiency and education. And I think the virus phenomenon is a good example of this.

You can't control the virus phenomenon through government legislation. It's out there. It's never going to stop.

It's the graffiti on the Internet freeway walls and you cannot stop it.

But individuals can stop it by protecting themselves.

Dr. Schmidt. And I believe that there is a 1 percent problem that will always be there, and we can solve that through traditional and existing legislation, as I mentioned.

Senator Mack. All right. Now let me turn to Madison Heights High School for a question.

And if you would, again, direct the question to a member of the panel, if that's your intention.

Mr. Bright. Hello, I'm Don. Donald Bright. With the advent of computers and automatic pilot, will there be any use for human airplane pilots in the future?

Will tomorrow's people be afraid to put their lives in the hands of a computer? Or will those who were raised with computers and therefore, more educated about them, be more trusting of them?

Senator Mack. I suspect that's for anyone on the panel who wants to respond to it.

Dr. Vest. Two decades ago, when our manufacturing industries began to change themselves radically, many companies made a mistake of assuming that getting lots of robots to do what people had always done would solve their problems.

It didn't.

What they ultimately learned was it takes a wonderful synergy and interaction of human beings and machines in order to do things well. And I believe that combination is what will always drive humankind forward.

Senator Mack. Dr. Schmidt?

Dr. Schmidt. I think that there's a lost issue here, which is the importance of human values in all of this.

We talk about what technology has done for networks. But what really matters is that humans control the evolution of this technology.

And I think we can. I'm very optimistic with respect to that.

I do believe that the synergy between what the networks are doing and what their human users are doing is mostly positive and that the issues can be managed by discussions like this and also the legislation that we already have.

Senator Mack. Thank you.

Senator Hutchison?

OPENING STATEMENT OF SENATOR KAY BAILEY HUTCHISON

Senator Hutchison. Thank you. I have been watching from my office in between meetings this hearing on the Committee channel and it's been very interesting. And I appreciate so much your time because I think the point is well taken that we don't want to pass regulations in this very important area when things are changing so rapidly and do anything that would stifle the growth or the opportunities that the new technology has provided us.

One of the areas that I've been most interested in is the education area. And Dr. Vest, I think your testimony is stunning, really.

We have been trying to look for more creativity in education because, obviously, if we're going to be behind, that's going to start showing in the type of employees that we are giving to the emerging companies.

One of the things that we have looked at is encouraging careers to classroom, looking at people who have expertise in computer technology and computer sciences who have been in the emerging companies, in the private sector, or in the military. And many of them retire at the age of 50 or 55 and perhaps would look at a second career in teaching.

I'd like to know if you think that this is something that we should pursue more vigorously. Do you think it will work? And if you see any problems, tell us what they are so that we can try to perfect it before we go too far forward.

Dr. Vest?

Dr. Vest. Well, speaking personally, as I think about primary and secondary education in particular, I think this is extremely important.

In the new world of high technology industry and so forth, human beings accumulate wisdom and experience just as they always have. The ability to share that with young people, to inspire them to make that world out there human is incredibly important.

And I really salute any kind of activity that our companies or the military or anyone else put together with our school systems to try to take advantage of that expertise.

I also believe much of that kind of expertise is going to be increasingly available through information technology and I think that that's one of the things that the World Wide Web may help us to do very well.

Even at the most advanced research universities, as we at MIT look to the future, we know that part of our education has to be conducted very differently because of the changing nature of industry.

And through a number of partnership activities with industry and sometimes with both government and industry, we are increasingly bringing into MIT, either as temporary or full-time faculty members, people of great experience in other sectors.

I think particularly of our new Center for Innovation and Product Development, which is something that we feel is missing in U.S. higher education in engineering and management. We know the problem. We know we have part of what it takes to do the job within the university.

But we know that we need a lot of help.

And we have joined together, with some help from the National Science Foundation, with leaders from companies like Ford, IBM, Xerox, and the U.S. Navy, and we're all working together, including volunteer leaders from those industries, to work with our students.

I think this is really an important part of the future at all levels of education.

Senator Mack. Ms. Eshoo?

OPENING STATEMENT OF

REPRESENTATIVE ANNA G. ESHOO

Representative Eshoo. Thank you very much, Mr. Chairman.

I can't help but say this at the outset of my comments, that this is everything that a hearing should be because you have been so highly instructive to us.

I really want to compliment each one of you. You're wonderful teachers. The teachers are sitting there and the students are here.

Let me just very quickly ask this and then go to another question.

And that is, the purpose of the overall hearing is to be instructive to us about where the hand of the Federal Government will be helpful and, of course, where we should be hands-off so that you, as major contributors to the American economy, to the global economy, will be able to continue to prosper.

There are some big Es in this.

We have education, education, education. Encryption policy, which you have spoken to. Export controls and what we need to do about

them. Certainly, electronic commerce and what it represents and its future and all that that represents and how we can be helpful in that area.

The research and development tax credit being made permanent. And of course, the issue of Y2K.

Would you add anything to that list just so that as we are absorbing all of this, the homework assignment, so to speak, to the Congress?

Mr. Papows. I actually think from my perspective that encapsulates the issues that from the perspective of the member companies, we've articulated for now.

The only thing that I would add to that is we should not forget the piracy and intellectual copyright protections issues, which this body has shown a great deal of leadership.

And it's not just, by the way, the WIPO treaties and some of the other work that we're all aware of. It's the work that the government has done through the issuance of some of the executive orders last year, particularly as it relates to making best practices at issue with government, which, remember, is one of the largest procurers of commercial information technology.

And I would ask that we specifically, as I know the Administration did last year, take those same standards to China and a number of the other large world markets where we're still struggling with those issues.

So I think you've been pretty inclusive. And if we added the piracy and intellectual property rights protections issues to the list, we've pretty well covered the waterfront.

Mr. Jaech. I think I'd add one more, which would be patent reform. I think the patent system as it exists today is a problem for us.

Representative Eshoo. Let me just—thank you very much—follow up with something that you mentioned, the piracy issue.

Hardware and software are probably the most pirated products in the world today. And I think statistics—certainly, you have offered them and others have touched on it.

It's my understanding that many foreign governments, technological infrastructures, are reportedly reliant on pirated products.

Do you foresee a problem in terms of Y2K because of these governments having pirated products, that they would be less inclined to work with the companies whose products have been pirated, and of course, we're trying to address this worldwide in terms of interconnectedness, et cetera, et cetera.

Would anyone like to go after that one?

Mr. Papows. Well, it's a fair point. For most of us who are in the traditional PC side of the market, one of the ways that we keep our

consumers from having Y2K compliancy issues is to keep them current to the later generations of the software.

Obviously, to the degree that people have circumvented the commercial system and proliferated legacy versions of the products for economic reasons, they may well not be compliant.

And it's not so much that governments would institutionally support that practice, but they may not be aware of what parts of either governments or financial or private sector systems are going to be impacted as a consequence of what's not known and understood.

So Y2K may be the once-in-our-lifetime experience to point out the pitfalls of the export of illegal software, but there obviously is a lot of damage that could be done as a consequence that all of us would like to avoid.

Mr. Larson. I'd like to add to that another example that parallels very closely what Y2K could bring to the piracy issue.

We're the largest manufacturer of anti-virus software. And one of the recent virus alerts was this Chernobyl virus where we had a cure for the virus and we worked very aggressively to make sure that our customer base, our paid or licensed customer base, upgraded to that cure before the virus was set to go off in late April.

Unfortunately, in certain areas of the world which happened to parallel closely areas where there are high piracy rates, the virus had a huge impact, particularly in the Pacific Rim, where you would think they would at least buy anti-virus software to ensure that their pirated software was free from —

Representative Eshoo. They didn't pirate it.

(Laughter.)

Mr. Larson. So we saw a significant negative impact of the Chernobyl virus in the Asian market in particular, and even the Malaysian stock exchange went down during this virus incident.

So I think that that is a parallel that would say that Y2K does present an issue.

What I would point out is there is a feedback loop because of our interdependency, that if in the more developing world, Pacific Rim, eastern Europe, we see that they have not upgraded to Y2K, that will have a feedback loop.

For instance, during the Chernobyl virus incident, NATO bases outside the United States were also adversely affected by this virus. And that's because they inter operate with those local networking systems.

So I think you're right on in your comment.

The challenge, though, is what happens is they come back and steal the upgrade.

Senator Mack. Just to say to the next panel, we're running a little bit over. But we've had lots of interest here this morning. I appreciate your patience.

And to the students at Seaholm High School, on our next panel, we will get to you for a question.

So Mr. Etheridge, you have the last question of this panel.

OPENING STATEMENT OF REPRESENTATIVE BOB ETHERIDGE

Representative Etheridge. Thank you, Mr. Chairman. Let me thank you for convening this because I agree with my colleague, Ms. Eshoo. This has been very instructive, a great morning, great panels.

My question deals with Mr. Gates, who earlier referred to education. Secretary Riley touched on education. I want to focus on that a little bit simply because at critical points in the history of this country, education has had a high priority.

The GI Bill during World War II sent a lot of men and women back to college. It gave a lot of people an opportunity for education at university level that never would have had it.

With the breakthrough of the Sputnik and the space age, generated a lot of interest and a lot of scientists. And we have a lot of young men and women who are scientists today because of the research and the dollars poured in by the Federal Government.

We get into a lot of arguments here in Washington about whether we ought to be involved or not, and local control, et cetera, et cetera.

We're facing a budget now where we're going to be looking at anywhere from a nine to eleven billion cut in secondary education. And we've talked this morning about higher education and how it has fueled the industry that you're a part of.

The last time I checked, most of the young people that wind up in the university go through the public schools at some point. That's how they get there.

With the changing technologies that we're now facing with your industries and every industry, really, no matter what they are, are tied to technology, my question becomes, how do we engage that young person at the K-12 level to get them in math and science?

I know in my State of North Carolina, we required algebra for all children to graduate. They said we wouldn't have any kids and they'd drop out.

What really happened was our math scores went up and we used algebra as a pump primer rather than a filter. It gets back, Dr. Vest, to the point that you made earlier.

So I hope you will touch on this whole issue of how do we engage a broader group of young people at the public school level in math and science because I think that's critical as we move through the new millennium and the digital world we're entering.

Dr. Vest. Just a couple of comments. And I'm afraid there's nothing particularly original about my views.

But at the end of the day, the quality of our education depends on two things.

First of all, what is the quality, motivation and effectiveness of our teachers?

And secondly, what is the kind of feedback that our young people get, not only within the schools, but from their family, the general public, the media and so forth?

I think there are some things we ought to be doing. And I hope I don't tramp on toes here.

I am a great believer that we ought to make it much easier for people who major in disciplines as opposed to going to schools of education, to become teachers in the primary and secondary system so that the knowledge base is upgraded.

I think we as a society simply need to value our primary and secondary teachers more than we do. They need to be able to earn more money than they do. They need to be able to have a whole lot more respect than we tend to give them.

I think if we start with that, then add to it what I really believe is going to be revolutionary but not yet well understood, information technology. Internet Technology is going to play a role.

We know one thing for sure—it's a terrific motivator of youngsters.

But we have to go the next step beyond that by learning how really to share what we know about learning, how to make it exciting through both the use of information technology and also, as I said several times, make it a really hands-on, discovery-based kind of learning.

There's nothing new in what I'm saying, but there's also nothing that is more important than motivating this nation to straighten up its act in K through 12 systems.

Dr. Schmidt. The interesting statistic is that half of America's teenagers are online and the other half use video games of one kind or another.

So, in fact, the infrastructure is largely available. But it's used for recreation.

Spend some time in a chat room if you want to see a new kind of recreation, instead of being used for these purposes.

This is a content problem.

Representative Etheridge. Mr. Chairman, I know my time is up. But having spent eight years as a state superintendent of schools, the reason I ask that question.

The other part of it is, for those who are out there, we need to have staff development for our teachers. You talked about one percent. And until they become engaged and really are comfortable, it's going to be hard to get it in that classroom and integrated into the curriculum that is so badly needed in our public schools.

Senator Mack. All right. Thank you. Thank you for those comments. And again, thank you for the panel. Very interesting and thought-provoking.

So thank you for being with us.

Dr. Vest. Thank you.

Senator Mack. I'm going to ask Senator Bennett to chair the final panel. I will be away for a few minutes and then come back.

Senator Bennett (presiding). The new panel is gathering. Let me take advantage of the time to comment to Ms. Eshoo.

As chairman of the Senate Committee on the Year 2000 Technology Problem, I can assure you that the piracy problem is very real with respect to Y2K.

It is primarily in the former Soviet Union and the countries and provinces that made up that political entity. And the problem is compounded by the fact that the pirated software, unlike the comments from the panel who are PC experts, applies primarily to what is referred to in the industry as Big Iron.

That is, the very large mainframe computers, many of whom were themselves pirated, either physically or by design.

That's why I have a great fear that one of the biggest parts of the world that will have serious Y2K problems will be eastern Europe and those countries that were part of the former Soviet Union.

They duplicated the IBM 360 and 370 series. We've moved beyond that in this country. They're still running things on those older computers that are very susceptible to Y2K and they're running pirated software.

The new government may not like it and it's not a government policy, but it's part of the inertia of the residue of the cold war.

So I couldn't resist sharing that with you.

Representative Eshoo. I appreciate it, Mr. Chairman. And I can't help but think that maybe the new paradigm will be kind of modeled on the past where we had nuclear disarmament treaties. We may be engaging in the future in treaties that deal with this whole area, and the better use of the technology.

But I appreciate what you said. Thank you very much.

Senator Bennett. All right. We have our panel settled now. We welcome you all.

We have Ariel Kleckner, who is the Founder and COO of RedGorilla.com.

We'll all be interested to find out what that is.

(Laughter.)

John F. Keane, who is President, CEO and Chairman of the Board of Keane, Incorporated.

Michael J. Durham, President and CEO of the SABRE Group.

And Gene Hoffman, Founder and President and CEO of EMusic.com.

So we go from airlines to music to gorillas.

Mr. Keane, you will tell us what you do. We appreciate very much your being here and Ms. Kleckner, we will start with you.

PANEL IV

STATEMENT OF ARIEL KLECKNER, PRESIDENT, AND COO, REDGORILLA.COM

Ms. Kleckner. Mr. Chairman and Members of the Committee, thank you for the opportunity to testify today and to Ms. Eshoo for her able representation of our District.

My name is Ariel Kleckner. I am Founder and COO and President of RedGorilla.com.

RedGorilla is an Internet start-up company that I founded with three colleagues of mine earlier this year. We are headquartered in San Francisco and we provide free and low-cost Web-based financial services for small businesses and independent consultants.

We are looking forward to the successful launch of our new product in the fall of this year.

I would like to talk to you today about my experiences as an entrepreneur and life in general in Silicon Valley and about some of the specific challenges RedGorilla has faced that point to larger issues within the high-tech industry.

My academic background, like that of many of my peers in Silicon Valley, is not in computer science.

I have a bachelors and masters degree in geochemistry and was in fact primed to go into a career in the oil industry after I completed my studies.

Instead, I opted to enter the world of high-tech, where the opportunities and excitement were and continue to be.

I haven't looked back since.

The roundabout way that I arrived in the technology industry is not unusual. Though things are changing now, when I was in college, students were not getting degrees in things like systems administration or web design.

In fact, most everyone I know in the computer industry arrived there by chance or by happenstance.

Different paths brought us to high tech, but we were all lured by the unique opportunity to pursue the challenging, fast-changing, entrepreneurial and lucrative careers that Silicon Valley has to offer.

We founded RedGorilla several months ago with a good idea and a team of four people with enough enthusiasm, energy and experience to turn this idea into a business.

This four-person management team has and will continue to be our key differentiator. There are a lot of people with a lot of good ideas in Silicon Valley, but the management team is what truly differentiates the success stories from the pipedreams. The management team is what allows young companies to attract investors, excitement, and key employees.

Once we had our management team in place, the real work began.

We quickly ran into the greatest challenge facing high-tech companies today—attracting and retaining talented employees.

At present, there are more technical jobs in Silicon Valley than there are technically-trained people to fill them. This has been the greatest concern of mine as the president of a young company, and a substantial portion of my time has been devoted to assembling a talented technical team.

How was I able to attract to individuals I needed?

By offering them stock options in our company. Stock options are a key factor in the ability of young technology companies like RedGorilla to employ a talented work force when salary dollars are scarce.

In fact, enabling employee ownership through stock options has been a cornerstone for emerging growth companies in industries like biotech, Internet, and software.

It has given employees a stake in the success of their firms and that in turn fuels America's entrepreneurial culture.

Stock options are also a critical means by which emerging technology companies and venture capital firms secure competent people to serve on their boards of directors.

Again, attracting such directors would be impossible if we could not rely on stock options for compensation. And providing stock compensation has the obvious benefit of giving directors the greatest incentive to seeing the companies through to success.

Despite the benefits of granting stock options to employees and directors, a threat to this practice has emerged in the form of a proposal from the Financial Accounting Standards Board, or FASB.

Financial Accounting Standard Board could issue two rulings this year that will have a significantly adverse impact on the ability of technology companies to use stock compensation.

First, FASB has proposed that if a company reprices its stock options and then sees a rise in the price of the stock, the increase in the value of these options must be deducted from the company's earnings.

The result—issuing stock options will become prohibitively expensive.

Second, FASB has issued a proposal that would require the expensing of options granted to members of a board of directors, meaning that the value of the options would have to be deducted from the firm's profits.

The technology industry is engaging FASB constructively on these issues. We are encouraging them to slow down and take a more comprehensive look at the entire accounting treatment of intangible assets.

Unlike the traditional economy, today's technology-driven economy is built not on assets, not on physical products, but on mindshare.

Even the most profitable of Internet companies often have little more than lines of computer code to call their own. But financial incentives exist to allow entrepreneurs to take the risks necessary to get started in this industry.

I am hopeful that we will reach an understanding on these issues and that we can work towards keeping these incentives intact.

So now that RedGorilla's technical team is in place, we've begun to build our site.

Our engineers and systems architects will spend this summer working through the design and construction of RedGorilla's back-end technology. At the same time, we are also working with the graphic designers and user interface experts that will design the front-end, with

the people that will market our new service to small businesses, and with the team that will work to drive traffic to our website and acquire registered and loyal users of RedGorilla's services once we have launched.

The ultimate goal of these efforts is to drive traffic to websites. And as the public's trust in the security of the Internet increases, all of this traffic will drive online commerce—e-commerce.

E-commerce represents unprecedented opportunities for innovation and economic growth. It allows a company like RedGorilla.com to compete globally and to take on large corporations.

What does this mean in terms of policy?

Simply that the potential and benefits of the Internet economy and of e-commerce are limitless—if they are permitted to grow.

I believe that government and industry must work together to ensure that today's fast-changing competitive environment is not choked by excessive regulation or taxation so that the Internet economy can grow with America in the lead.

The rapid change, advancement, and innovation that began in Silicon Valley are spreading at Internet speed to the rest of our country and around the world. And with these changes come the promise of enhanced prosperity and a better quality of life.

We have only seen the beginning.

Thank you.

[The prepared statement of Ms. Kleckner appears in the Submissions for the Record.]

Senator Bennett. Thank you very much.

Mr. Keane?

**STATEMENT OF JOHN F. KEANE, PRESIDENT,
CEO AND CHAIRMAN OF THE BOARD, KEANE, INC.**

Mr. Keane. Good morning, Mr. Chairman, and Members of the Committee.

Thank you for the opportunity to tell you a little bit about the information technology services industry and to outline some of the ways that I believe government can help.

Information technology services companies design and implement the technology that helps organizations be more successful.

They are the people, the people that integrate the computers, telecommunications, software products, and business processes that make them work together.

They make a bank's ATM work. They enable Charles Schwab to trade stocks. And their work allows Amazon.com to function on the Internet.

I'm Founder and CEO of Keane, Incorporated, a software services company headquartered in Boston, with operations throughout the United States, Canada and the United Kingdom.

Keane helps organizations plan, build and manage applications software. Our clients include Fortune 2000 companies, government agencies, and health care organizations.

I started Keane in 1965. And like many other start-up technology companies, began with few tangible resources.

Mainly myself and a telephone.

I located in an office over a doughnut shop in Hingham, Massachusetts. I was young and I had the desire to build a new business.

I knew I could help companies apply new information technology to their business operations much more effectively than they could do it themselves.

Today, Keane is a company with over one billion dollars in annual revenues and we have 12,000 employees. And we are still applying new technology to our clients' operations and improving their business processes.

But we are doing it on a much larger scale and much more effectively than we did in 1965.

Information technology services companies are making an enormous contribution to the American economy.

For example, in each of the last five years, an average of 7200 such companies have been started and during this time, over 380,000 new jobs have been created. And because of these efforts, the United States is clearly leading the world in the use of computer technology.

According to a recent IDC report, almost 49 percent of the world-wide base of PCs at home and education is located in the United States. And 47 percent of world-wide spending on Internet Technology software and services is done in the United States.

And United States companies clearly dominate the market for computer hardware, software, and services.

A key question for all of us is how does the United States maintain this leadership in a global environment that is becoming increasingly more competitive and which is changing very rapidly?

In the few minutes that I have this morning, I'd like to focus on three things that I believe contribute to our industry's success to date and which are going to continue to be important to success in the future.

They are, one, open markets, free and fair competition.

Two, an educated and flexible pool of labor.

And three, the protection of intellectual property.

First, open markets.

Virtually every information company starts with a standing start just as Keane did. New ideas, creativity, but little in the way of financial resources.

This is the definition of the entrepreneur. It is important to note that many new businesses fail. However, succeed and a few succeed very big.

And these are the companies that permanently change the way we do things.

For the optimum benefit of society, it is essential that winners be determined by meritocracy, in a system based on open and fair competition.

Contrary to some people's opinion, it is the small companies that characterize the information technology industry. All of us are aware of the Microsofts and the Oracles because they're successful, just at the Mark McGwires and the Sammy Sosas because of their success.

Where it is the farm system that makes baseball, it is the emerging small businesses that give our industry its vitality.

In my home state of Massachusetts, we have over 2500 information technology companies, employing 125,000 people and generating eight billion dollars in annual revenues.

About 75 percent of these companies employ fewer than 25 people.

Public policy should recognize the importance of and support the needs of these companies.

The first principle, as it is in the Hippocratic Oath, is do no harm. We cannot strangle America's high-tech innovation with regulations, taxation and oversight. Workforce, workplace, and industry legislation must be minimized for this industry to flourish.

Taxes, such as the so-called Internet tax, can have a major dampening effect on the pace of innovation required to maintain our leadership position in a global market place.

Constant government oversight will have a similar negative impact on high-tech businesses whose existence depends on their ability to respond to market dynamics, unfettered by bureaucratic obstacles.

Second, an educated and flexible pool of labor.

Senator Bennett. Could I ask you to summarize each of these a bit? Our time is going by.

Mr. Keane. Okay. Information technology requires an educated workforce. And because of rapid changes in technology, there's a major shortage of labor.

Policies should facilitate the reaching outside of our national borders to bring in educated and skilled personnel.

America has always been the land of opportunity and overseas skills can contribute significantly to the continued development of our industry.

Third, the protection of intellectual property.

Intellect content is the basis of the information age. And conceptually, this is very different from the Industrial Age, where tangible property was king.

Copyright and patent laws need review and updating to accommodate this new technology growth within our own country and globally.

I would like to leave you with a quote. It goes something like this.

It is not the strongest, nor even the most intelligent that survives. It is the most adaptable.

The author—Charles Darwin. His thoughts were directed at the evolution and survival of living species and is extraordinarily relevant to the development and success of the American species and our way of life.

Thank you.

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

Senator Bennett. Thank you very much.

Mr. Durham?

STATEMENT OF MICHAEL J. DURHAM, PRESIDENT AND CEO, THE SABRE GROUP, INC.

Mr. Durham. Thank you, Senator.

Good morning to yourself and to the other Members of the panel.

It's a pleasure to be here this morning to talk about the high technology industry and to touch on some of the key challenges that are facing our industry and our company in the months and years ahead.

We're also very happy to be able to participate in the product demonstrations tomorrow. We will be able to demo some of the neat things that we're working on in our laboratories to make travel easier, more exciting, and considerably more fun to plan and take place in the 21st century.

SABRE is a global, diversified information technology services company with two principal lines of business—electronic travel distribution and information technology services.

We have over 20 years experience in distributing travel. We were online before online was cool.

And in fact, almost a third of the world's air travel reservations today, almost \$70 billion worth of airline tickets were effected over the SABRE network in 1998.

SABRE also operates the world's largest online Internet travel site, called Travelocity.com.

Travelocity.com has over six million members in now only its third year of existence, and it's growing at a very attractive 15 percent growth rate.

And that's 15 percent per month, not per annum.

So a very exciting and growing part of our business is our Internet-based travel distribution business.

In the solutions area, we provide a broad array of information technology services principally to the airline industry, enabling those carriers such as U.S. Airways, American Airlines, Gulf Air, Aerolineas, Argentinas, and Canadian Airlines to provide the kind of services to their customers that are differentiating themselves from their competitors.

SABRE, like many companies in the airline industry, is faced with both good news and bad news.

There is a tremendous demand for our products and services globally. In fact, we do business in over 108 countries around the world.

The bad news in all of that is that there are a number of obstacles to our growing our business as rapidly and as successfully as we would like to. I think those obstacles can be summed up in the context of access—access to skilled workers, access to consumers, and access to markets.

Let me briefly deal with each one of those.

Sitting through the testimony this morning, I've heard a lot of discussion about H1B visas and the challenge that the cap on those visas provides to technology companies trying to hire skilled workers.

I won't rehash what has been stated before. But I think it's important for the government to realize a couple of facts.

One is that although the number of visas available to U.S. companies almost doubled in 1999 versus 1998, we ran out of visas earlier in the fiscal year than we did in 1998.

The second factor is that there is a body of work to be accomplished. There is demand for the products and services that are created by these skilled workers.

It's going to get done.

I think the question for the U.S. Congress is is that work going to get done by United States companies with people who are working, living, contributing to their communities, paying taxes in the United States, or is it going to get done offshore, because the work will get done one place or the other.

There isn't in my knowledge a single major software developing company that does not have software development facilities overseas, in part because of the difficulty of getting U.S. workers.

So I think it's not just an issue of education, but that is a huge part of it. But in fact, it's a question of the economic dynamism of the U.S. economy and particularly in this industry.

A lot of good interim solutions have been proposed. Raising the cap is an obvious one. Providing exemptions for the kinds of workers that are in short supply in this country I think is another one.

I think working cooperatively with the Congress, we can find a solution to this problem which allows our industry to grow and at the same time, meets the needs of other constituencies.

The other access question we have is to customers.

The Internet provides a whole new way in which various service and product providers can control access of service providers to the ultimate customers.

There's a tremendous amount of change going on in the market place right now. I think it's very difficult to forecast, frankly, where all of the various trends about distribution are going to sort out.

But one thing we know for sure from our heritage as being a travel distribution company—that shelf space, particularly shelf space first line, first screen, eye-level shelf, these things always have been key issues in retail distribution.

They are no less key because the space is on a 13 by 15 computer screen. And it's important if it's the corner of an important shopping mall or if it's the eye-level space in a large supermarket.

If individual companies have the ability to control access through whatever reason, to that key selling space, we will not see the kind of growth and competitive forces brought to bear on growing electronic commerce in this country, or globally.

And finally is access to worldwide markets.

The United States market, particularly in air travel, is intensely competitive, as the Congress has taken up many hearings along those subjects over the course of the years.

The same is less true internationally.

International carriers are frequently in the position to control access to their markets and work cooperatively with IT service providers in which they are a part owner and deny access to U.S. companies on an equal footing.

Department of Transportation, the U.S. Trade Representative, and in some instances, Department of Justice, have all been involved in helping us fight those competitive battles overseas. Over 15 Members of Congress have written letters to the Department of Transportation regarding these issues on our behalf and on behalf of other U.S.-based computer companies.

I would just ask that the Congress continue its degree of diligence and foresight in helping us maintain a strong U.S. presence in these international markets.

Finally, I'd just like to conclude with a commendation. I think it's tremendous that the Congress is taking the efforts that it is taking to become educated on these kinds of issues.

Four years ago, I was a financial executive. I knew relatively little about information technology. And I know what kind of a steep learning curve there is to come up that growth curve, particularly a person from my generation who didn't grow up with video games and associated other technologies.

I always thought that the microwave oven was my technology.
(Laughter.)

I think it's great that you're doing that and I think it's tremendously important for you to fulfill your mission in the Congress.

Thank you very much for letting us participate.

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

Senator Bennett. Thank you.
Mr. Hoffman?

**STATEMENT OF GENE HOFFMAN,
PRESIDENT AND CEO, EMUSIC.COM**

Mr. Hoffman. Good morning, Mr. Chairman, Members of the Committee.

My name is Gene Hoffman. I'm the Founder, President and CEO of EMusic.com in Redwood City.

I'll try to keep my comments brief and see if we can get ourselves back on time.

It's a distinct pleasure to be here in front of you today, especially at my age. And we'll talk about that a little bit more in a second.

But this is really ground-breaking sort of Summit, bringing technology leaders like my peers and myself, in front of your esteemed colleagues and Congress is exactly the right thing to be doing.

Getting an understanding of what the issues are is the best thing that Congress can be doing at this point in time.

I'm going to summarize some key issues from my written testimony, my oral testimony. I'll deviate just a little bit, but I'll come back to it as I go through.

I'd like to comment on something that Mr. Barksdale said yesterday. I'd like to thank the Federal Government for making an investment before I was born in technology that has given me the opportunity to become something above and beyond what most entrepreneurs can do.

The key thing that Internet and high technology and the Federal Government's investment in that has done is given people like myself a significantly lower barrier to entry.

Seed capital, the ability to take an idea from an idea to a company and reach an international audience in sales and marketing strength is now something that you can do easily.

And that is something that the Federal Government is specifically responsible for with their funding of DARPA.

There are two fundamental items in the success of Internet companies. And I think those are making things easier and making things less expensive.

I want to go back to something that Mr. Greenspan said yesterday.

Quoting—Intermediate production and distribution processes so essential in information quality control rapport, are being bypassed and eventually eliminated.

The increasing ubiquitousness of Internet web sites is promising to significantly alter the way large parts of our distribution system are managed.

The Chairman continues to describe the fact that basically the infrastructure is changing and the capital can be reinvested in other things—disintermediation—and gentlemen and ladies, disintermediation is what my company is about.

What we do is take out or give another opportunity beyond CDs and vinyl and cassettes and truck retail stores for people to buy music.

We sell music after licensing it directly from artists and labels to customers for 99 cents a song or \$8.99 an album. And we are truly virtual business, one of the first truly virtual businesses to come onto the market.

We're always in stock. We have no real cost of inventory. And we fulfill directly over the Internet.

It's instant gratification of a product where, shall we say, inefficient distribution system has been the norm in the music business.

The interesting thing that our company allows you to do is download music directly to computer and basically use that at home or in your dorm room as a college kid and play music back either on your computer, basically making your computer a home stereo, or on portable devices like the diamond rio.

These devices of the future here is that music will be an assumed thing in your life. Music is going to be so much easier to use.

In fact, it might be possible that the music industry is \$100 billion business trapped in a \$40 billion infrastructure.

While this transformation is truly helping to fuel the economy, making things far more efficient for both customers, driving the cost to the customer down, making it easier to use music, it's also driving up the efficiency and the money that can be made for artists and labels.

And that I think is the true value of the Internet economy moving forward.

Interestingly, though, there are true public policy issues that arise from this. And there are basically two major categories—I would say copyright protection and additionally, fostering open standards.

Let me talk about both of those quickly.

When looking at copyright protection, please make sure not to favor either camp in the business here.

Basically, there are two. There are old media companies and new media companies. And neither should be favored in copyright legislation.

Currently, there is an open and level playing field and that's the way the business should remain. The market will make decisions in this case.

Quickly, there's also open standards in the birth of the networked economy.

And what I mean by this is open standards allow other companies to leverage off the work of a third party. Basically we can assume that the infrastructure is there. We can assume that the Internet service provider and the PC developer, because those open architectures are there, we can develop a new application for downloadable music on top of that.

It's kind of the one and one equals three concept. One person with e-mail is not interesting, but two are very.

The other thing is open standards from a consumer point of view are very, very important. It allows the consumer to know that technology

has moved forward over time and that no one entity is in control of the standards or the motion of technology moving forward.

And quickly, to close, and my apologies for running over, I would challenge you that keeping open standards fostered in our economy will continue to create more and younger entrepreneurs like myself.

In fact, I would venture to say that the people on the conference call from Carnegie-Mellon and the high schools are my competitors soon—not even next year, but next week.

And the reason is open standards will allow them to be able to leverage off all the other work that myself and my peers here today do in this new economy.

Thank you.

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

Senator Bennett. Thank you. And with that, we'll hear from one of your competitors. We will go to the Seaholm High School for the next question.

Question: Senator, a couple of points of clarification.

We were requested by Senator Abraham's office to prepare a question for the Secretary of Education. Although he may not be present, the Members of the Committee should hear the concerns that this question addresses.

Senator Bennett. Absolutely. And we will forward the question to Secretary Riley.

Go ahead.

Question: As a professional educator—do you want my 25 cents worth on this?

Senator Bennett. Absolutely.

Mr. Williams. Hello, my name is Kyle Williams.

We at Birmingham Seaholm have recognized that today's technological society is putting increasing demands on our energy resources and have implemented a curriculum on renewable energy.

Does the Department of Education have a plan for a comprehensive curriculum for renewable energy for K through 12 in the public schools?

Senator Bennett. We will forward that question to Secretary Riley.

Let me comment briefly that, traditionally, the Federal Government has never involved itself directly in curriculum. The Federal Government has allowed curriculum choices to be made at the local level.

There would be a very serious debate about the Federal Government drawing up a specific curriculum and then mandating that it be taught in every school.

But we will see to it that Secretary Riley gives you a direct answer.

While we have you, do you have a question for any member of this panel?

[Secretary Riley's response to the above question appears in the Submissions for the Record.]

Question: No.

Senator Bennett. Okay. Thank you very much.

Question: But we have some comments.

Senator Bennett. Well, we'll give you a minute for a comment or two. Go ahead.

You've waited patiently. You deserve that.

Question: We at Seaholm have integrated our ninth grade universal science with technology. Eighty-five to ninety percent of our incoming ninth graders take universal science and they are exposed to technology—electricity, mechanical systems, aerodynamics, and so forth.

It's hands-on.

Also, we have integrated the mathematics and technology. Specifically in the area of SPC—statistical process control in manufacturing.

Third, the program at Seaholm is based on real industrial practices. The program is supported primarily by people in industry.

This fall, I will have somewhere between 30 to 34 students in 14 to 16 universities preparing for engineering or computer science, including three at MIT.

This practice has been going on for the last 15 years. So we're quite proud of that and wanted to get our two cents worth in.

Senator Bennett. Thank you. I think you should be proud of that and we'll see to it that the president of MIT knows which farm system he's getting some of his best players from.

Thank you.

I should make it clear to the panel that the exodus of the Members of the House has nothing to do with your testimony. A vote has been called in the House and they've had to go over to the House floor to answer that rollcall.

Senator Mack. It's just one indication of how far we are behind the electronic age.

They, by the way, have cards where they walk into the House floor, put those cards in a receiver, if you will, and vote electronically.

It does make sense that they could have done that right here if they would allow that kind of thing. But the rules of the House don't permit it.

But, anyway —

Ms. Kleckner. Perhaps we could develop something for you.

(Laughter.)

Senator Bennett. The issue is not the technology.

Senator Robb. It's the culture.

(Laughter.)

Senator Bennett. The fear is that the Senator might be indisposed and a member of his staff would then take the card and run amok.

So, at least in our Chamber, we must physically be in the Chamber where we can be recognized.

Senator Mack. If I may just add.

Senator Bennett. Sure.

Senator Mack. In a sense, that's exactly the conflict that's taking place in society today, about how to deal with the technologies that are available to us, but still thinking, if you will, in the old age.

Senator Bennett. And it's also a question of identity. Maybe we need a digital signature.

Not to tell tales out of school, but I did know of one Congressman who, towards the end of his final term, was not, shall we say, completely aware of his surroundings at all times.

His staff would accompany him on the floor and hold his hand as he would put his card in. And the staff would be known to determine whether he would be voting aye or nay.

So it happens even when you're physically in the chamber sometimes. But it's a question of identity.

You have the best saved till last. We'll go to Senator Robb.

Senator Robb. Thank you, Mr. Chairman.

Let me just comment on the discussion or the colloquy that you and Senator Mack were just engaging in with respect to our ability to use technology.

It has been a frustration of mine for the 11 years that I have been in the Senate pushing the government to use the technology that was developed here at home in a variety of applications and even with at least one of our guests here this morning and with many others.

We continue to do it, but glacial would be an overstatement of my own assessment of the pace with which we have utilized the technology that we have developed and in many cases, some of our competitors overseas have taken advantage of our very deliberate approach to technology development.

Let me just ask a general question. And I think, Mr. Hoffman, you seem to be responding to this, but I want to get a brief comment from the others, if I may.

And that has to do with what is the appropriate role in government. You've each alluded to some aspects of it.

But I think with respect to being able to ensure equal access and fair competition with respect to some of the concerns that we have and that are current.

And secondly, with respect to fair competition for U.S. companies operating in overseas markets.

Would anybody like to take a shot at that?

Mr. Durham. As far as U.S. companies working overseas, we at SABRE, it has actually been the test case in the Department of Justice's efforts with positive comity with their counterparts in the European Union (EU).

I think we'd have to call that experiment, that getting Economic Community(EC), in essence, to be responsible for antitrust investigations occurring in their jurisdiction, even if they are affecting U.S. companies, and vice-versa for the Department of Justice here, that that experiment is a somewhat mixed success at best at this point.

That we've got relatively little action out of the EC. We were able on a bilateral basis to reach an agreement with the parties with whom they were investigating.

But after a very long and prolonged effort, there was very little that came out of the EC that protected the interests of U.S. companies.

So I would take that experience as yet an indicator that while, in concept, the positive comity approach is, I think, a good one, that the U.S. administrative branch and, as oversight, the congressional branch, needs to keep a very active hand in protecting U.S. companies' access to foreign markets.

It's not something that we're yet at the point where we can comfortably cede that to regulatory authorities in other international jurisdictions.

Senator Robb. With respect to the fairness and equal access question, does anybody disagree with Mr. Hoffman with respect to the open access architecture that was suggested?

Mr. Keane. I think open architecture is absolutely essential.

Perhaps the most important concept in our industrial revolution is the concept of the replaceable spare part. That was Remington Arms.

Originally, if you had something wrong with a rifle, you went to a rifle smith. It may take two or three weeks to hand-customize the trigger mechanism.

And they came up with the assumption that every rifle, every part should fit in every rifle.

Well, if we didn't have that as a concept, we couldn't put together television sets, airplanes, cars, computers, and so forth.

Conceptually, when you look at the Internet and you look at the number of parts, hardware, software, telecommunications, business processes and so forth, they are exactly like the concept—and you want them to be replaceable spare parts.

That's what an open system is all about. So that you need to be working on only one part and you know it's going to plug in and work with everything else.

So you continually build a platform and advance from that platform not having to redo an awful lot.

Senator Robb. Thank you.

Senator Bennett. Senator Mack, we welcome you back.

Senator Mack. Thank you. And I apologize to Ms. Kleckner and Mr. Keane for not being here for your presentations. I had something that I had to run back to the office for.

But I was struck by a couple of comments that were made by Mr. Hoffman and Mr. Durham. The one about it's going to get some somewhere—if we as a political body decide not to respond to your needs with respect to an educated work force and allow people to come in to fill those positions, then we're not only shortchanging you, but we're shortchanging the entire U.S. economy.

When I think about this, one of the strengths of the U.S. economy has been the willingness to have open trade in many areas. We certainly believe in the free flow of capital.

This concept that somehow or another, we should control labor also seems to be somewhat antiquated.

I think you're experiencing some of the thinking about the old economic ways.

I was thinking earlier this morning as most of us were taught economics as being a closed economy. Every time that the economists talked to us, or our instructors talked to us, it was if it only took place in the United States.

Years and years ago, that was accurate. But not today.

So I think that that was a very helpful statement that you made.

I'm fascinated by what you're doing. I don't understand it well enough and I hate to admit that. But I don't understand it well enough.

And to prove how little I understand, the idea of—let's see—open standards, help me to relate to the copyright issue in open standards.

Mr. Hoffman. Certainly.

Senator Mack. They're not the same thing, are they? Can we deal with the issue of copyrights and at the same time remain committed to open standards?

Mr. Hoffman. I would venture to say that that's currently what the status is in the law. The law is very clear about what copyright infringement is, what copyright infringement, for those who aren't making commercial benefit out of it, the Net Act.

I think our copyright legislation as it exists today is very strong. It clearly has been effective in the software business.

And as other businesses are now, shall we say, coming into the crosswinds of the software business—the music business, soon video and other truly intellectual property-based businesses—I think a lot of the rules and a lot of the lessons learned in the software business are going to apply.

The point I am trying to make about open standards is that, right now, there are somewhere between seven and eleven consumer electronics manufacturers making MP3-capable devices.

The value of this to the consumer is when you buy music in MP3 format, you know that you can move it forward. It's just like buying music on a CD.

The issue gets to be that as you close standards down, you somewhat slow the adoption rates and the economic capabilities of what you can generate from them.

It becomes the interchangeable part issue.

If you have to go back to one single entity and say, Mr. Entity, I'd like to be able to do this or that, then you don't truly have that open competition and you don't have the additional products which we haven't yet foreseen.

The neat thing about what we're doing here specifically is you start talking about using music as I assume I have my entire music collection here in my pocket.

Now I'm worried about, gee, I'm in the blues mood or the jazz mood. And there's a whole other step of obfuscation above that that has yet to be seen in the market place.

Keeping those things open and moving those things forward in an open way is a strong way to further invigorate the economy as we move

into the disintermediation of music, the disintermediation of video, and all the other intellectual property, if you will, that is currently not in the true software business.

Senator Mack. If you will allow me just to —

Senator Bennett. Yes.

Senator Mack. Because, again, this is interesting.

I think one of the images that's been created about the idea of downloading music on your computer is that, somehow or another, you're not providing the maker of that music with proper compensation.

And so help me through that.

Mr. Hoffman. Well, I can tell you that, today, we sell downloadable music in an open format to customers and they buy it. They pay 99 cents a song.

They mostly buy albums, of all things. We always thought that they'd spend only 99 cents and choose their favorite songs. But they actually buy nine dollar albums because it's far more convenient for them to.

And given the chance, most customers would rather do the right thing.

Senator Mack. Okay. So you're saying that when someone goes through you, the mechanism in fact works.

Mr. Hoffman. Yes.

Senator Mack. But I'm thinking, are there people out there who in fact are able to find music.

Mr. Hoffman. Yes, there are.

Senator Mack. And to download it and to —

Mr. Keane. This is a real issue. Let me give you a personal example.

I have three children. They're all grown now. I think they're pretty ethical and so forth.

One Christmas, one of my sons gave my daughter a whole package of music tapes that he had copied and thought that he had given her something absolutely wonderful—no concept of copyright law.

Now that's going on all over America with all of our youth.

However, then you heard earlier on the prior panel about piracy laws.

What's the difference between that and going to your PC and making a copy of WordPerfect or Microsoft '95, and give it to your officemate?

That has been happening all over the country.

The same thing now is true with software as with music. And other intellectual property. It is much different than physical things. We have to look at things in a much different way than we've ever looked at them before.

Mr. Hoffman. I think that Mr. Keane makes my point for me in some ways.

Two and five copies of software installed or pirated. But as you see, the software business has been more effective and not less effective, moving forward in the digital age, in policing copyright.

In fact, the real value of the network is, now, instead of having flea markets all over the world selling, shall we say, bootleg copies of CDs, the music industry can put an enforcement team, a small enforcement team that can be highly effective online because for anyone to be effective at distributing illegal copies of music, means that they're easily findable in the world community.

Instead of it being from here to New Jersey, where there's a flea market operator selling thousands of dollars worth of goods, it's now from here to my network connection when I go out to the network and find out, hey, this site is doing something wrong and this site is doing something wrong.

And I can shut them down far easier than I've ever been able to in the past.

It's really an enforcement issue. The good thing here is, and I commend the Congress people right here for really enabling the enforcement and the law to be clear, concise and effective in being able to police that.

The issue is, using technology to try to stop that is a dangerous and slippery slope.

Senator Bennett. Senator Robb, you wanted to follow up in the second round?

Senator Robb. Just very briefly, Mr. Chairman, and I'm running late, so I will be brief.

First, a question to Ms. Kleckner.

You talked about getting your RedGorilla site up and operating. In your term, this is an observance of the market, not in terms of your own operation, but the concept of patient capital as opposed to footloose capital that would move with the operations that the business is in, the technology business.

Is this typical or is this atypical with respect to the movement of capital, with respect to the operations of technology businesses?

Ms. Kleckner. Well, I think the Internet economy has shattered a lot of old paradigms of what we consider patient capital versus kind of footloose, fancy-free investments.

Senator Robb. It's introduced a lot of people to IPOs, too.

Ms. Kleckner. That's certainly true. And it's unprecedented. I don't think any of us can really foresee the outcome of this in the market place and otherwise five years from now, ten years from now.

So I don't have a good answer for that question.

What I do know is as a company, we looked at the Internet and the market place and we saw a hole in the market place and moved in.

Understandably, that may appear very opportunistic and if that's what it is, that's what it is.

But I guess that's business.

Mr. Keane. I might add in response to that, something is going on in the economy that has never happened before.

I'm from the Boston area. There's a lot of technology companies. Something called Angels. And if you know what an Angel is—it's happening in Silicon Valley and it's happening in all pockets of technology.

And Angels now are mostly people who have had software companies, maybe have sold their software companies, and they're still almost in their 20s or 30s—they're still young and they still don't want to be just investors. They want to be investors and they want to contribute. They want to consult. They want to use their past experience.

And there's a group called the Common Angels. We meet once a month, overlooking Boston Common—hence, the Common Angels. We review four Internet companies every month. That's month-after-month.

And they are the ones that are investing and they're the ones that are also advising.

So it's a whole new infrastructure that is being set up.

Senator Robb. One brief follow-up question with respect to Angels.

Some of those Angels were able to become Angels because of stock options. And that's always an essential element in any discussion of the technology field in particular.

Is the participation in stock options as widespread in the nonexecutive level as it is in the executive level? And are the fortunes of those who may be smaller participants disproportionately influenced by downturns as opposed to the presumption that stock prices are going to continue to rise?

Mr. Keane. I would like to see some statistics, but there are thousands of millionaires at Microsoft and most small companies start with a very capable group of individuals, all of which have stock options and it's an American phenomenon in technology today.

But I might add, on the other side of the coin, those young people work 24 hours a day and if there were 40 hours in a day, they'd be working 40 hours a day.

It really is sweat equity in the highest level. And they create things that just they or everyone else just couldn't believe could ever be created.

So the benefits of it is absolutely enormous. But the power of driving those young people is absolutely enormous, too.

Senator Robb. I thank you for your testimony. I thank you, Mr. Chairman, and Mr. Chairman, for participating.

And I'd like leave with telling Mr. Durham that I have indeed visited the sites that we've talked about and I found it most satisfactory in terms of providing that additional information.

Mr. Durham. Great. Thank you very much, Senator.

Senator Bennett. We want to thank the panel. We appreciate your being here.

I want to thank the schools. I know that Chairman Mack would join me in that.

Senator Mack. I have one more question.

Senator Bennett. You have one more question.

Senator Mack. If I could.

Senator Bennett. By all means.

Senator Mack. Again, I apologize for coming in late.

This discussion about capital. Mr. Hoffman, you made the comment that—something related to the fact that the barriers are lower today. And I would expect that you experienced the same thing.

I'm not positive. But maybe all of you have done so.

Give me a sense about what is happening out there. What has happened—I'm a former banker. When I started in banking in the mid-1960s, it was a very fixed process.

Many people made the claim even in Wall Street, if you just weren't part of the system, you just couldn't break into the capital markets.

Obviously, that's changed.

Help me through some of the things that have changed. And I guess probably more importantly, what are some of the other things that need to change to expand or to make it easier for people to get into at least requesting capital.

Mr. Hoffman. I think one of the best things that's happened is that the capital markets have become competitive, between Angels, corporate venture capitalists, which is a whole new concept—you've got Lucent, AT&T, Samsung, people like that, huge corporations trying to play in the venture capital game.

It basically gets to a point where the competitive market is almost entrepreneur-favored, and that's a very good thing.

At the end of the day, you have entrepreneurs keeping more of their companies, building stronger companies with a much more diversified investor base, which is also a real value.

The fact that corporate valuations in initial seed stages are that much higher means that you have that much more equity to feel comfortable seeding out to additional investors that don't necessarily bring just capital.

Often, in a later round, you'll go to a strategic investor and allow them to invest a large piece of capital in a way that you wouldn't have in the past been able to do because of the compression, if you will, of that capital structure.

I think the number-one concern for capital structure moving forward and also kind of the overall capitalization, on the capitalization side, raising money, raising money has gotten to be a much easier process. You don't necessarily have to be part of the old-boy network, if you will, to be able to go in and go to Sand Hill or Cambridge and pitch venture capital to raise that fund or pitch bands of Angels, the Common Angels.

I think the most important thing is making sure that we differentiate between AT&T and a high-tech company at the FASB.

I have some very serious concerns even outside of the current stock option issues.

The stock option issues are very serious. I have a very senior board. And as a young individual at 23, a chief executive at a NASDAQ company, my board is extremely senior and I grant them significant option packages to be able to have their time and attention.

And for me to take a direct earnings hit on that is not a very wise move for the future of the economy.

Further, our ability to not really effectively use options to incent outside contractors, which is something that is already now in place in the FASB, is something that ought to be looked at.

I have real concerns that we can't vest options for an outside contractor. I mean, often as a young start-up, we move to a new building

and we've got a phone contractor who's in Silicon Valley and options are the secret sauce of making Silicon Valley move forward.

We can give that phone contractor a thousand shares in options and vest them over three years in the past. That's very attractive. We don't have to pay him a cent.

So that hard-earned start-up capital stays internal.

But now we can't. We have to vest them up front, which adds, shall we say, volatility as we get further on because more shares are available to sell on the market. You don't get the long-term commitment from those people that you really are aiming to get with those stock options.

An important thing to note here. My company, for example, is a 100-percent stock option company. Everyone from the lowest administrative front-desk person to myself and my board are all compensated across the board.

So when we go all night preparing for an important launch and everyone stays, including the administrative staff, that's why.

Also, that FASB comes back in from an accounting point of view when you start talking about pooling and technology write-downs.

I mean, it's a bit arcane, but the issues get to be very significant because, for example, we have exclusive rights to content. But I get no book value from that.

Now I understand that. But moving forward, I can see that that's going to be a real issue.

Further, the periods that I write down these intellectual property rights are just a significant issue. For us to necessarily be blocked—basically, what's occurring in the community right now is there are two sets of earnings. There's what the FASB requires and there's earnings before all the other stuff.

And that's what analysts are starting to look at. They're starting to ignore all these other things. And that's a significant issue because from a public policy point of view, what you're saying is, all this supposed consumer protection that's built into these FASB rules, is slowly but surely being ignored by the market that's supposed to be protected by it in the first place.

Senator Mack. Anybody else?

Ms. Kleckner. Well, I might just go back to another question.

Yes, from the gentleman that is answering our phones to the people sitting on our board of advisors, everyone is receiving stock options.

I can't imagine how we'd be able to run our company at this point any other way.

With the ability to reprice stock options, should a stock price fall, we're still able to protect our employees.

What FASB is proposing now will significantly prohibit our ability to do so.

So we would just ask that Congress examine very closely the issues at hand.

Senator Mack. Thank you very much.

Senator Bennett. Senator Mack sits on the Finance Committee that's concerned about those issues. So your concerns have been well placed here today.

Let me thank you again. I want to thank the schools for their patience and their participation. They added a flavor to this hearing that is not usual in congressional hearings and one that I think was very salutary.

I'm grateful to each of you. Mr. Hoffman, I'll be looking for your product now.

Mr. Hoffman. Thank you.

Senator Bennett. Ms. Kleckner, I'd like to know a little bit more about yours, too.

Mr. Durham, I've long been an admirer of SABRE and what you have accomplished.

And Mr. Keane, I can't let you go without commenting publicly on your work with respect to Y2K audits. You're one of the good guys..

Senator Mack. Is this just a young man with a lot of gray hair?
(Laughter.)

Senator Bennett. As Members of the Senate know, I'm obsessed with Y2K. I've been captivated by it for the last couple of years.

We've tracked the work you've done in Lee County, Florida, and other places where you have exposed, shall we say, less than adequate remediation with a very insightful kind of audit.

So I am impressed by the entire panel and all of you and the skills that you've brought here and your willingness to share those with the Congress.

Thank you very much. The hearing is adjourned.

Senator Mack. Thank you.

(Whereupon, at 12:50 p.m., the hearing was adjourned, to reconvene at 10:00 a.m., on Wednesday, June 16, 1999.)

SUBMISSIONS FOR THE RECORD

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399

Tel 425 882 8080
Fax 425 936 7329
<http://www.microsoft.com/>

For more information
Media Only
Contact: Jennifer Curley
(202) 326-1768



Statement by Bill Gates Chairman and CEO, Microsoft Corporation

Thank you Mr. Chairman and Members of Congress. It is an honor to be here.

Mr. Chairman, I know that we are joined today by a number of students. I'd like to extend my greetings to them -- and also to note how different things are today than when I was in school. Today, students have access to powerful personal computing devices and a sea of information through the Internet that I could only dream of when I was a teenager.

We truly live in an amazing time. The information age is an era of new possibilities for us, for our children, and for the entire nation.

It is the greatest time of innovation and change in history. In less than 25 years we have seen the personal computer evolve from a hobbyists' toy to a tool many Americans can't imagine being without. We have seen its power double every 18 months, its price fall and its importance grow at home, at school and in every office. I know that many of you on this Committee are technology enthusiasts and appreciate this significance of this change.

As we learn more about how the information age is affecting us, the more we understand its central role in creating the remarkable new prosperity in this country today, and in accelerating economic development throughout the world. We are creating a new digital economy for this new information age.

Mr. Chairman, I know that yesterday Chairman Greenspan appeared before this Committee. Last month, he made a very important observation that I'd like to read very briefly. He said: "The newest innovations, which we label information technologies, have begun to alter the manner in which we do business and create value, often in ways not readily foreseeable even five years ago... The breadth of technological advance and its application has engendered a major upward revaluation of business assets, both real and intangible."

I'd like to reinforce Chairman Greenspan's points by telling you about the findings of a major new study of the digital economy carried out by the Business Software Alliance, an organization representing most of the nation's largest software developers. The study will be released tomorrow, and I will ask that, when it is released, its entire contents be entered into the record of this committee.

The results of the BSA study once again confirm that the unexpectedly strong economic growth this country is experiencing can, in large measure, be traced to the vibrant, competitive and fast-growing computer technology industry. This sector has created more new jobs than any other part of the economy. In fact, we can predict today that by the year 2000, the software industry's contribution to the U.S. economy will be greater than the contribution of any other manufacturing industry in America -- an extraordinary achievement for an industry that is less than 30 years old.

Today, America not only sells more cars than Japan. We also lead the world -- by a wide margin -- in software development. Last year this sector grew more than 15%, and is growing at nearly four times the rate of the economy as a whole. The software industry contributed more than a \$13 billion surplus to the U.S. balance of trade, and this will rise to roughly \$20 billion next year. A strong technology sector has spurred the renewal of industries old and new across America.

Moreover, new technology companies are being created every day, and are generating incredible valuations overnight. The slew of recent mergers reminds us just how quickly the landscape of the high tech marketplace is changing. That change will continue. In this industry in particular, the free market is working, and working well.

Mr. Chairman, I believe that in Washington, D.C., there is a term for people who are incredibly interested in public policy. They are known as policy wonks. Well, in my industry, these people are called computer geeks, and I'd have to say that I am one. If you will indulge me for a few moments longer, I'd like to share some of my enthusiasm for what technology will mean for us in the future. I am very optimistic about what computer technology will mean for all of us – and for the students who are joining us today via satellite.

As technologies change, so does our mission at Microsoft. For the past 20 years our vision was of a PC on every desktop and in every home – a tool that anyone could use to get things done. And today, a majority of American businesses and more than half of U.S. households have a PC. Now we are moving into a new era. The merger of telecommunications, computer technologies and consumer electronics with the world of the Internet will create a new universe of intelligent PCs and complimentary devices that will deliver the power of the information age to anyone, anywhere, and anytime.

What this means is that there will be a proliferation of smart, connected devices, from palm-sized digital assistants and "tablet" personal computers to smart TVs and Web-enabled cellphones. All of your files, schedule, address book and everything else you need will automatically be available on each of these. When you're traveling you'll be able to call up your itinerary, book an appointment or view your stock portfolio using the device you have to hand. It will know the information you need, and when and where you need it. Wherever you are, you'll be able to access your own "digital dashboard" – your personal portal to your own secure office desktop – on any PC.

We are working hard to develop software that makes computers even easier to use – next year we aim to spend some \$3 billion on research and development. And one day in the not too distant future, computers will be able to see, listen and speak. At home or in the office, you'll be able to control your PC by talking to it. It will automatically back up your information, update its own software and synchronize itself with your devices on your home network. You'll even have a notepad on your refrigerator that will be up to date and allow you to coordinate with other information at home, at your office or at your children's school.

When Congress is in session, a wireless network will keep you in touch with your office. I don't need to tell the members of this committee how important mobility is as you move between your state or district and the nation's capital. As technology becomes more flexible and more powerful, it can be a tremendous tool in terms of creating efficiency and instant communication.

The PC also holds the potential to make government more efficient and more responsive. We already see the beginning of this with government web sites that offer people a wealth of information and resources. As government increasingly incorporates technology into its operations it will make information flow even more open and efficient. At Microsoft, our use of technology has all but eliminated paper flow, and I can tell you from first-hand experience that's a wonderful thing. Technology also offers an opportunity to get the public more involved and, some day, perhaps, to engage people in a two-way dialogue on the important issues and challenges we face.

The continuing rapid growth in the Internet will help power this information revolution, just as the proliferation of new devices will help make the Internet more useful and accessible to everyone. Five years ago, who would have imagined that people would now be shopping for automobiles, home loans, airline tickets or clothing on the Web? Electronic commerce has increased tenfold in the last few years, making it convenient for people to purchase almost anything, anytime, from anywhere. By 2002, nearly 50 million Americans will be shopping online, spending almost half a trillion dollars on the Web. There is endless speculation about which companies will be successful. The big winner will be consumers. They will see better prices, more choice, more opportunities to do the things they want to do.

As Chairman Greenspan made clear, companies have already seen enormous benefits from computer technology – benefits that are now being multiplied by online commerce. But there is much more to be done. Like helping companies integrate their computing systems and create digital processes to perceive and react to competitive challenges and consumer needs. By doing this, they will be able to extend the gains in productivity that are helping fuel our economic strength today.

But turning this vision of the future into a reality will take another important investment in America – investment in education. We cannot fill all of the jobs being created if we don't make technology a key part of every child's education.

Education in the digital age will offer tremendous promise. Learning will be more student-centered. Teachers, parents and students will work collaboratively, and students will be prepared for a technology workplace with the opportunity to engage in lifelong learning. At Microsoft we call this approach the Connected Learning Community. Taking education into the digital age is a challenge for all of us. Government at all levels, public-private partnerships and philanthropic institutions will play critical roles in preparing today's students for tomorrow's workplace.

Only 14% of teachers currently use the Internet as part of their instruction. We need to make much more progress here. At first, people believed that the Internet was suitable only for quizzes or just learning about technology itself. Today, the educational community knows that the Internet can be a resource for allowing curious minds to learn in new ways – about math, physics, philosophy, in fact about anything.

A New York school superintendent attending one of educational conferences we hold at Microsoft recently explained that the PC and the Internet are encouraging students to do more writing, more reading and less TV watching. As a result, "I don't know" is fast becoming "I don't know yet."

Exciting projects are underway to give students the latest tools for learning. At Microsoft, we are working on a pilot project at 500 schools to provide laptops to each student. The results to date have been amazing in terms of increased learning. Many other companies and organizations are involved in similar efforts, whether providing the latest technology for learning or providing scholarships for math and science excellence.

I've had an opportunity to learn a little about how Birmingham Seaholm High School and Pittsburgh Super Computing Center College are using PC technology. Juniors at Birmingham Seaholm are using computers in a very entrepreneurial fashion – they have built a cookie factory and next year plan to develop a micro robot that will take cookies off the cooling rack. Students in Pittsburgh are doing some great work on improving high speed networking performance and capabilities. These schools are to be commended for the work they've done to use technology as an important tool in improving education.

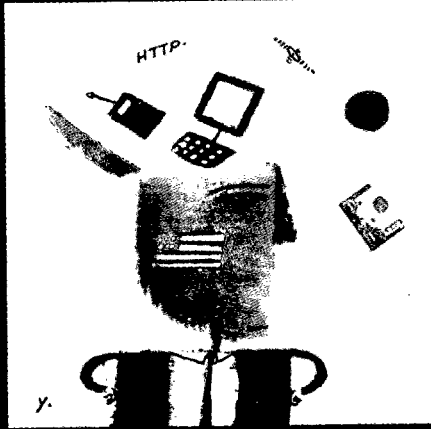
I look forward to talking with some of the students who have been working with PCs. Unlike their parents, most of whom learned about computers in adulthood, the information age is the only age these students have known. Their success will depend on how well we teach them.

When you look at the phenomenal economic growth produced by technology, and the huge increase in demand for highly skilled knowledge workers, it is clear that our ability to continue benefiting from technology will largely depend on how well we educate the next generation to take advantage of this new era.

In closing, let me sum up why I'm excited to be here today and to be part of this hi-tech summit. At Microsoft we make software. We make software for a simple reason – we want to provide tools to make peoples' lives better. At Microsoft we're excited about the future – we're excited about the tremendous economic benefits of our industry, but we're more excited about helping every individual – in business, in schools and in the home – lead more productive lives.

Thank you.

Forecasting a Robust Future



*A study conducted by Nathan Associates
for the Business Software Alliance*

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Executive Summary

The U.S. software industry has emerged as one of the fastest-growing and most vibrant segments of the U.S. economy.

Without question, it is a great success story in modern business history. Sales of software products and services in the United States in 1998 rose 17.8 percent to reach \$140.9 billion, the highest level ever. In addition to sparking dramatic economic growth, the software industry has fueled an information revolution. Consumers today enjoy unprecedented access to information that is changing the way we live and work.

Consider the software industry's record of achievements:

Increasing Rate of Growth

The trend growth rate of industry sales has increased 50 percent. Between 1990 and 1994, sales grew at a continuous rate of 10.5 percent, and since 1994, sales have been growing at a continuous rate of 15.4 percent. In contrast, the Gross Domestic Product of the U.S. economy has been growing 5.4 percent per year since 1994, only about one-third the rate achieved by the software industry.

More Jobs

The trend growth rate of software industry employment has nearly doubled. Average annual employment in the industry grew 7.1 percent between 1990 and 1994, and since 1994, it has been growing 13.9 percent per year. In comparison, total private industry employment has been growing 2.5 percent per year since 1994.

Higher Wages

The software industry now provides employment for 806,900 people in the United States. On average, they earn \$68,900 per year. The average wage for employees in all private industry excluding the software industry is less than half this amount. In 2008, employment in the core software industry will rise to 1.3 million people.

Economic Ripple Effect

In addition to the impacts of the demand for software on the software industry, spending by the industry and its employees stimulates a ripple effect of economic activity in other industries. The combination of the software industry's direct impact and the ripple effect generated employment for 2.7 million people in the U.S. economy in 1998. It also generated an income tax base from which federal and state treasuries collected \$28.2 billion in individual income taxes. In 2008, the demand for software will generate employment for 4.3 million people in the economy and income tax revenue of \$50 billion.

Consistent Trade Surplus

Although the U.S. economy has a deficit in its trade balance, the deficit would be nearly 40 percent greater if not for the trade balance surplus contributed by the U.S.-owned packaged software industry. The industry has consistently generated an increasing annual trade surplus. In 1997, this trade surplus was \$13 billion. In 2000, it will exceed \$20 billion.

Strong Contribution to U.S. Economy

By the year 2000, the software industry's contribution to the U.S. economy will be greater than the contribution of any other manufacturing industry. In fact, the contribution of the software, data processing, and other computer-related services group in the U.S. economy today exceeds the contribution of all other industry groups in the manufacturing and services divisions. Moreover, this rise to prominence has occurred in just a few years.

Software Piracy Costs Jobs and Tax Revenue

The core software industry could have propelled the U.S. economy even faster if not for the continuing worldwide presence of software piracy. Losses from piracy are not limited to industry sales. Piracy also steals jobs from the economy and tax revenue from federal and state treasuries. In 1998, the losses from software piracy totaled 109,000 jobs and \$991 million in tax revenue in the United States. If piracy remains unabated, in 2008 it will cost the U.S. economy 175,700 jobs and \$1.6 billion in tax revenue.

Introduction

In June 1997, Nathan Associates Inc. produced a study¹ of the U.S. economic impacts of demand for the products and services of the core software industry. This industry² comprises business establishments located in the United States that are primarily engaged in developing customized or packaged software, or designing integrated systems of hardware and software. The June 1997 report presented impacts on the core software industry and other industries with regard to sales, employment, wages, and tax revenue. In addition, it presented estimates of employment and tax revenue lost because of software piracy in the United States.

This report presents an update to the June 1997 study. Previous estimates of core software industry sales, employment, and wages in 1996 are revised with newly reported measures. In addition, this report presents the industry's profile for 1990 through 1998 and a forecast for 2008. The total impacts of the demand for software, including the ripple effect of spending by the core software industry and its employees, are updated and presented for 1998 and forecast to 2008. Also included here are updated estimates of the economic losses from software piracy in 1998 and 2008.

The scope of the previous study also was expanded by the inclusion of the following two new dimensions of impact:

- ▶ The balance of trade in products and services of the U.S.-owned packaged software segment of the core software industry
- ▶ The impact of the Internet on the software industry and employment

SECTION 1

**Software Industry's Value, Jobs,
and Wages Continue to Increase Rapidly**

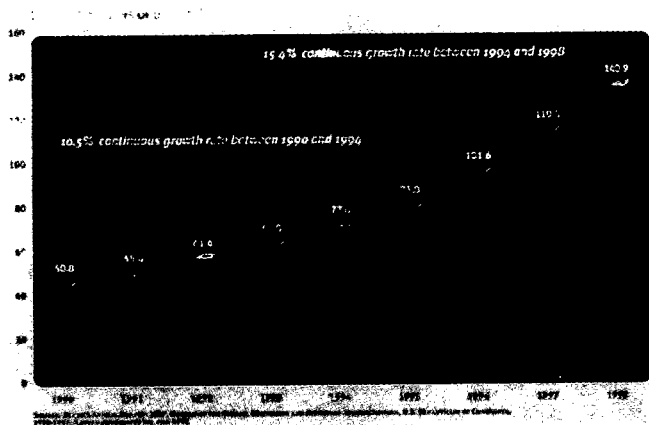


Industry Sales Rose 18 Percent in 1998

The demand for products and services of the core software industry continues to grow at an impressive pace. In 1998, sales increased 17.8 percent to reach \$140.9 billion — the highest level ever.

Even more impressive than this one-year increase is the increasing trend rate of growth (see Figure 1). Between 1990 and 1994, sales grew at a continuous rate of 10.5 percent. Between 1994 and 1998, sales grew at a continuous rate of 15.4 percent — a 50 percent increase in the trend rate of growth. In contrast, the U.S. economy grew 5.4 percent per year, only one-third the rate of the software industry.

FIGURE 1: ANNUAL RECEIPTS OF CORE SOFTWARE INDUSTRY ESTABLISHMENTS IN THE UNITED STATES, 1990-1998



While customized software (the programming services segment of the industry) accounts for the largest share of industry sales (41.5 percent in 1998), the fastest growth is in the packaged software³ segment of the industry (see Figure 2). Between 1990 and 1998, sales of the packaged software segment grew 15.1 percent per year. Meanwhile, sales of integrated system design services grew 13.5 percent per year, and sales of programming services grew 11.8 percent per year. In 1998, the packaged software segment accounted for 36.2 percent of core software industry sales.

Core Software Industry Contributions Outpace Other Manufacturers

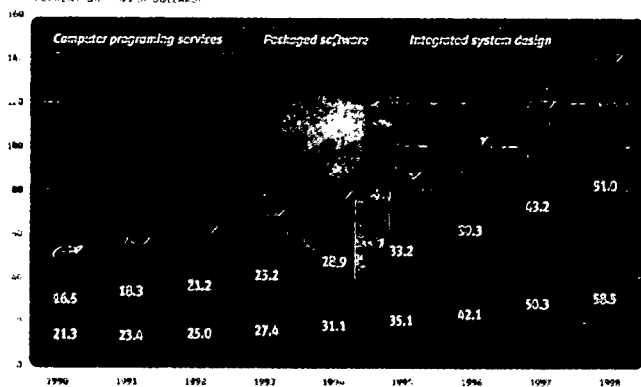
The industry's increasing growth rate, combined with its ability to add value to the services and materials it uses to develop, replicate, and distribute software, have propelled it into a new position of prominence. In just two years, the industry's contribution⁴ to the U.S. economy increased from third largest among all industry groups in the manufacturing division into a tie⁵ for second largest. Only the motor vehicles and motor vehicle equipment manufacturers contribute more.

The software industry's remarkable rise is expected to continue. Given current trends, beginning in 2000 the industry's contribution to the U.S. economy will exceed that of all other manufacturing industry groups.

When extending the ranking to include industry groups in the services division⁶ as well as the manufacturing division, the contribution of the core software industry ties for fourth place (see Figure 3). However, the combination of the core software industry and all other industries in the computer programming, data processing, and other

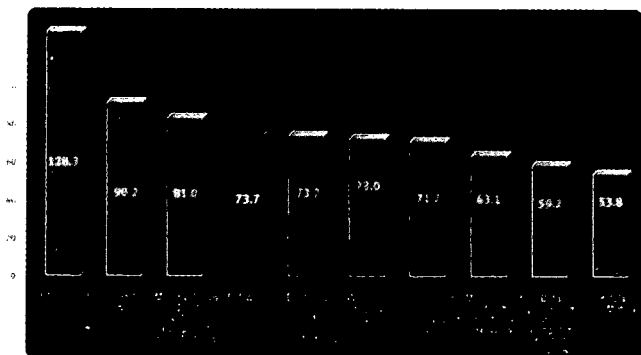
Figure 7: ANNUAL RECEIPTS OF CORE SOFTWARE INDUSTRY ESTABLISHMENTS IN THE UNITED STATES, BY INDUSTRY SEGMENT, 1990-1998

CURRENT BILLIONS OF DOLLARS



Source: Bureau of Economic Analysis, 1999. Data for 1990-1994 from the Survey of Current Business, U.S. Department of Commerce. Data for 1995-1998 from the Survey of Current Business, U.S. Department of Commerce.

TOP 10 VALUE-ADDING INDUSTRY GROUPS IN THE SERVICES AND MANUFACTURING DIVISIONS OF THE U.S. ECONOMY IN 1997



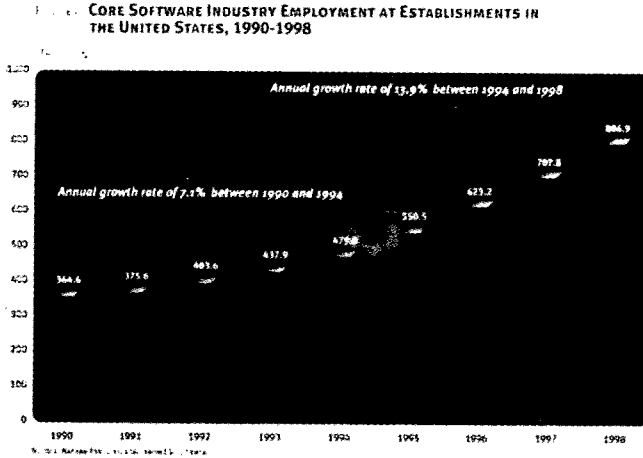
Source: Bureau of Economic Analysis, 1999. Data for 1997 from the Survey of Current Business, U.S. Department of Commerce. Data for 1990-1996 from the Survey of Current Business, U.S. Department of Commerce.

computer-related services industry group is the leading contributor among all industry groups in the services and manufacturing divisions of the U.S. economy. Its contribution totaled \$132.9 billion in 1997.

Employment in Software Industry Growing 14 Percent Annually

The growing demand for software is generating a rapidly increasing number of jobs in the core software industry. The trend rate of growth in industry employment has nearly doubled — from 7.1 percent per year between 1990 and 1994

to 13.9 percent per year between 1994 and 1998 (see Figure 4). In 1998, the industry employed 806,900 people in the United States, and now has workers in every state. Assuming software industry employment continues to grow at its long-term (1990 to 1998) trend rate, the industry will employ more than 1.3 million people in the United States in 2008.



No other high-tech industry is providing employment opportunities at such a rapidly increasing rate (see Table 1). In sharp contrast, total private industry (excluding software) employment has increased only 2.5 percent per year since 1994.

Table 1. Employment in High-Tech Manufacturing and Core Software Industries, 1990-1998
(thousands, except where noted)

Industry	1990	1991	1992	1993	1994	1995	1996	1997	1998	Annual Growth
HIGH-TECH MANUFACTURING										
Consumer Electronics	84.4	85.1	81.4	83.4	88.9	83.0	82.6	81.8	na	-0.4%
Communications Equipment	263.3	248.7	238.0	239.7	243.5	263.6	272.3	276.4	na	0.7%
Electronic Components and Accessories	343.6	325.1	306.9	313.6	324.9	346.2	355.0	371.9	na	1.1%
Defense Electronics	280.5	260.0	230.4	205.5	182.4	158.7	160.1	159.8	na	-7.7%
Industrial Electronics	302.6	286.9	272.4	266.0	265.2	268.0	276.1	277.5	na	-1.2%
Electromedical Equipment	40.1	43.4	48.6	49.1	52.0	55.0	55.8	56.4	na	5.0%
Photonics	120.4	116.9	113.1	108.2	106.8	102.7	105.2	107.9	na	-1.6%
Total high-tech manufacturing	1,435.0	1,366.1	1,290.7	1,265.5	1,263.7	1,277.2	1,307.1	1,331.8	na	-1.1%
CORE SOFTWARE	364.6	375.6	403.6	437.9	479.9	550.5	623.2	707.8	806.9	10.4%
								(Between 1990 and 1997)		9.9%
ALL PRIVATE INDUSTRY BUT CORE SOFTWARE	90,539.7	88,631.5	88,946.2	90,765.0	93,666.4	96,344.3	98,645.2	101,497.7	103,383.5	1.7%
								(Between 1990 and 1997)		1.6%

Note: na means not available.

Sources: Nathan Associates Inc. from ES-202 data and industry definitions of the American Electronics Association.

Growth In Average Annual Wage Indicates Industry Skills Gap

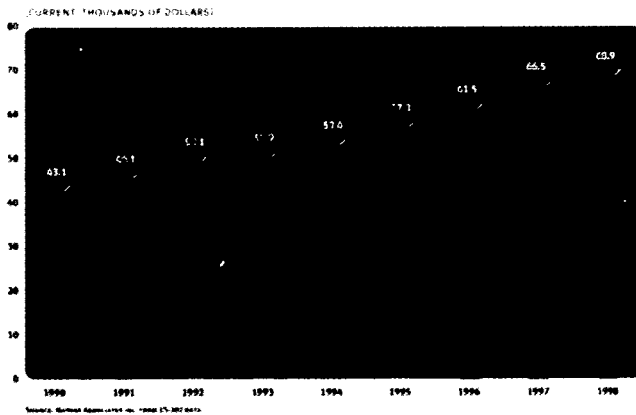
In 1998, total wages¹ of the core software industry reached \$55.6 billion (see Figure 5). Total wages in 2008 are expected to reach \$99.1 billion.

FIGURE 5: CORE SOFTWARE INDUSTRY'S TOTAL WAGES, 1990-1998



The average annual wage of core software industry employees rose to \$68,900 in 1998 (see Figure 6). In contrast, the average annual wage per employee in all private industry excluding the core software industry was \$29,800 in 1997, the last year for which wage data are reported.

FIGURE 6: ANNUAL WAGES PER EMPLOYEE IN THE CORE SOFTWARE INDUSTRY, 1990-1998



The core software industry's demand for employees exceeds available supply, a condition sometimes referred to as a *skills gap*. Since 1994, the average annual wage of a core software industry employee has risen 7.6 percent per year — 81 percent faster than average wage growth for employees in private industry. Core industry employee wage growth also outpaced average wage growth for employees in other high-tech industries (see Table 2). As a result of the skills gap, the software industry must outbid other industries to recruit, hire, and retain qualified employees.

Table 2. Average Annual Wage of Employee in High-Tech Manufacturing, Software, and Other Private Industries, 1990-1997
(thousands of current dollars, except where noted)

Industry	1994	1995	1996	1997	Annual Growth
HIGH-TECH MANUFACTURING					
Consumer Electronics	37.1	36.7	39.2	41.8	4.1%
Communications Equipment	43.8	46.0	48.4	52.3	6.0%
Electronic Components and Accessories	30.1	31.0	32.1	34.0	4.1%
Defense Electronics	49.1	52.1	56.7	57.8	5.6%
Industrial Electronics	39.1	41.6	44.1	47.1	6.4%
Electromedical Equipment	43.7	46.8	49.8	51.9	5.9%
Photonics	46.7	50.3	52.2	54.0	4.9%
CORE SOFTWARE	53.4	57.3	61.5	66.5	7.6%
ALL PRIVATE INDUSTRY BUT CORE SOFTWARE	26.4	27.3	28.4	29.8	4.2%

Sources: Nathan Associates Inc. from ES-202 data and American Electronics Association industry definitions.

Software Industry Boosts U.S. Economy



Just as the demand for software generates a vibrant software industry, the software industry's demand for products and services of other industries boosts activity throughout the economy. For example, software industry purchases of blank CDs, packaging materials, or transportation services stimulate the industries that manufacture or provide these products and services. Likewise, spending of software industry employees stimulates the economy.

The boost given to the economy from spending by the software industry and its employees is sometimes referred to as the economic "multiplier" or ripple effect. When taking the multiplier effect into account, nearly 2.7 million people were employed in the U.S. economy (including the core software industry) in 1998 because of the demand for software. The impact on wages totaled \$128.1 billion. In 2008, 4.3 million people will be employed directly and indirectly because of the demand for software. They will earn wages totaling \$228 billion.

Federal and state governments benefit from this boost to economic activity by collecting tax revenue on the income it generates. Considering only the individual income tax⁴, the wage impact of software demand provided a tax base from which \$28.2 billion in revenue were collected by federal and state governments in 1998. Of the total tax revenue collected, \$12.3 billion were collected from the wages of core software industry employees. The remaining \$15.9 billion were collected from the wages earned by employees of other industries as a result of the demand for software (see Table 3). In 2008, the tax revenue impact will total \$50 billion.

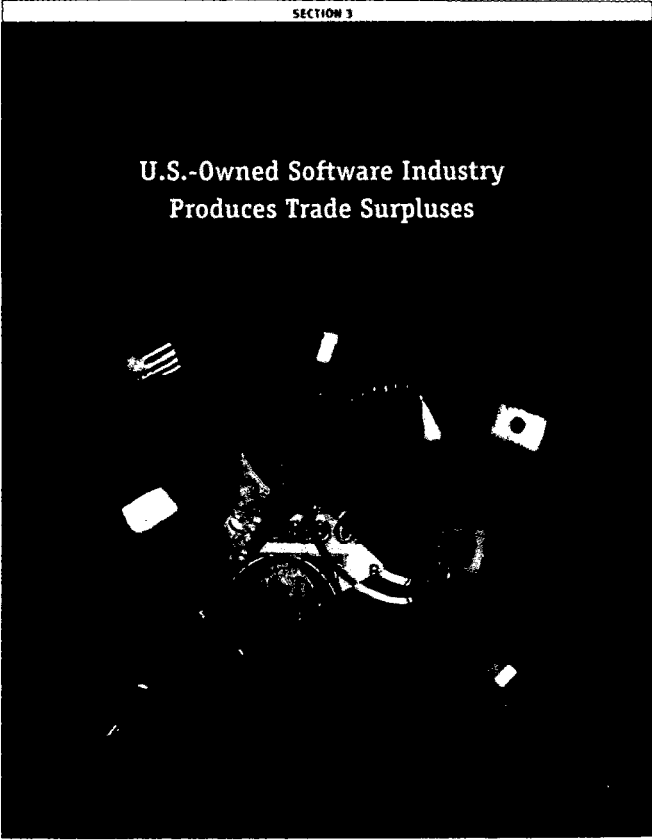
Table 3. Direct and Indirect Income Tax Revenue Impacts by State, 1998 (millions of dollars)

STATE	Income taxes collected on core software industry wages			Income taxes collected on wages in other industries (ripple effect)			Totals direct and indirect		
	STATE	FEDERAL	TOTAL	STATE	FEDERAL	TOTAL	STATE	FEDERAL	TOTAL
Alabama	15.6	86.5	102.1	20.0	111.2	131.2	35.6	197.7	233.3
Alaska	—	.5	.5	—	.6	.6	—	1.0	1.0
Arizona	11.5	75.1	86.6	12.4	81.3	93.7	23.9	156.4	180.3
Arkansas	3.2	12.6	15.8	4.4	17.5	21.9	7.6	30.1	37.7
California	587.9	2,292.7	2,880.6	773.7	3,017.3	3,791.0	1,361.6	5,309.9	6,671.5
Colorado	77.3	354.1	431.4	103.8	475.6	579.4	181.1	829.7	1,010.8
Connecticut	27.5	117.0	144.5	36.4	155.0	191.3	63.8	272.0	335.8
Delaware	2.3	7.9	10.2	3.1	10.8	13.9	5.4	18.7	24.1
District of Columbia	8.9	43.9	52.7	12.0	59.6	71.7	20.9	103.5	124.4
Florida	—	254.6	254.6	—	340.0	340.0	—	604.5	604.5
Georgia	86.9	379.2	466.1	111.6	487.2	598.8	198.5	866.4	1,064.9
Hawaii	2.5	7.2	9.8	4.6	13.1	17.7	7.1	20.3	27.4
Idaho	2.4	8.3	10.8	3.1	10.4	13.5	5.5	18.8	24.3
Illinois	56.6	334.7	391.4	74.9	442.6	517.5	131.5	777.4	908.9
Indiana	12.0	49.0	61.1	15.9	64.8	80.7	28.0	113.9	141.8
Iowa	9.0	35.3	44.3	11.8	46.2	58.0	20.9	81.4	102.3
Kansas	7.6	31.8	39.4	9.5	39.4	48.9	17.1	71.2	88.3
Kentucky	4.5	16.7	21.1	5.2	19.5	24.7	9.7	36.1	45.8
Louisiana	1.9	14.0	15.9	2.7	19.5	22.1	4.6	33.5	38.1
Maine	1.9	6.8	8.7	2.5	9.0	11.5	4.5	15.8	20.2
Maryland	117.9	432.2	550.1	160.4	587.8	748.2	278.2	1,020.0	1,298.3
Massachusetts	233.2	678.6	911.8	308.9	898.6	1,207.5	542.1	1,577.2	2,119.4
Michigan	38.0	170.0	208.0	44.4	198.4	242.8	82.4	368.4	450.9
Minnesota	60.9	196.0	256.9	79.8	256.6	336.3	140.7	452.5	593.2
Mississippi	1.2	7.6	8.9	1.6	9.8	11.4	2.9	17.4	20.3
Missouri	31.6	141.2	172.8	39.1	175.0	214.1	70.7	316.2	386.9
Montana	1.4	5.1	6.5	1.8	6.9	8.7	3.2	12.0	15.2
Nebraska	9.7	42.2	51.8	12.6	55.2	67.8	22.3	97.4	119.7
Nevada	—	22.2	22.2	—	26.5	26.5	—	48.7	48.7
New Hampshire	1.0	59.2	60.1	1.3	78.4	79.6	2.3	137.5	139.8
New Jersey	72.9	381.6	454.4	89.3	467.6	556.9	162.2	849.2	1,011.3
New Mexico	2.2	10.6	12.8	2.4	11.4	13.8	4.6	22.0	26.6
New York	143.6	461.9	605.5	175.0	566.1	742.1	319.7	1,028.0	1,347.7
North Carolina	45.2	159.4	204.6	58.1	204.8	262.9	103.3	364.2	467.6
North Dakota	.2	1.4	1.6	.2	1.9	2.1	.4	3.3	3.7
Ohio	53.2	256.5	309.6	62.1	299.3	361.4	115.2	555.8	671.0
Oklahoma	5.6	22.2	27.7	7.7	30.8	38.6	13.3	53.0	66.3
Oregon	39.9	109.1	149.0	50.1	137.1	187.3	90.0	246.3	336.3
Pennsylvania	45.2	243.9	289.1	61.5	331.7	393.2	106.8	575.6	682.4
Rhode Island	5.2	20.9	26.1	6.9	27.6	34.6	12.2	48.5	60.7
South Carolina	5.8	24.8	30.6	7.5	31.9	39.4	13.3	56.7	70.0
South Dakota	—	4.4	4.4	—	5.8	5.8	—	10.2	10.2
Tennessee	.6	56.5	57.1	.8	70.1	70.8	1.4	126.6	127.9
Texas	—	627.4	627.4	—	872.6	872.6	—	1,500.0	1,500.0
Utah	30.6	119.5	150.1	41.2	160.5	201.6	71.8	280.0	351.8
Vermont	1.3	6.0	7.3	1.7	7.9	9.6	3.0	13.9	16.9
Virginia	164.1	639.9	804.0	223.2	870.4	1,093.6	387.3	1,510.3	1,897.6
Washington	—	1,042.2	1,042.2	—	1,309.5	1,309.5	—	2,351.7	2,351.7
West Virginia	1.2	4.9	6.1	1.6	6.7	8.3	2.8	11.6	14.4
Wisconsin	35.6	110.6	146.2	47.1	146.3	193.3	82.7	256.9	339.6
Wyoming	—	.9	.9	—	1.2	1.2	—	2.1	2.1
Total	2,058.3	10,196.6	12,254.9	2,679.8	13,275.0	15,954.7	4,738.1	23,471.6	28,209.7

Source: Haffan Associates Inc.

SECTION 3

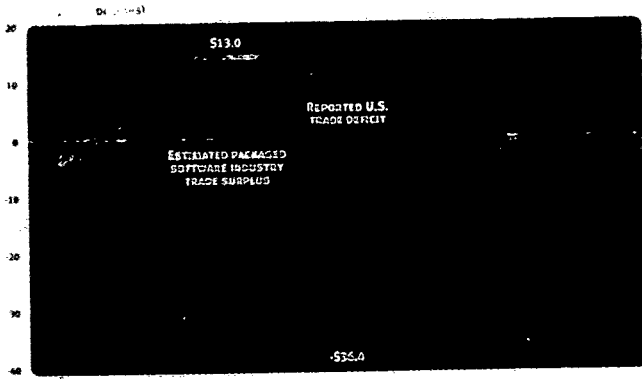
U.S.-Owned Software Industry
Produces Trade Surpluses



Another important measure of the software industry's impact on the economy is its contribution to the balance of trade. A trade surplus (exports in excess of imports) indicates a competitive industry worldwide, generating jobs in the U.S. economy and earnings from foreign operations.

In 1997, the U.S.-owned packaged software segment of the core software industry contributed a surplus of \$13 billion measured in retail value⁸ to the U.S. trade balance (see Figure 7). Without this contribution, the U.S. economy's trade deficit, which stood at \$36.4 billion in 1997 (excluding U.S. military and government transactions), would have been 36 percent higher.

FIGURE 7. PACKAGED SOFTWARE INDUSTRY'S AND U.S. ECONOMY'S TRADE BALANCES ON GOODS, SERVICES AND INCOME, 1997



Source: U.S. Balance of Payments Statistics, Bureau of Economic Analysis. U.S. Department of Commerce.

Larger Surplus Every Year

The U.S.-owned packaged software industry can be counted on to contribute a larger trade surplus every year. Between 1990 and 1997, the industry's surplus increased 17.9 percent per year (see Figure 8). Over the same period, the U.S. economy's trade deficit, excluding military and government transactions, more than doubled (see Figure 9). In the year 2000, the U.S.-owned packaged software industry will generate a trade surplus exceeding \$20 billion.

U.S.-OWNED PACKAGED SOFTWARE INDUSTRY'S ANNUAL TRADE SURPLUS, 1990-2000

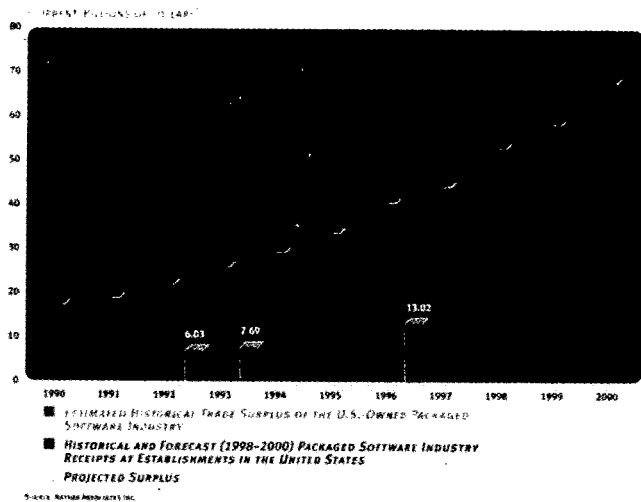
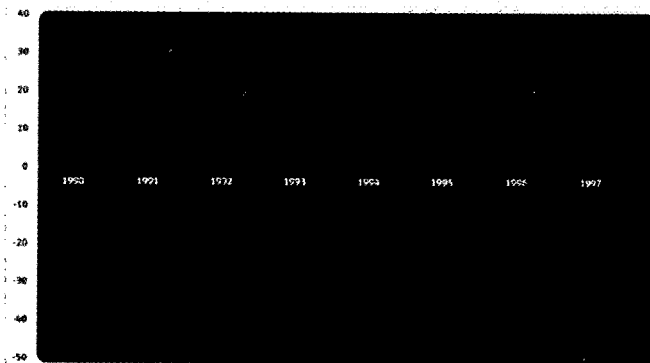


FIGURE 9. U.S. BALANCE OF TRADE, EXCLUDING MILITARY AND GOVERNMENT TRANSACTIONS

(CURRENT \$ BILLION)



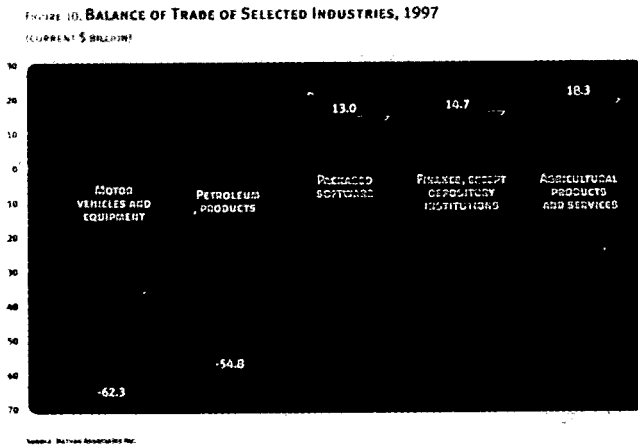
SOURCE: BUSINESS SOFTWARE ALLIANCE, INC. AND THE BUREAU OF ECONOMIC ANALYSIS, U.S. DEPARTMENT OF COMMERCE

Surplus Significant Compared with Other Industries

Although statistics on international transactions are not reported by industry, the data that are reported can be used to derive rough estimates of the trade balances of some industries. For purposes of comparison, consider estimates¹⁰ for the following four industries:

- ▶ Agricultural products and services
- ▶ Petroleum and petroleum products
- ▶ Motor vehicles and equipment manufacturers
- ▶ Finance, except depository institutions

The estimated trade surplus of the U.S.-owned packaged software industry in 1997 was roughly comparable to the surplus of the finance industry, but less than the surplus of the agricultural products and services industry (see Figure 10). The trade balances of the petroleum and auto industries were in deficit in 1997.

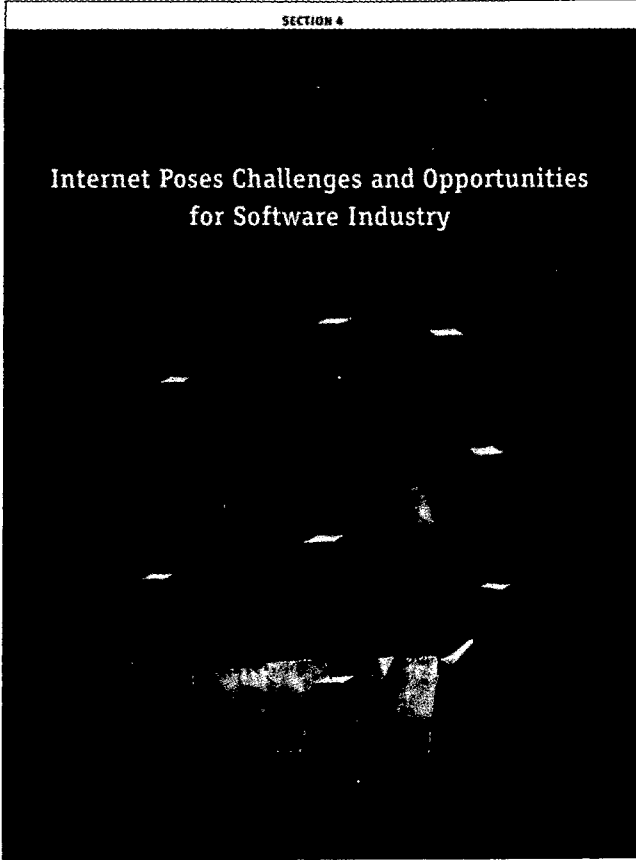


Although these estimates do not provide the basis for a comprehensive ranking of the U.S.-owned packaged software industry's trade balance relative to all other industries, they do illustrate that the U.S. software industry is making a very significant and positive contribution.

More generally, the trade surplus reflects strong foreign demand for the products and services provided by the U.S.-owned packaged software industry. The innovativeness of U.S. software publishers and their responsiveness to consumer demand have created an industry that is highly competitive on a global basis. The result is not simply a growing U.S. software industry trade surplus, but increased employment and income within the U.S. economy. In addition, the U.S.-owned packaged software industry contributes directly to the productivity and competitiveness of other U.S. industries, with the result that those industries are then able to generate more sales abroad and create more jobs and income in the United States.

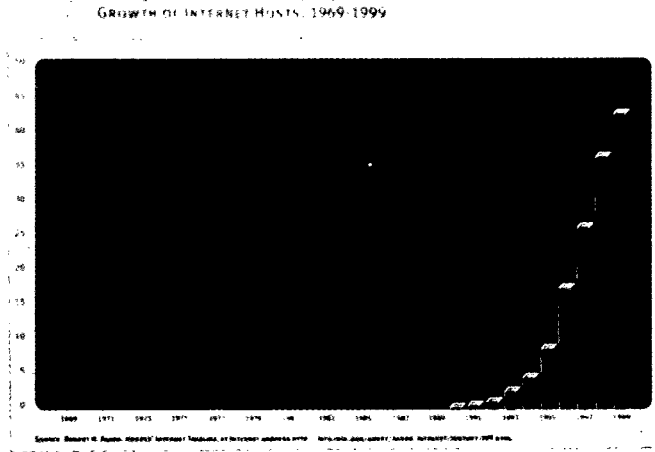
SECTION 4

Internet Poses Challenges and Opportunities
for Software Industry



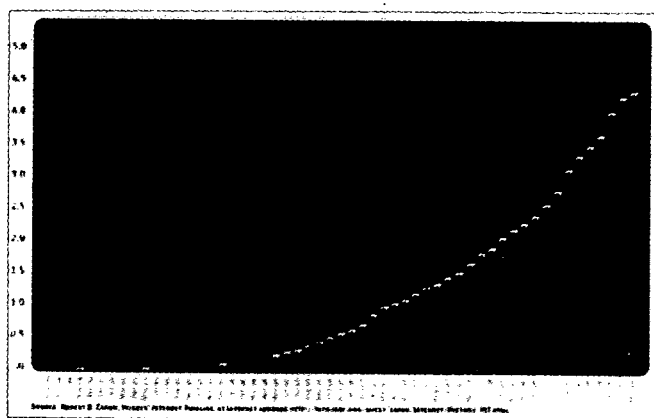
The Internet poses both a challenge and an opportunity to businesses in the core software industry. The challenge is to remain innovative and competitive, and to continue providing value to the consumer. The opportunity is the vast global market available via the Internet. Not only does the Internet efficiently link the software industry with talented software developers and suppliers of goods and services, it also provides a direct path to the consumer.

To appreciate the impact of the Internet, consider its explosive growth. Between 1969 and 1999, Internet host computers increased from the original four to over 40 million (see Figure 11). World Wide Web server growth is further testament to the impact of the Internet (see Figure 12). New communities outside the traditional boundaries of distance and time are forming an intricate web of nearly instantaneous communication around the world. Globally, nearly 150 million people are now linked to the Internet, including one out of every three people in the United States age 16 or older.



The market characteristics of the online community are significantly different from its offline counterpart. For example, online users are more affluent. Jupiter Communications, an information technology research firm, reports the average annual income of online households was \$61,540 in 1998. The average of offline households was about half that — only \$34,250. The online market is now only 51 percent male, a dramatic shift from the male-dominated Web of earlier days.

FIGURE 12. GROWTH OF WORLD WIDE WEB SERVERS. JUNE 1993-FEBRUARY 1999
(MILLION)



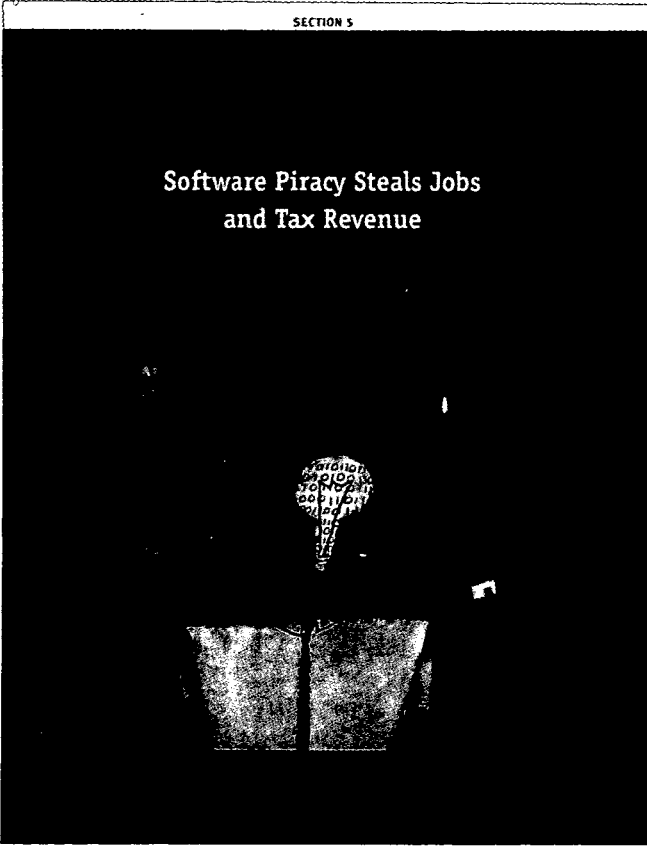
In terms of market size, technology research firm International Data Corporation (IDC) projects Internet revenue will climb to \$155 billion in 2001, a 95 percent increase over 1997 revenue. By 2002, IDC expects over 47 million Americans to be shopping online and spending \$425 billion on the Web. Online purchases of software are expected to undergo a tenfold increase in value, reaching \$900 million by 2000.

Internet Creates Demand for New Software Products and Services

The key to advancing Internet growth is to ensure the easy, rapid, and low-cost exchange of information. New software programs make this possible. At the same time, however, questions of security become even more important. IDC expects firewall products (mechanisms that limit access to a site from the Internet) to grow faster than any other software product — 40 percent per year between now and 2002. Anti-virus software will also become increasingly important. In fact, anti-virus software is expected to be the largest segment of the security software product market in 2002, accounting for nearly half of worldwide security software sales. Electronic authorization, authentication, and administration, as well as encryption products, will also be among the most popular software products as Internet use continues to expand.

Despite its economic promise, however, the Internet also threatens to exponentially increase the rate of software piracy. For example, thousands of "warez" sites providing illegal software can currently be found on the World Wide Web, a situation which threatens to aggravate the already serious threat posed by software piracy to the industry.

Software Piracy Steals Jobs
and Tax Revenue



Software piracy is a problem of global proportions. According to a study conducted by International Planning and Research (IPR) Corporation, software piracy continues to plague the industry around the world (see Table 4). In the United States, 25 percent of all software applications installed in 1998 were pirated copies.

Table 4. Average Software Piracy Rates by Region, 1994–1998 (percentage of applications installed each year)

Region	1994	1995	1996	1997	1998
Asia/Pacific	68	64	55	52	49
North America	32	27	28	28	26
United States	31	26	27	27	25
Western Europe	52	49	43	39	37
Latin America	78	76	68	62	60
Eastern Europe	65	63	60	77	76
Middle East/Africa	80	78	74	65	62
World total	49	46	43	40	38

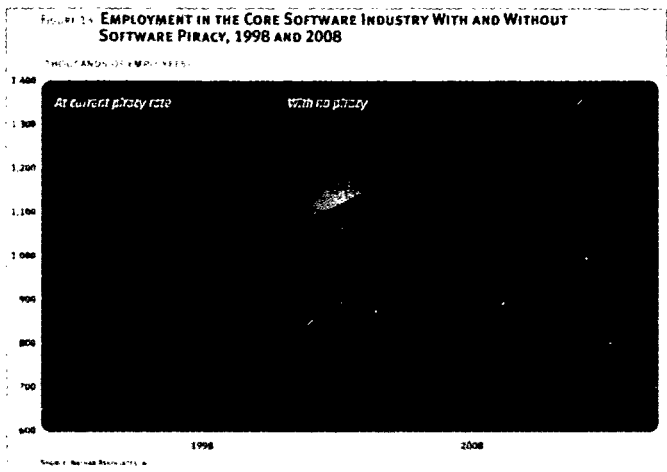
Sources: International Planning & Research

The immediate and direct impact of software piracy is lost sales. In 1998, the retail value of worldwide pirated software of U.S. publishers was nearly \$11 billion.

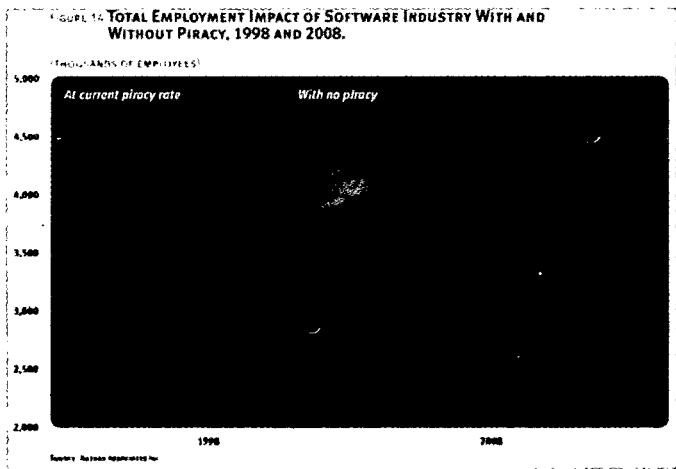
Piracy comes in many forms, but end user piracy is the most widespread and economically damaging. End user piracy occurs whenever a person makes multiple copies of a program in violation of the license agreement, such as when a program purchased for a single user is installed on multiple computers. Hard disk loading piracy occurs when manufacturers and retailers of computer hardware illegally load software onto computer hard drives in an effort to boost sales of their hardware products. Optical disk piracy is mass production of counterfeit products, packaging, manuals, and holograms. Its name derives from the fact that most mass-produced counterfeit software resides on CD-ROMs.

The newest frontier in software piracy is the Internet. Literally thousands of pirated software products can be downloaded illegally from the Internet. In recognition of this problem, the U.S. Congress has enacted the No Electronic Theft (NET) Act to aid in the prosecution of Internet piracy.

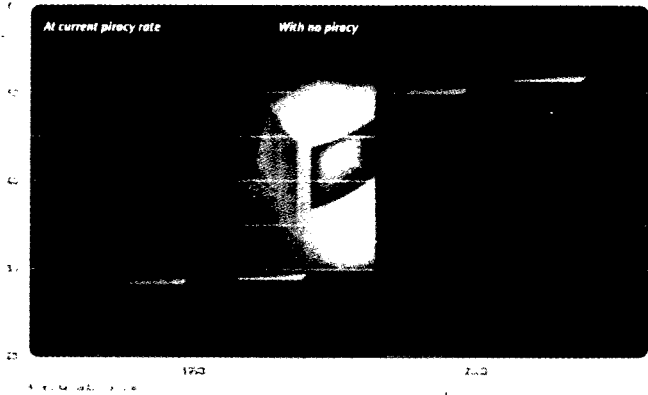
In addition to the critical issue of lost sales, piracy also steals industry jobs. In 1998, if pirated software had instead been legally purchased, the industry would have been able to employ 32,700 more people (see Figure 13). In 2008, if software piracy remains at its current rate, 52,700 jobs will be lost in the core software industry.



When the ripple effect of software industry spending is included, the economic losses from software piracy are even greater. Economy-wide, software piracy cost 109,000 jobs in 1998 (see Figure 14). Wage loss in 1998 totaled \$4.5 billion, and the subsequent income tax revenue foregone was \$991 million. In 2008, the number of jobs lost due to software piracy will rise to 175,700. Wage loss in 2008 will be \$7.3 billion, and tax revenue foregone will be \$1.6 billion (see Figure 15).



TOTAL TAX REVENUE IMPACT OF THE SOFTWARE INDUSTRY WITH AND WITHOUT PIRACY, 1998 AND 2008.



These losses from software piracy have the added impact of slowing innovation and, consequently, hampering economic growth. Not only does the risk of lost sales from piracy reduce the software industry's incentive to invest in research and development, it also makes it more difficult for new developers to enter the market.

Endnotes

- ¹ Nathan Associates Inc., "Building an Information Economy — Software Industry Positions U.S. for New, Digital Era," Business Software Alliance, Washington, D.C., June 1997.
- ² An industry is a collection of economic units, such as business establishments (generally, a single physical location) or enterprises (more commonly referred to as companies, which might consist of several establishments), that have in common the principal product or group of products they produce or distribute, or the principal service they provide. To be classified as an industry, the collection must be statistically significant in terms of number of employees, volume of business conducted, and other measures of economic activity.
- ³ Packaged software is mass-produced for widely used applications such as operating systems, word processing, spreadsheets, graphics, e-mail, etc.
- ⁴ The conventional measure of an industry's contribution to an economy is its value-added — the difference between the dollar value received by the industry from its sales of products and services and the dollar value paid by the industry for its purchases of products and services produced or provided by other industries.
- ⁵ The core software industry is tied for second place with manufacturers of electronic components and accessories, which includes semiconductor manufacturers.
- ⁶ Other divisions of the economy include agriculture, forestry, and fishing; mining; construction; transportation, communications, electric, gas, and sanitary services; wholesale trade; retail trade; and finance, insurance, and real estate.
- ⁷ Wages include bonuses, stock options, the cash value of meals and lodging, tips and other gratuities, and employer contributions to deferred compensation plans such as a 401(k). Employee's contributions for old-age, survivors, disability insurance (OASDI); health insurance; unemployment insurance; workers' compensation; and private pensions and welfare funds are included in wages, but the employer's contributions are not.
- ⁸ Tax revenue estimated and presented in this report understates the fiscal impacts of software demand. The estimate includes only revenue from individual federal and state income taxes. Revenue from business income, property, and sales taxes was not included.
- ⁹ Software is distributed in a variety of ways not easily tracked. Some software is sold by producers directly to consumers. Other software is sold through a distribution channel involving businesses other than the producers. At each stage of distribution, the price of software is increased to recover distribution costs. If one were to assume that all software reaches the final consumer via the channel, the trade surplus of the packaged software industry in 1997 was \$10.4 billion.
- ¹⁰ Estimates of the trade balances of these four industries are inclusive of trade in goods, services, and income. However, it was assumed that no royalties and license fees (part of reported services trade) were received or paid in agriculture and finance industries. Royalties and license fees in the petroleum products and auto industries were estimated from reported royalties and license fees on industrial processes and the industries' export and import shares of trade in goods. For the agriculture and finance industries, trade between affiliates is reported without any industry detail in the other private services classification, so here it is estimated from the industries' shares of reported unaffiliated transactions. Income estimates are from reported U.S. direct investment abroad and foreign direct investment in the United States. The income reported in international investment data by industry was adjusted back to the basis on which income is reported without industry detail in the U.S. international transactions accounts.

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For more information or additional copies of this study, please contact:

Business Software Alliance
1150 18th Street, NW
Suite 700
Washington, DC 20036
Telephone: 202.872.5500
Facsimile: 202.872.5501
e-mail: software@bsa.org

•

BSA—Europe
79 Knightsbridge
London SW1X7RB
Telephone: 44.171.245.0304
Facsimile: 44.171.245.0310

•

BSA—Asia
300 Beach Road
#32-07 The Concourse
Singapore 199555
Telephone: 65.292.2072
Facsimile: 65.292.6369



**Testimony by
Richard W. Riley
U.S. Secretary of Education**

**Joint Economic Committee
Tuesday, June 15, 1999
Washington, D.C.**

Good morning. I want to thank the Committee for inviting me to address you today and for focusing on such an important subject as the impact of technology on the U.S. economy.

The sustained growth of our economy is a development from which most Americans have benefited. You have already heard from a number of CEOs in the technology industry of how technology has constituted a strong base in the expansion of our economy (and, I am told, that the previous testimony has emphasized the clear importance of education standards and education quality in preparing our country for its technological future).

I agree with many of these comments. Statistics show, for instance, that more Americans today make computers than make cars. More build semiconductors than construction machinery. And these jobs pay higher -- on average 73 percent higher -- than other private sector jobs. Furthermore, virtually every sector of our economy utilizes technology to enhance its efficiency and productivity.

But I think it is critically important, even as we recognize these facts, to address what we need to do to be prepared for the future in order to continue this kind of positive economic growth.

I want to direct my comments today to the underlying importance of the link between education, technology and our economic success in the present and in the future.

I firmly believe that we need to build a broader and stronger workforce that knows how to capitalize on the potential of technology. It is indisputable that technology is profoundly changing what we learn and how we need to learn. And the appropriate use of technology is a critical part of an overall educational experience that will help our students reach high standards of learning.

In addition, our students need a broader base of knowledge and set of skills to navigate these rapidly changing times.

We are at a critical point in our history. We can remain leaders in the area of technology -- or we can fall from the top. The outcome will depend largely on the investments and improvements we are willing to make in our schools.

Information technologies do not operate in a vacuum. The mere existence of a high powered computer or a telecommunications network, for instance, does little for a society that lacks the knowledge or skills to use it.

The urgency to address the shortage of information technology workers is also the urgency to focus on bringing high standards of learning into every American school.

Chairman Greenspan, from whom this Committee heard yesterday, has identified this issue perfectly when he attributed our continuing national prosperity to a thriving "economy of ideas." His point was that our nation's growing wealth increasingly is being driven by ideas – by intellectual and human resources rather than by physical labor and natural resources.

Today, education and technology power our economy and empower our citizens. Across our society, demands for specialized skills requiring knowledge and training in the sciences, mathematics and technology are growing.

Almost 90 percent of new jobs require *more* than a high school level of literacy and math skills. Consider, for instance, that an entry-level automobile worker today must be able to apply formulas from algebra and physics to properly wire a car's electrical circuits.

The time, energy, and resources communities invest in building better schools and helping young people move from school into college and rewarding careers will shape the future of our world.

We need to focus on providing a strong grounding in the basics – if we want strong skills in the world of technology. We need rigorous coursework and qualified and well-trained teachers in every classroom – if we want students who can take on the challenges of the modern workplace.

We need to persuade more bright young Americans to pursue study in math, science, and technology so they can build promising futures for themselves and our country.

That is why this Administration has focused on increasing investments in education that can make a real difference in the quality of the lives of Americans – from pre-school to post graduate education. It is why we have emphasized learning in the basics – reading, mathematics, science, and technology education. It is also important that they learn how to be good citizens.

Our proposal on the reauthorization of the Elementary and Secondary Education Act will benefit our nation's K-12 students. It will reinforce and enhance the importance of high standards and of providing every child the opportunity for a quality education. It will ensure that students meet high expectations and that schools provide real accountability.

This focus includes preparing tomorrow's students and teachers to use technology, and helping schools acquire the technology they need for the 21st century. But it also includes an effort to modernize schools, invest in quality after-school extended learning programs, reduce class size, and recruit and train more quality teachers.

The ESEA proposal also places special emphasis on helping at-risk students achieve educational and career goals through efforts to raise student achievement, lower dropout rates and offer extended learning opportunities.

We also need to expand the pipeline to success. How can we do this? Research shows, for instance, that young people who have taken gateway courses like algebra I, geometry, and chemistry go on to college at nearly twice the rate of those who do not. And the difference is even more striking for low-income students. These students are almost three times as likely to attend college if they take this rigorous series of courses early.

It is why our Administration developed with members of Congress the GEAR UP Partnership, which links colleges primarily with middle schools to help disadvantaged students prepare for college.

I should note one more resource that can make all the difference -- a qualified, well-prepared and fully engaged teacher. Unfortunately, while there are many talented, dedicated teachers today, there are far too many teachers who are teaching out of field, without even a major or minor in their subject area. This is exacerbated by record student enrollments and teacher retirements that will create a demand for 2.2 million new teachers over the next 10 years.

I am especially excited about our creation of a National Commission on Mathematics and Science Teaching for the 21st Century. I am delighted that Senator John Glenn has agreed -- indeed was eager -- to serve as Chair of this Commission as his next mission for his country. This American hero understands as well as anyone the need to focus on teaching and learning math and science at high levels in order to build for the future.

I am also pleased that the Administration and Congress have created a national commission to explore the skills necessary for the information technology workforce, and to examine ways to expand the number of skilled workers. Senator John Warner was a key advocate of this Commission.

One critical way in which we must work to build a strong economic and educational future is to continue to invest in the newest basic -- the newest tool for learning -- technology.

Today's students are the first generation that will be expected to have technology skills for their careers and future success. Over the next six years, for instance, according to the Bureau of Labor Statistics, it is estimated that there will be a 70 percent growth in computer and technology related jobs.

Those Americans with the ability to use technology effectively will be in the best position to build rewarding careers and productive lives.

Technology is not a substitute for solid teaching and learning. It is a tool for helping teachers teach and for helping students learn at the highest levels. It is one part of a comprehensive quality learning experience that, at its very core, involves the concept of teaching people to think and to continue to learn throughout their lifetimes so that they can benefit from change.

As Robert Hutchins, the great educator and former president of the University of Chicago wrote, "The object of education is to prepare the young to educate themselves throughout their lives."

The Federal Government has placed a particularly strong emphasis on investing in educational technology. We provide under seven percent of the budget nationally for education. But we provide 25 percent of the funding for innovative use of technology in schools.

This investment includes the Technology Literacy Challenge Fund, which provides \$425 million in grants to help States and Local districts develop educational technology and provide teachers with the professional development they need to use technology effectively in the classroom.

It also includes the Technology Innovation Challenge Grants, a \$106 million competitive grant program to demonstrate innovative uses of educational technology by building partnerships among local school districts, universities, businesses, libraries, software designers, and others.

The Community-Based Technology Centers helps expand access to information technology and learning services through the creation of computer learning facilities in low-income communities. And the Preparing Tomorrow's Teachers to Use Technology program provides \$75 million to help ensure that tomorrow's teachers are prepared to integrate technology effectively into the curriculum.

These initiatives are helping to stimulate the development of an educated, flexible, capable, thinking and caring workforce that can put theory into practice and be good citizens. Not everyone can be a high tech CEO or an inventor of some new technology. But without a competent, educated labor force to bring life to great ideas, the successes we are now achieving will whither.

I also want to highlight one of the most important aspects of technology – that is the promise it offers in terms of increased accessibility to quality education for many who have traditionally been denied that access.

For instance, many students who live in rural areas have been able to link up with world class libraries and museums and participate in distance learning programs. And many disabled students have used learning technologies to open doors to resources that might otherwise have been closed to them.

But even as we see increasing opportunities of this kind across the country through the use of technology in learning, it is clear that we are not doing enough. We are failing to seize this opportunity to close the gaps in educational excellence that remain.

Unfortunately, we are in the midst of a severe “digital divide” – a gap between those who have access to computers and the Internet – and those who do not. And it is a divided center largely on racial, economic, and other demographic lines.

I am pleased that the E-Rate, which Vice President Gore has provided leadership on, is helping to make a real difference in leveling the playing field when it comes to the wealth of technological learning tools on the Internet. And the recent increase in funding will only quicken the pace of expanded opportunities.

In part because of the E-Rate, 89 percent of the nation’s schools – and 51 percent of its classrooms are now wired to the Internet. And if the funding stays at the current level, every classroom should be wired by the end of the year 2000.

Just a few years ago many schools did not even have these kinds of technological opportunities they are getting today. These students are the workforce of tomorrow – and we want the best-prepared workers and citizens we can get.

Increasingly, in my conversations with business leaders I am hearing about the value they place on knowing how to think and solve problems creatively, rather than simply being able to do the job for which they were hired. These leaders of business understand the value of an education grounded in the basics, but which includes a diverse learning experience that helps to broaden a person’s skills.

A good friend of mine, for instance, who runs Policy Management Systems Corporation in South Carolina, Larry Wilson, has told me that his best recruits in his high tech software company are music majors.

That is why this Administration is continuing to push for a broad range of initiatives – from recruitment and training of quality teachers, to helping communities build and modernize schools, to strengthening quality learning opportunities in the earliest years and open the doors to higher education.

Together these initiatives offer a comprehensive means of achieving high standards, of helping students think critically and of learning to make wise choices.

Members of the Committee, I can assure you that providing this kind of investment in quality education is the best way to guarantee that the economic success we have achieved – and which you are studying here today – will continue for years to come.

In closing, I want to leave the committee with four broad recommendations.

First, I urge the Committee to refocus its attention not simply on technology, but on technology as one critical piece of the education of our nation. Without this broader emphasis, I feel we will be shortchanged in the future and unprepared for the real challenges that lie ahead.

Second, I believe we need to increase our investment in research and development of this field. We know, for instance, that there are significant links between the use of learning technology and achievement in traditional subject matter. And we also know, through several studies, that students in schools that integrate technology into the traditional curriculum have higher attendance and lower dropout rates—which leads to greater academic success.

But we are far enough along in the technological revolution and its application to learning that it is time for systematic review and analysis of what works best. I urge the Congress to address this.

Third, I encourage all of the members of the technology industry who are testifying before you as well as those who are not to work to develop partnerships with local schools and community technology centers. In addition, I urge these business leaders to work with the education community and experts on learning, to design the next generation of technology applications for learning.

Whether your specialty is hardware or software, wiring, or something else, there is a great need for what you do in our schools. Invest in your communities and you and your businesses will be stronger for it in the end.

Finally, and perhaps most importantly, we need to maintain and expand the focus on strengthening equity in education generally, and in access to learning technologies in particular. Our newest tools for learning give us the power to close the divide that often exists based on race, economics, gender, or other factors. We must seize, not shirk this responsibility and opportunity through important and sensible policies like the E-Rate. It is time to break the cycle of technological inequity, not perpetuate it.

Members of the Committee, if used effectively, the learning tools of technology can be an extraordinarily positive force for improvement in our schools, as well as for increased economic success and productivity in our workplaces. Let us use this tool wisely. To paraphrase a wise old man in Star Wars: May the force of education and technology be with us.



UNITED STATES DEPARTMENT OF EDUCATION
OFFICE OF LEGISLATION AND CONGRESSIONAL AFFAIRS

November 10, 1999

Mr. Stephen Schultz
Joint Economic Committee
G-01 Dirksen Senate Office Building
Washington, DC 20510

Dear Mr. Schultz:

On June 15, 1999, the Joint Economic Committee held the *National Summit on High Technology: Day Two-Explore*, at which Secretary Riley testified. A group of students from Scaholm High School, Birmingham, Michigan, addressed a question to Secretary Riley after his departure. Senator Mack forwarded their question to me.

I am forwarding to you the Secretary's response.

Please contact me whenever the Department might be of help.

Sincerely,


Scott S. Fleming
Assistant Secretary

enclosures

cc: Honorable Connie Mack

400 MARYLAND AVE., S.W. WASHINGTON, D.C. 20202-3100

Our Mission is to Ensure Equal Access to Education and to Promote Educational Excellence throughout the Nation.

RENEWABLE ENERGY CURRICULUM

Question: Does the Department of Education have a plan for a comprehensive curriculum for renewable energy for K through 12 in the public schools?

Answer: The U.S. Department of Education does not have a plan for a comprehensive curriculum for renewable energy. The Department of Education Organization Act (Public Law 96-88, 20 USC 3403(b)) prohibits the Department from directing, supervising, and controlling curriculum as part of an effort to ensure State and local control over education. In addition, our records over the past few years indicate that we have not provided any grant funds to outside organizations to develop curriculum regarding either energy conservation or renewable energy.

The U.S. Department of Energy funds a laboratory, the National Renewable Energy Laboratory (NREL), which conducts programs for students and teachers related to renewable energy and energy efficiency. Although NREL has not developed entire courses, NREL has developed lesson plans and disseminates lesson plans developed by teachers that are related to renewable energy and energy efficiency.



703 HART SENATE OFFICE BUILDING, WASHINGTON, D.C. 20510 ■ CONTACT KRISTEN LUDECKE OR JUDE MCCARTIN (202) 224-5521
 FOR IMMEDIATE RELEASE: Tuesday, June 14, 1999

**Bingaman Touts Private Sector Research and Development
 Investment Act at Capitol Hill Technology Forum**

**Proposal Extends and Improves Tax Credit to
 Boost U.S. High Tech Growth**

WASHINGTON -- Speaking at a high-tech summit organized by the Joint Economic Committee today, U.S. Senator Jeff Bingaman (D-NM) made the case that the tax credit for research and experimentation should not only be made permanent, but made better. Bingaman is a member of the Joint Economic Committee and last year served as its Ranking Member.

"We need to make sure we remain a nation of innovators," Bingaman said. "For that to happen we need to ensure businesses are encouraged to research promising new technologies. We have a tax credit on the books that's supposed to do this, but it's not working as well as it should," Bingaman said.

"I know there is some sentiment out there that we should just make the credit permanent and leave the rest alone. I share the belief that making the credit permanent is a very important reform. But there are steps we can take to make the credit more beneficial to small businesses and start-ups, and to invest in the next generation of scientists. These are changes we should make now while we've got the chance," Bingaman said.

Bingaman, a member of the Senate Science and Technology Caucus, introduced the legislation in early May with Senator Pete Domenici (R-NM). It makes the research and experimentation (R&E) tax credit permanent, and it strengthens incentives for private companies to undertake research that leads to new processes, services and products. One recent study evaluating a permanent R&E tax credit estimated a \$41 billion stimulus for the economy by 2010, with \$13 billion added to the economy's productive capacity by 2010.

"The American economy owes much of its health to the increases in productivity that new high tech products and services have delivered. These capabilities have enabled American businesses to establish a position of world leadership in areas as diverse as medical and bio technologies, microelectronics and telecommunications. This bill will establish the stable research environment that companies need to make the long-term investments required

to keep our economy growing.”

Bingaman added, “This legislation provides new incentives for companies to invest in research at universities, national laboratories, small businesses and consortia partnerships. The output of these investments will be not only new products, but the next generation of trained scientists and engineers that will be the foundation of America’s technological and economic strength well into the next century.”

SUMMARY

Private Sector Research and Development Investment Act of 1999

This Bill addresses two broad goals:

- establishes a permanent Credit, and
- strengthens the formulation of the Credit.

The Bill enhances the Credit received by all users of the regular Research Tax Credit. Thus, all companies benefiting from its current formulation are positively impacted. The changes in the Credit are focused in the Alternative Credit and Basic Research Credit portions of the current Credit legislation and represent significant enhancements to these options.

The Bill addresses several concerns with the existing Credit

- base period used for the regular credit, 1984-88, is out-dated.
- 50% rule precludes most startups from gaining full credit.
- basic research credit is very difficult to use.
- alternative credit provides no strong incentive for increased research intensity.

In addition to permanence, the Bill increases the maintenance level of the alternative credit to 4%. (Thus the Bill meets the goals of some groups who favor simply permanence and 1% addition to the alternative credit.) In addition, the Bill:

- establishes a 20% marginal rate for increased research intensity for users of the alternative credit,
- changes the base period for alternative credit users to an 8 year average,
- eliminates the 50% rule for users of the alternative credit,
- encourages industrial partnerships with universities and national labs,
- expands definition of basic research to include all published work,
- enables basic research at FFRDCs to count toward the basic research credit,
- qualifies 100% of contract research accomplished at universities, national labs, and small businesses,
- encourages establishment of research-driven consortia by providing 20% credit for their research expenses,
- provides a phase-in of credit for start-up businesses,
- enables small businesses to count patent filing fees toward research expenses.

With these enhancements, the bill provides a permanent Research Tax Credit that addresses shortcomings in the current formulation of the Credit. Furthermore, the Bill meets the goals of constituents who favor only permanence or only permanence plus an increase in the alternative credit.

PREPARED STATEMENT OF REPRESENTATIVE DEBBIE STABENOW

I would like to thank the leadership of this Committee, Chairman Mack and Vice Chairman Saxton, as well as Senator Bingaman and Representative Stark, for bringing together such an esteemed group this morning and especially for opening the proceedings to all interested Members. I would also like to extend a warm welcome to the students and faculty at Seaholm, Madison, and Clawson High Schools in Michigan that are participating today through interactive video. They represent the vast possibilities that the technological explosion of the last decade holds out for education and worker training, and I am very glad they could be with us today.

The tremendous growth of the Internet and the High Tech industry in general has meant monumental changes in how people learn, conduct business, and communicate—and we have seen only the beginning. With these changes have come incredible economic opportunities and a real boon for the U.S. economy. The numbers are staggering: The Department of Commerce credits the IT industry with producing nearly 35% of real economic growth over the last three years. Further, that department also estimates that the value of the IT industry was more than \$680 billion in 1998, and that it accounted for 8% of the total GDP and almost 15% of total economic growth. In addition, computer industry positions pay on average almost two times more than the average American job.

However, this brave new world presents challenges as well as opportunities. For many Americans, access to the products and training necessary to share in this bright economic future is limited. Rural areas, for example, often face roadblocks to entering the Information Superhighway, such as having to pay long-distance rates in order to get online. We must endeavor to ensure that as many people as possible, especially children are able to take part in these exciting developments. The jobs of the next century will depend on possessing technological skills, which means a greater emphasis on math and science. Moreover, we must also take pains to train our teachers to take advantage of technology to further educational opportunities for our students.

There are many ways to accomplish these goals. I have supported efforts such as the e-rate, which allows schools and libraries to afford Internet connections, and Net Days, through which I have helped wire more than 50 schools in my congressional district. I am also the sponsor of bills that would allow tax credits to teachers to buy computers and also receive computer-related training. In addition, I host the Great Space

Adventures throughout my district, which creates interest in math and science education through the wonder of space. Families participate in a number of space-related activities, from launching their own rockets to meeting astronauts.

Besides making technology available to as wide an audience as possible, we must carefully examine government's role in relation to the IT industry. Technology is advancing so rapidly that future efforts at regulation may be futile at best, destructive at worst. A good example of this is export controls. Though updated in 1996, current export control thresholds are lagging behind technological and market realities. A PC selling for \$1,500 today has the same computing power as the \$20 million Cray supercomputers of the 1980's. The Pentium III chip to be introduced this summer will give standard PCs greater than 2,000 Million Theoretical Operations Per Second (MTO) capability, the current threshold requiring a notification before sale to a sensitive country. This will result in a significant increase in the applications, overwhelming current resources to process these requests, shutting American companies out of foreign markets.

Congress must make sure that its actions help nurture the IT industry, and measure such as making the Research & Experimentation tax credit permanent are steps in this direction. My colleagues and I on the New Democrat Coalition have been leaders in this area, and look forward to working with industry officials on the numerous issues before us. I thank the Committee leadership again for their efforts, and our panelists for their time and expertise.

PREPARED STATEMENT OF REPRESENTATIVE BOB ETHERIDGE

Thank you, Mr. Chairman. I want to thank our distinguished panel of witnesses, particularly Bill Gates of Microsoft and U.S. Education Secretary Richard Riley for many, going back to his service as a Governor of my state's neighbor South Carolina. And it is my considered opinion that Secretary Riley is by far the best Education Secretary we've ever had, and I think our nation owes him a great debt of gratitude for the leadership he has provided for the education of all our nations's children.

Mr. Gates, I appreciate your leadership on the vitally important mission of improving education that is so important to our continued high tech success. My district is in and around the high tech center at North Carolina's Research Triangle Park. Ours is a booming area, and technology has remade the face of town after town in my district. Education is the key to that continued prosperity. In fact, the biggest challenge facing local businesses is to field a workforce with high tech skills in a region where unemployment remains below two percent.

Prior to my election to Congress in 1996, I spent eight years as the elected Superintendent of my state's public schools. I am very proud of the advancements os the 17-point gain in eighth grade math (twice the national average gain) as measured by the respected NAEP tests.

To build on the success we have achieved and move confidently into the future, I conducted a comprehensive study of the science and math initiatives taking place in and around my district and recommended an action agenda for continued success. My agenda items include: making science and mathematics training and experiences available and accessible to all students; attracting more minorities into science and mathematics teaching; fostering innovative instruction and hands-on teaching methods; seeking partnership and cooperative investment between government, industry, colleges and universities and school systems. We need to find ways to awaken the interest of America's youth for participation in science, mathematics and technology.

People will certainly have differing ideas about how we achieve these goals, but one area we should agree on is the need to invest more in our children and education for the high tech industry. We know the wrong direction is the one some of the Congressional Leadership would have us take in abandoninig national responsibility to support education. In fact, there is talk of a \$9 billion to an \$11 billion cut to next year's appropriations bill that funds education. That is just plain wrong. The nation's chief state school officers have proposed instead increasing investment in education by fifteen percent per year over the next ten

years. We need more such bold proposals to rally support for education for the Information Age.

Finally, I want to congratulate Microsoft for its commitment to public-private partnerships to support high tech education. For example, two universities in my district, Shaw University and N.C. State have benefitted from Microsoft's donations of many thousands of dollars worth of software. Such good corporate citizenship will pay handsome dividends as the young people educated with these materials make their contributions to a better world in the years to come.

I would like to conclude with an urgent plea to Me. Gates to lead a national campaign to support education. As the most recognizable leader in the cutting edge field of high tech, you sir, are in a unique position to lead the charge to make sure America is prepared to lead the Digital Age of the next millennium.

PREPARED STATEMENT OF ROBERT W. HOLLEYMAN II

Mr. Chairman and Members of the Committee, my name is Robert Holleyman, and I am President and CEO of the Business Software Alliance* (BSA). From our headquarters in Washington, D.C., BSA conducts public policy, anti-piracy, and education activities in 65 countries around the world. On behalf of the CEOs of BSA's member companies, five of whom are testifying before you this morning, I want to express our sincere appreciation for the opportunity to participate in this week's unprecedented National Summit on High Technology.

Yesterday, you heard Federal Reserve Chairman Greenspan testify that America's technology industry has not only substantially boosted economic growth in our country, but more importantly, *it has fundamentally transformed the economy itself* by making American businesses more efficient, productive, and competitive than ever before. Today you are hearing from five CEOs of BSA member companies, who have played a pivotal role in this economic transformation. In addition to Mr. Gates, from whom you have already heard, these BSA CEOs are Jeff Papows of Lotus Development Corporation, Bill Larson of Network Associates, Dr. Eric Schmidt of Novell, and Jeremy Jaech of Visio. These CEOs, together with seven of their colleagues, are in Washington this week to participate in BSA's fourth annual CEO Forum.

As you have heard Mr. Gates discuss this morning, the U.S. software industry is, without a doubt, one of the great success stories of modern business history. The industry is among the fastest-growing and most dynamic sectors of not only the U.S. economy but, indeed, the global economy. Tomorrow, as Mr. Gates mentioned, BSA's CEOs will release the results of a new study, conducted by the economic consulting firm of

* Since 1988, the Business Software Alliance (BSA) has been the voice of the world's leading software developers before governments and with consumers in the international marketplace. Its members represent the fastest growing industry in the world. BSA educates computer users on software copyrights; advocates public policy that fosters innovation and expands trade opportunities; and fights software piracy. BSA worldwide members include Adobe Systems Incorporated, Attachmate Corporation, Autodesk, Inc., Bentley Systems, Inc., Corel Corporation, Lotus Development Corp., Microsoft Corp., Network Associates Inc., Novell, Inc., Symantec Corporation and Visio Corporation. Additional members of BSA's Policy Council include Apple Computer, Inc., Compaq Computer Corporation, IBM, Intel Corporation, Intuit Inc., and Sybase. BSA websites: www.bsa.org; www.nopiracy.com.

Nathan Associates Inc., that quantifies the *direct* impact of our industry on the U.S. economy as well as the *indirect*, "ripple" effect felt by other sectors of the economy as a result of the demand for software products. This study, based on industry data collected from 1990 to 1998, examines trend software industry growth rates throughout this decade in areas such as total industry sales, employment, and tax revenues generated. Based on these trends, and on economic models of the future of our industry, the report forecasts extremely robust industry sales, employment, and tax revenues through 2008, the last year projected.

These leaders of the information age are here to share their vision for America's technology future and to engage policy makers in discussions on the full range of issues critical to the industry's continued success. Their agenda - and that of the BSA - can be summed up by four key goals:

1. To tap the unprecedented economic promise of electronic commerce;
2. To promote continued technological innovation through strong international copyright protection;
3. To create more and better American jobs through trade liberalization; and
4. To ensure that legislative proposals before the Congress advance an overall, net-friendly economic policy.

Policy initiatives before this Congress will have a real and measurable impact on the bottom line of each and every company in our industry - and that means on the economic opportunities and standard of living of America's workforce. Let me give you just one example in the area of software piracy.

Through the enactment of specific legislation, the United States Congress armed our nation's Trade Representative with a powerful tool -- Special 301 -- that has allowed us to identify and take action against nations which turn a blind eye to rampant piracy of U.S. copyrighted works, including software. Special 301, combined with the international legal protections championed by the United States and adopted in the WTO Agreement on Trade-Related Intellectual Property Rights (TRIPS), paved the way for our industry to aggressively combat piracy on a global scale. As a result, in 1998 alone, BSA was able to initiate over 12,000 enforcement actions worldwide. These actions, in turn, have had a dramatic impact on worldwide piracy rates and on the size of the legal software market globally. Let me be specific: looking at just eight

of the world's largest software markets, by reducing piracy rates from their 1992 levels to the levels experienced in 1998, our industry was able to realize nearly \$4 billion in *additional* legal software sales *in just these eight markets in 1998 alone*. While piracy rates remain unacceptably high even in these markets, the pattern of action is clear: solid governmental policy initiatives provide our industry with the tools we need in order to reduce piracy internationally, and these reductions, in turn, overwhelmingly benefit *U.S.* software developers, who are far and away the world's single largest producers.

Through American ingenuity, technological innovation, and sound public policy, BSA's member companies and the U.S. software industry have become true global leaders. The result, as you will hear today, has been increased prosperity for *all* Americans. On behalf of our member companies, we are pleased to have the opportunity to appear before you this morning.

PREPARED STATEMENT OF JEFFERY PAPOWS

Good morning Mr. Chairman, Mr. Vice Chairman and Members of the committee. My name is Jeff Papows and I am the President and CEO of Lotus Development Corporation. I am pleased and honored to be part of the first ever High Tech Summit hosted by the Joint Economic Committee of the U.S. Congress.

Mr. Chairman, I commend you and your colleagues for the leadership you demonstrate in holding these proceedings. The U.S. software industry has materialized as one of the fastest growing and most innovative sectors of the U.S. Economy creating thousands of new jobs and unlimited opportunities for entrepreneurs and small businesses. Since 1994 U.S. Software sales have grown at a continuous rate of 15.4% - in contrast to a continuous rate of 5.4% for overall Gross Domestic Product. In effect, the U.S. Software industry is growing almost three times faster than the economy as a whole. It makes sense to take stock of what we need to do as a nation to keep things on track. By working together, we can make sure the right framework is in place for continued growth in the U.S. Software industry which paves the way for a strong economy overall.

In my home state of Massachusetts, corporate headquarters for Lotus, there are over 2,348 software companies with revenues of \$8.4 billion and that number continues to grow each year. To keep this trend moving in the right direction, Massachusetts is working to put policies in place that will foster an Innovation Economy - an economy based on intellectual capital and the ability to translate new ideas into competitive products and services fast than the competition. So what is happening at the Federal level, is happening at the state level as well.

Corporate History and Community Involvement

I would like to give you some background on the products and corporate culture of our company. Lotus Development Corporation, an independent subsidiary of the IBM Corporation, is based in Cambridge, Massachusetts and has about 8,500 employees worldwide. Founded in 1982, Lotus popularized the electronic spreadsheet and launched the personal computer business software industry with Lotus 1-2-3. In more recent years, Lotus is the leading supplier of the software that lets you send e-mail around the world, conduct electronic commerce over the

Internet, and share Web based information across networks. These software products, Lotus Notes and Lotus Domino, are referred to as messaging and groupware solutions. These technologies represent the new foundation for our industry and the exploding Electronic Commerce marketplace.

As we began the decade of the 90's - few people used e-mail as a means of communication. In 1999, 2.7 trillion e-mail messages will traverse the Internet in the United States alone, more than four times the volume of traditional postal-delivered mail. Internet commerce is doubling every 100 days. The Internet, like the railroads of the 1800's, has forever changed the way we communicate, conduct business, and measure our economy.

The Internet also gives us the chance to make real a vision we have at Lotus: "Connected communities that shrink the world; Access to ideas that expand the world." We try to live that vision in the market place through the products we create, and in the many communities where we have a presence around the globe. At Lotus, we believe in sustaining and supporting the communities in which we live and work through a strong commitment to community service. The Lotus Philanthropy Program, founded in 1985, facilitates the sharing of a portion of the company's profits (1% of pretax profits), products and people in ways that assist individuals and communities, particularly those disadvantaged due to race or class status, in achieving their highest potential in terms of social and economic development.

The following statements express the core values of Lotus Philanthropy:

- The development of community partnerships is a fundamental component of the company's overall business strategy.
- Individuals and communities have the inherent capacity to provide the most effective solutions to the challenges they face.
- Civil societies are defined by the protection of civil rights, the defense of human rights, the preservation of diversity, and the promotion of democracy.
- Equitable access to technology -- and the power of knowledge and open communication -- is fundamental to a democratic society.

The company combines monetary contributions with employee time which allows us to get much more directly involved in the human efforts behind philanthropy. Lotus is very proud of these efforts, and pleased that we have been able to increase our community involvement in the wake of the IBM merger with goods and services in kind. For example, in working with the Massachusetts Tech Corps to wire the public schools to the Internet we were able to provide human capital for installation and training as well as personal computers and software.

Many of our philanthropy programs are in force around the world reflecting the global nature of our company.

U.S. Software Industry - A Global Business

As the engine that drives the Internet, the software industry is truly a global industry. 65% of Lotus' revenues are generated off-shore and these are without a doubt our largest growing markets. The total worldwide market for software alone is predicted to double between 1996 and the year 2001 from \$105 billion to \$203 billion. Our ability to continue to create innovative products and sell to these markets overseas will be key to our success at sustaining economic growth, creating more jobs, improving wages, and contributing to a better standard of living for all Americans.

A key indicator of the software industry's increasing importance to the U.S. economy is its contribution to the U.S. Balance of trade. In 1997, the U.S. Software industry contributed a \$13.0 billion surplus to the U.S. goods, services and income trade balance. In contrast, the overall U.S. Economy registered a trade *deficit* of \$36.4 billion. The software industry's surplus reflects an historic trend of increasing export activity. As our industry's sales have grown, an increasing proportion of those sales are made overseas.

Trade Barriers - Export Controls on Encryption Technology

Clearly, the U.S. Software industry must remain fully competitive in export markets to continue to contribute this vital trade surplus to our overall economy. We need to be vigilant of trade barriers, both within and outside our country, if we are to keep strong growth on track for the U.S. Software industry. Our industry's competitiveness in foreign

markets is becoming more and more dependent on the U.S. Government easing restrictions on the export of software with strong encryption technology. Outdated export restrictions increasingly cripple our industry's ability to supply secure, American-made systems to foreign companies and are allowing competitors abroad to displace U.S. Software products. If this continues, you will see a reduction in foreign sales by U.S. Software companies, a reduction in the industry's trade surplus, and an even greater U.S. Trade deficit

Fortunately, Congress is making a serious effort to bring down this self-imposed "trade barrier" and bring our export policies in line with market realities. Legislation has been introduced this year in both the House and the Senate to liberalize export controls on encryption. In the House, H.R. 850, the Security and Freedom through Encryption Act (SAFE), introduced by Representatives Bob Goodlatte (R-VA), and Zoe Lofgren (D-CA) ensures that all Americans may use and sell any encryption domestically and provides much needed export control relief. The bill, with over 250 cosponsors, passed the House Judiciary Committee in March and is currently moving through the Permanent Select Committee on Intelligence, Armed Services, International Relations, and Commerce.

In the Senate, The Commerce Committee completed hearings last week on the Promote Reliable On-line Transactions to Encourage Commerce and Trade Act (PROTECT - S. 798). While this bill prohibits domestic controls, it does not go as far as the SAFE Act in giving much needed export relief to technology companies. It is encouraging, however, to see such strong leadership and momentum in both Houses of Congress which gives me hope that this may be the year we see meaningful legislation go to the President for signature.

The Executive Branch, over the last several years, has made a series of policy decisions that allow for export of strong encryption to selected industry segments (banks, financial institutions, insurance companies, health care providers, and subsidiaries of U.S. Corporations operating abroad). While we welcome these changes, they fail to provide export relief worldwide consumers demand. We are still left with a policy that provides the U.S. Software industry with market access to only 50% of the global market outside the U.S. As the global leader in the Software market, we cannot afford to cede 50% of the market place to foreign competitors.

I applaud the Administration's commitment to an ongoing dialogue with industry on this issue. While it has been painful at times for everyone involved, the conversation has produced a better understanding on both sides. I encourage the Congress to consider ways to continue to foster this dialogue between government and the technology industry to find solutions to law enforcement's legitimate concerns and to help legal authorities develop the technical means they need to address the problem. An example can be found in the Senate PROTECT Act which calls for the National Institute of Standards' Information Technology Laboratory to improve the government's technological capabilities. A joint NIST / Industry advisory board is tasked with providing a forum for communication and coordination between industry and the Federal government regarding information security issues and to keep Federal law enforcement and national security agencies up to date on emerging technologies.

America's export policy should promote widespread deployment of American products with encryption capabilities in the worldwide market. Resolution of this issue would eliminate one of the chief barriers to our growth outside the United States.

Other impediments to our growth are dependent on more complicated and multifaceted solutions.

Our Industry's Biggest Trade Barrier - Software Theft

Unlike many other major U.S. Industries, the software industry does not face what would be considered traditional trade barriers. Most nations have very low, if any, customs duties on software, and traditional market access barriers - such as quotas or content restriction -- do not tend to apply to most software products.

This does not mean that the industry does not face trade barriers in overseas markets. On the contrary, the industry faces a barrier that is massive and wholly unfamiliar to most other large export sectors of the U.S. Economy: Widespread theft. The responsibility of the Federal Government to use all tools available to combat piracy of intellectual property over the Internet extends to the global marketplace. Thankfully, the United States Government is actively engaged in combating software piracy around the world. One example is the top priority being given to

full implementation of the WTO Agreement on Trade Related Intellectual Property Rights (TRIPS) by January 1, 2000 - TRIPS is the bedrock of the software industry's ability to fight piracy and continue to compete internationally.

The U.S. Congress answered this call to fight global piracy, and specifically Internet piracy, by enacting the 1998 Digital Millennium Copyright Act (DMCA) during the last Congress. This allowed the U.S. Government to be among the first countries to implement the WIPO Copyright Treaty - a critical step towards recognizing the rights of copyright owners in the digital era and combating the theft of copyrighted works globally. It gave the United States Government the standing it needs to encourage other countries to follow suit.

LEADING BY EXAMPLE

Government agencies and public institutions are typically among the largest users of computer software. In the United States, for example, the Federal Government is the single largest purchaser of computer-related services and equipment with procurements valued at over \$20 billion annually. As such, government leaders have an obligation to establish legalization policies and procedures that both prevent software piracy within the public sector and set an example for the private sector to follow.

The U.S Government has recently stepped up its efforts to promote government legalization - first by implementing its own "clean house" policy, and second by urging foreign governments to do the same. On September 30th of last year, President Clinton signed an Executive Order on Computer Software Piracy, which for the first time clearly articulates legal software use and procurement requirements for Federal agencies and recipients of Federal funds. The White House has directed the USTR to work with foreign governments to adopt similar government legalization policies and Ambassador Barshefsky has undertaken this initiative vigorously.

The software industry is working closely with the USTR and other U.S. Government agencies to comply with this directive and ensure that foreign governments adopt adequate legalization policies. In recent months, four government legalization decrees were issued, most notable was the issuance of the State Council decree in the People's Republic of

China (PRC). But much work remains to be done. In order for these directives to be worth the paper they are written on, they must be implemented in a structured and transparent manner. This is particularly important in the case of China.

We urge Congress to support these efforts to promote proper use and procurement of software among governments throughout the world.

The economic impact of global software piracy extends beyond the world of the software industry. According to a study by the economic consulting firm of Nathan Associates, Inc., software theft in 1996 cost the U.S. Economy 130,000 jobs and an additional \$1 billion in tax revenues. If the United States were to eliminate software piracy by the year 2005, our economy would gain (on top of projected growth) an additional 216,000 jobs, \$8.8 billion in wages, and \$1.6 billion in tax revenue. Certainly something to shoot for. What is at stake is the future of an industry that makes a major contribution to the U.S. Economy, jobs and our global competitiveness.

PREPARED STATEMENT OF WILLIAM LARSON

Mr. Chairman and Members of the Committee it is an honor to appear before you today on behalf of Network Associates. Thank you for the invitation.

Before I begin, I would also like to thank the Members of the Committee for the great work of the last Congress on behalf of the high tech industry. Your efforts in the areas of H1B visas, intellectual property protection, and uniform standards for securities litigation are vital to our industry, and are greatly appreciated.

Network Associates is a member of the Business Software Alliance (BSA), which represents the world's leading software developers. I am in Washington today as part BSA's 4th annual CEO Forum, during which we will meet with Congressional leaders and the Administration to discuss policy issues of particular importance to the U.S. software industry. Tomorrow we will release the results of a new study commissioned by the BSA detailing our industry's impressive contributions to the economy, particularly in terms of the number of high-skilled, high wage jobs we create in the United States.

BSA's policy agenda this year focuses on promoting the continued, rapid growth of electronic commerce; ensuring strong copyright protection, both in the United States and internationally; creating increased opportunities through trade liberalization; and a number of related priorities currently before the Congress, including the need for strong American encryption technology; solutions to resolve the Y2K challenge; and ensuring America's leadership role in innovation.

Many of you may not be familiar with the name of Network Associates, but you are familiar with our products. Network Associates makes McAfee VirusScan, Pretty Good Privacy encryption, Gauntlet firewalls, and the CyberCop line of intrusion detection products. Many of these products are being used right now in your offices here on Capitol Hill. We are the third largest software company in the world, and the world's largest maker of security software. Last year we had revenues totaling one billion dollars, and we employ over 3000 people in 44 locations around the globe.

Today my colleagues and I are talking about the key role that software

companies play in the U.S. economy. The facts are hard to dispute. Our industry creates jobs: better, higher paying jobs than other manufacturers. And, we are continuing to grow and to employ. Our industry now employs over 800,000 people, and that employment is growing at an annual rate of over 13 percent – compared to a total private industry rate of 2.5 percent. At this rate, there will be 1.3 million workers in the software industry by the year 2008.

The U.S. software industry is dominant globally. Our industry alone created a \$13 billion trade surplus in 1997. **However, in one very important sector – security software – that dominance is threatened by misguided U.S. policies.**

The security software market is booming, exceeding 50 percent (that's five-zero) growth annually. In 1999, the non-U.S. market for security software is projected to be over \$1 billion.

This growth in a relatively new market sector emphasizes the fact that security is an essential element to the continued development of the information infrastructure and to the growth of e-commerce, and potential customers worldwide are recognizing this. Without robust security systems, consumers and businesses will not develop the trust necessary for the transition from traditional commercial activities to electronic commerce and online communication. Our customers, including financial institutions, manufacturers, governments and other organizations have recognized this reality, and are now procuring the technology necessary to ensure that their networks are secure. This technology includes firewalls, virtual private networks (VPNs), intrusion detection systems, and desktop encryption. To promote the U.S. software industry's lead in these important technologies, it is essential that U.S. export controls on encryption products be reevaluated.

Here are some real life examples of how U.S. companies like Network Associates are losing sales of these key products to foreign competitors due to U.S. export controls.

- Network Associates had secured a deal with Chrysler Corporation for desktop encryption products prior to the acquisition of Chrysler by Daimler Benz. U.S. laws allow more liberal exports to foreign offices of U.S.-owned companies, but not to foreign-owned companies. Daimler-Chrysler is now looking to German company

Utimaco, which can supply encryption to all its offices, and its suppliers worldwide. This is a seven-figure deal that could be lost.

- Network Associates is in competition with Checkpoint – an Israeli software company – for a contract worth about half a million dollars with the Orient Overseas Container Line Ltd. (Hong Kong). However, the customer is looking for a strong encryption VPN, which we cannot provide due to export regulations.

For these and other international customers, choosing a security solution is somewhat like installing plumbing in a building under construction: once customers select foreign security systems and build networks around them, there will be no opportunity for U.S. companies to regain that market leadership. The time to act is now, as companies and organizations are building and rebuilding their networks to enable online communications and e-commerce.

In our surveys of the market, we have found over 750 international products that compete directly with U.S. security products. This number is growing because U.S. companies are being forced to cede the market to these competitors.

I would like to leave the Committee with one thought. We have discussed how important the software industry is to the U.S. economy, and how important security software is to the growth of e-commerce and the information infrastructure. Wouldn't it be better for all of us if U.S. companies, such as those represented at this table, be the dominant force in the international market for these key technologies? Or is it preferable for U.S. companies to cede this strategic market to their foreign competitors, leaving U.S. companies and government agencies reliant upon foreign-made encryption products to meet their security needs?

I thank the Committee again for the opportunity to come before you today, and I look forward to your questions.

THE INTERNET, IDENTITY AND PUBLIC POLICY

Testimony before the Joint Economic Committee of the US
Congress

June 15, 1999

DR. ERIC SCHMIDT

Chairman and CEO

NOVELL, Inc.

THE INTERNET, IDENTITY AND PUBLIC POLICY

DR. ERIC SCHMIDT

Chairman and CEO, NOVELL, Inc.

Mr. Chairman and members of the Committee:

My name is Eric Schmidt. I am the Chairman and CEO of Novell, Inc., which is the world's largest provider of directory enabled network software.

I want to thank you, Chairman Mack, for holding this hearing. And I want to add a special note of thanks to Senator Bennett and the Business Software Alliance who have been so instrumental in making it a success. As you have heard from previous witnesses, the US high-tech sector has made an extraordinary contribution to America's economy. Hearings such as this one help keep open the lines of communication between Washington, DC and Silicon Valley, which is crucial to the success of the new digital economy. In my comments, I will discuss the evolution of the Internet and note some of the major public policy questions facing us.

When discussing the new, networked economy, I firmly believe we're at the beginning, not the end, of something very big. And even though these are still the early days of the Internet, it is clear that the network is becoming the centerpiece of every unique computing activity.

The first phase of the Internet explosion was all about getting connected. It was the "hook-up and infrastructure" wave. Once people overcame the problem of getting connected, the growth of the network exploded. The only problem was, no one could find anything or anyone! This created a critical need to manage the profiles of the people, devices, and objects on the network.

The second wave of the Internet is all about managing the relationships that people develop over the web.

THINK ABOUT IT: Every time you register with a web site—whether to buy books on Amazon.com or airline reservations with Sabre—you are creating a relationship with an outside organization. But in doing so, you are providing information about your life, some of it quite personal. At the very least, online enrollment forms want your name, street address, email address, and telephone number. They would also like a credit card number, thank you, if you'd like make a purchase. Do you prefer window or aisle? Do you like mysteries or romance? Manual transmission or automatic? What is your shoe size? Could we have your Social Security Number? Do you take any prescription medicines? Do you have any pre-existing medical conditions?

When you visit a website, the website is actually visiting you!

The trail of data individuals leave behind when they use the Internet---what some call digital fingerprints---is a rich source of information about their habits, their preferences and the company they keep.

In disclosing this information to a variety of online organizations, you are establishing a *digital identity*---a virtual you---on the virtual world of the Internet. But who manages that relationship? The stark answer is that nobody does. There's no IT manager acting on your behalf. There's no way of preventing one organization from sharing information with another. Conversely, there's no way of encouraging some information to be shared if it's in your best interest.

If anyone should manage the relationship, it should be you!

This is the position that the industry is advocating, and it also happens to be an issue that Novell is taking very seriously. Our mission is to provide people with a coherent way to manage everything they want to do on the Net.

The explosion of Internet identities and the need for managing them has powerful public policy implications. The debate about online privacy shows just how serious they are.

For now, government's role should be to encourage private sector solutions, investigate

and prosecute deceptive business practices, and monitor privacy abuses to determine the actual harm to consumers. It is only through a clear understanding of genuine consumer needs and the private-sector's ability to meet them that we will be able to craft appropriate policies. The last thing Congress should do is rush to judgement about the need to regulate this new medium.

But there is an area where Congress does have an immediate and compelling role to play, which is on the minds of many of my peers in the industry: That is, the role of the Federal Government in supporting fundamental research.

As a scientist by training, I am keenly aware of the tremendous power of research. It is thanks to Federal funding for research in the post-war years that we have the Internet. One of the best investments Congress can make is to assure strong support for Federal research *and* systematic incentives for commercial R&D. Today, we are short-changing both of these. Except for small increases in the past three years, overall Federal support for research has been flat or declining for a decade. Moreover, Washington has treated the R&D Tax Credit as a temporary political fix rather than as a sustained incentive for innovation. We must make substantial, consistent increases in Federal funding for basic science, engineering and technology research. And we must make the R&D Tax Credit permanent! A permanent R&D Tax Credit is not just an issue for the BSA or the software industry, but for all of high tech. It is TechNet's top priority for 1999.

Phase One of the Internet took many people by surprise. The second wave will be just as dynamic. We are entering an era that will be defined by an always on, always aware network... and a network that is always aware of the identity of the user. With its arrival, I believe, we will see the fulfillment of the Internet's great promise to enable and enhance digital communities in business, government services, education, medical research, culture, and every other area of human endeavor and interest. A more human network, has the potential to improve our lives in ways we haven't yet imagined.

Thank you very much.

STATEMENT OF JEREMY A. JAECH

CHIEF EXECUTIVE OFFICER, PRESIDENT AND CHAIRMAN OF THE BOARD

VISIO CORPORATION

BEFORE THE JOINT ECONOMIC COMMITTEE

NATIONAL SUMMIT ON HIGH TECHNOLOGY

June 15, 1999

Good morning, Mr. Chairman and members of the Committee. My name is Jeremy Jaech and I am President, CEO and Chairman of Visio Corporation. I am honored to be here today participating in the Joint Economic Committee's first National Summit on High Technology. Thank you, Mr. Chairman and members of the Committee, for your recognition of the importance of the technology industries to our nation's technological leadership and economic growth.

Visio Corporation, headquartered in Seattle, Washington, develops, markets and supports drawing and diagramming software for enterprise-wide use by businesses, governments and other organizations. Founded in 1990 with just a handful of employees, Visio currently employs over 600 people and is pioneering the business-drawing category in personal computer software. Our products are sold in more than 45 countries and sales outside of the U.S. represent approximately 40 percent of Visio Corporation's total revenue. Our mission today is to become the single worldwide standard for creating, storing and exchanging drawings and diagrams in business. I am pleased to report that we are steadily achieving this goal.

Technology and innovation are clearly critical to Visio's business. What is less obvious, however, is the critical role that federal science policy has played and will continue to play in our nation's continued technological achievements and the corresponding economic rewards that all Americans will enjoy.

For that reason, I want to thank the members of the Committee for sponsoring these hearings that focus on the critical role that technology plays in today's economy. I would like to use this opportunity to highlight what I believe is one of the most fundamental policy issues supporting our nation's continued technological and economic leadership: an enhanced national commitment to research and development.

The history of Visio and of our industry perfectly illustrates the critical role of federal policy in supporting and empowering technological advancements that result in new companies and industries with enormous impacts on the U.S. economy.

Most Americans probably don't realize that many of today's most exciting technological breakthroughs are the result of federally sponsored research, much of it conducted at our nation's universities. During the past decade, federal investments in information technologies enabled fundamental advances that have been a major factor in the continued leadership of the United States. For example, the Defense Advanced Research Projects Agency (DARPA) fueled the development of the computer-aided design software industry by supporting early university-based research in integrated circuit layout, simulation and synthesis tools.

Visio has built upon computer-aided design software programs to create a new and distinct market category: computer-based drawing and diagramming for general business users. We have gone beyond "traditional" design software to create an entirely new market in drawing and diagramming software for business users. Today we are the leading company in this product category, our products are the industry standard, and are extending our core technology into new segments.

Just as research and development was critical to the birth of the computer-aided design industry, R&D continues to play a central role in Visio's growth. Our ability to constantly innovate and to translate those innovations into new products and services is unquestionably our lifeblood. I believe any technology company would agree. It is no exaggeration to say that R&D is one of the largest contributing factors to the past, present and future economic growth of the technology industries and of the U.S. economy as a whole.

The American economy reaps the rewards of the federal and industry investment in R&D in numerous ways -- through the creation of thousands of new, well-paying jobs, increased productivity and more effective communications. In short, our nation's investment in innovation has paid tremendous dividends through the development of entirely new industries and a communications revolution.

The information technology industries accounted for one-third of U.S. economic growth from 1995-1997 and today these industries are growing at more than twice the rate of the rest of the economy. These industries are supporting high quality jobs for American workers. The average worker in information technology and IT-related jobs earned 64% more than the average private sector wage.

Perhaps most important, advances in technology have significantly improved the quality-of-life for all Americans. We at Visio are proud of the small part we are doing to contribute to growth in efficiency and productivity, new ways of doing business, and tremendous advances in our ability to communicate with one another.

Unfortunately, however, the American investment in basic research has declined in the past decade and is threatened by continued budgetary pressures. The Council on Competitiveness reports that federal funding for research decreased at an average annual constant dollar rate of 2.6 percent per year from 1987 to 1995.

To keep America's economy growing into the next century, government and industry must work together to reverse this trend. Industry and the federal government must make a joint commitment to increasing the American investment in research and development.

The federal role should be to ensure consistent increases in funding for basic science, engineering and technology research. As the February 1999 report of the President's Information Technology Advisory Committee points out, the federal role is irreplaceable in ensuring sufficient investment in critical, long-term research for which no market advantages are foreseeable.

Top priorities for funding increases should include DARPA and the National Science Foundation, which provides 25 percent of all federal support for basic research at academic institutions.

A strengthened federal commitment to basic research has an added benefit: It is among the most effective ways to invest in the American education system. Federally supported basic research provides hands-on scientific training to students in America's colleges and universities and fosters new generations of technology industry leaders.

A renewed federal investment in basic research must be matched by a renewed commitment to R&D by corporate America. The establishment of a permanent R&D tax credit would be the most effective tool to spur additional corporate research and development.

Since its enactment in 1981, the R&D Tax Credit has provided a powerful incentive for increasing research by American industry. A 1998 study by Coopers & Lybrand indicated that the Credit provides a 31 percent return on investment -- more than twice the rate of typical incentives.

However, the Credit's history of short-term extensions (and gaps in coverage) have created a level of uncertainty that makes it extremely difficult for firms to rely on the

Credit as an incentive to invest in longer-term research. This is ironic, as it is exactly this type of long-term research that the Credit is designed to encourage.

Making the R&D Credit permanent will provide tremendous benefits to our nation, in terms of technological advances and economic growth. Coopers & Lybrand estimated that a permanent R&D Credit would result in an additional \$41 billion in R&D investment between 1998 and 2010.

To conclude, these are extraordinarily exciting times. New technologies, products and markets are changing the way we do business, the way we communicate and the way we live our lives on literally a daily basis. The rapid pace of this change makes it easy to forget that this progress has its roots firmly in the past and in our nation's strong historic commitment to innovation.

Industry and the federal government must rededicate themselves today to a strengthened national R&D policy to ensure that the technology and productivity gains of the past continue into the next century.

On behalf of Visio Corporation, I'd like to thank the members of the Joint Economic Committee for your commitment to these critical issues. We look forward to working with you to achieve a strengthened national investment in a balanced research and development portfolio.

Presentation to the Joint Economic Committee
Charles M. Vest, President
Massachusetts Institute of Technology
June 15, 1999

Introduction

I want to emphasize five points this morning:

- I. Complacency is the enemy.
- II. The U.S. innovation system must be understood.
- III. The most vulnerable parts of this system are education and long-term research.
- IV. The many areas of Science and technology are important, interrelated and evolving in unpredictable ways.
- V. There is an essential role for the federal government in supporting research and education.

I. Complacency is the enemy.

Our economy is riding high.

Some even believe that we are in a "new economy."

In any event, this is the age of knowledge and innovation. Companies are fast-paced, knowledge-based, global, electronically interconnected, and spawned by entrepreneurs.

This means that our continued success depends on new knowledge and appropriately educated and trained people.

Yet the knowledge driving today's industries has been accumulated during the past 40 years of federal and industrial support of long-term research.

Are we doing the right things to generate the knowledge that will drive future economic success?

No.

We are reducing our investments. We are going in the wrong direction.

Total federal R&D expenditures have been steadily decreasing by about 2.6% per year. In 1985 federal R&D was about 1.2% of the U.S. GDP. In 1997 it was about 0.8% of GDP.

Federal spending on basic and applied research fell by 12% as a share of GDP between 1993 and 1997.

Are we attracting increasing fractions of our bright young men and women into science, mathematics and engineering and creating broad technical literacy?

No.

This situation is unfortunately acute among minorities and women.

We cannot be complacent. We must turn these situations around.

II. The U.S. innovation system must be understood.

Innovation - both technological and organizational - increasingly drives the strength of businesses and indeed, entire economies.

In the U.S., we have a loosely coupled innovation system of industry, government, and academia. It generates new knowledge and new technologies through research, and it educates men and women to use this new knowledge to create new products, processes and services and move them into the commercial sector.

The shock of the Japanese challenge in the late 70s and early 80s stimulated our manufacturing industries to level the playing field of world competition by dramatically improving manufacturing and reducing product cycle times.

In large companies, accomplishing this also involved dramatically changing the R&D function in very important ways. R&D efficiencies were gained, discovery processes were accelerated, and the research and engineering functions were better integrated. This was very important and effective. But it came at a price:

Most corporations cut back very substantially on fundamental, long-term research. Why? Because it is not clear that the benefits of such research will likely accrue directly to the performing company. Coupled with declining federal support, this does not bode well for future U.S. innovation.

Indeed, Michael Porter of Harvard and Scott Stern of MIT have constructed an "innovation index" of nations that involves analysis of 8 factors:

- Number employed in R&D
- Expenditures on R&D
- Openness to International Trade and Investment
- Strength of Protection of Intellectual Property
- Share of GDP Spent on Secondary and Tertiary Education
- GDP per Capita
- Percentage of R&D Expenditures Funded by Industry
- Percentage of R&D Performed by Universities

The results show that the U.S. may indeed be living off historical assets that are not being renewed. The U.S. is still near the top, but the gap with other nations is becoming increasingly small.

Projections into the future show us likely to drop below several other countries by 2005 - largely because of cutbacks in R&D spending, emergence of shortages in the talent pool, and slowing of policy innovation.

III. The most vulnerable parts of this system are education and long-term research.

Education

Much of our public K-12 system is a disgrace.

Far too many teachers major in education, rather than in a discipline and use of computer technology is lagging.

In 1995 the percentage of 8th grade students reporting that they have a computer at home was greater in 15 other countries than in the U.S.

There are both positive and negative trends in higher education in science, engineering and mathematics.

5% of U.S. 24 year olds have earned natural science or engineering (NS&E) degrees. This compares with 6.4% in Japan, 7.6 % in Korea and 8.5% in the UK. A decade ago, we led all of these countries in this metric.

U.S. Bachelors degrees in NS declined from 1976 - 1990 then grew at 7.7% annually from 1990 - 1995.

U.S. Bachelors degrees in Engineering declined from 1986 - 1990 then essentially stabilized.

U.S. Doctoral degrees awarded in S&E were stable from 1975 - 1985, but grew steadily since then.

Engineering, math and computer science account for most of this growth.

However, in 1986 about 30% of NSE doctoral degrees were awarded to non-US citizens.

In 1995 about 50% of NSE doctoral degrees were awarded to non-US citizens.

Universities maintain U.S. Basic Research Strength

Universities are the largest performers of the basic research in the U.S, conducting over 50% of all basic research. Universities increasingly are the only game in town when it comes to long-term research that ultimately generates the truly new ideas that define the future.

Universities help drive the Economy

The stake in research universities is high. For example, a 1997 study by BankBoston showed that MIT graduates founded or co-founded over 4,000 companies employing 1.1 million people with revenues of \$232 billion.

In the field of biotechnology alone, there are at least 45 U.S. companies founded or cofounded by MIT graduates, or else founded on MIT patents. They employ nearly 10,000 people and produce annual revenues of \$3 billion, roughly one quarter of the revenue of all U.S. biotechnology companies.

I am confident that many other major universities such as Stanford or Illinois could tell similar success stories.

Nation-wide, about \$17 billion of product sales and 137,000 jobs have been generated based on patents licensed by universities.

The role of universities in commercializing technologies they develop has been dramatically enhanced by the Bayh-Dole Act (1980) that gives universities the IP rights developed under federal grants and contracts, with the federal government retaining free usage.

In 1978 - i.e. before Bayh-Dole - the government held 28,000 patents, but only 5% had been licensed. In 1992 - soon after Bayh-Dole went into effect - 2700 patents were filed by U.S. universities and over 1500 licenses were granted.

This highly effective legislation must be maintained.

IV. The many areas of science and technology are important, interrelated and evolving in unpredictable ways.

Companies are being formed today in areas that hardly existed a few years ago:

- Gene therapy
- Electronic commerce
- Financial technology
- Three-dimensional printing
- Optical communication
- Haptic devices
- Biological materials
- Environmental technologies
- Smart materials, etc.
- Biology will soon become the fourth science underlying engineering - joining physics, chemistry and mathematics.

The seamlessness of science and technology, and the interrelation of their subfields, is demonstrated every day. Medical CAT scanners depend upon fast computation and efficient sensors. The advances in mapping and sequencing of genomes depend on robotics, computer science and combinatorial mathematics. Advances in one area are necessary for progress in another, and synergies at their interfaces are increasingly important.

Every agency has a vital role. For example, the Department of Defense supports half of all engineering and computer science research conducted at our nations public and private universities.

V. There is an essential role for the federal government in supporting research and education.

In 1998 the House unanimously adopted H.R. 578, a resolution based on the report "Unlocking the Future," authored by Rep. Vern Ehlers, Vice Chairman of the House Science Committee. Soon after, again unanimously, the Senate passed S. 2217

promoting federal investment in R&D. Senators Frist, Rockefeller, Domenici, Lieberman, and others led that effort. Together these actions demonstrate a growing bi-partisan agreement that support of science and engineering research, especially basic research, is an essential function of the Federal government in the 21st century.

The report "Renewing the Federal Government-University Research Partnership for the 21st Century" issued by the National Science and Technology Council in April 1999 demonstrates a deepening understanding of the issues across all federal agencies.

What is missing is a sense of urgency.

Economists generally agree that more than half of our economic growth since World War II is due to technological innovation, largely through federally sponsored research in our universities.

The information technology industry represented by the entrepreneurs and leaders at this table exists primarily because of strong DOD investment in university research 30 years ago. And it is advancing through the creative work of bright young men and women graduating with educational experiences enabled in very large measure by federal support of university research.

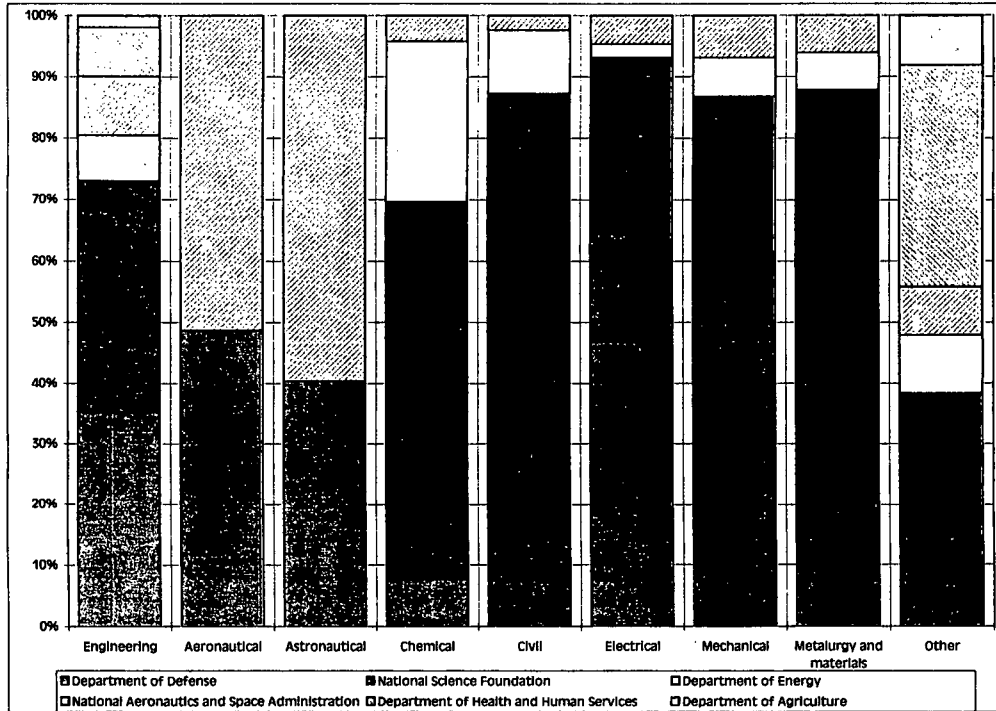
We must perform the research and educate the students today that will assure such innovative industries and a vital economy 20 years from now.

I particularly ask your leadership in accomplishing four objectives:

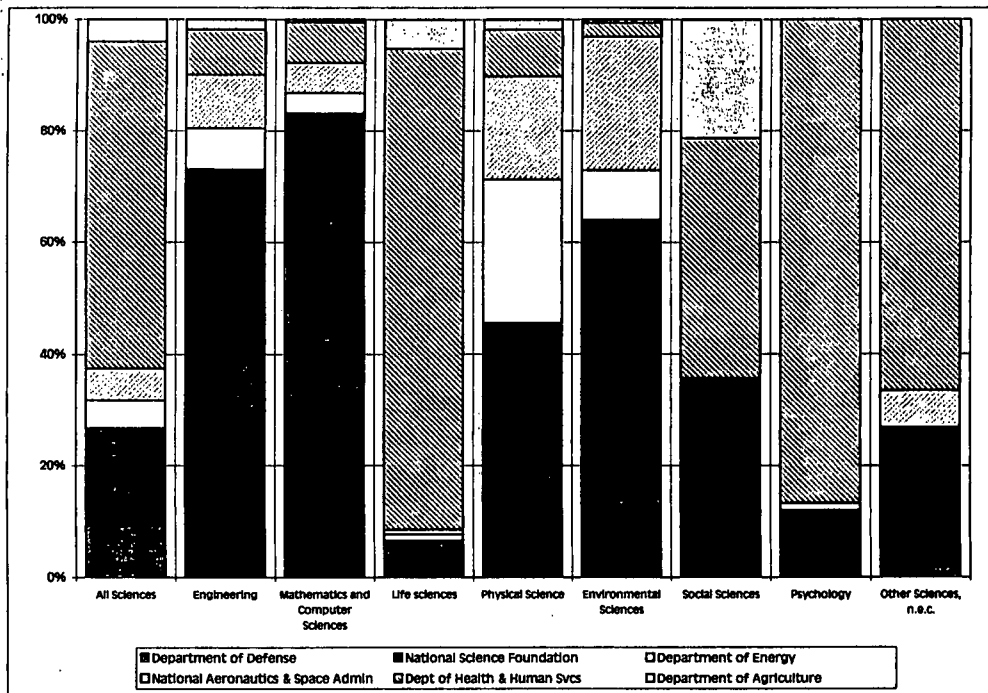
- Give your highest possible priority to stable and substantial federal funding for fundamental research.
- Invest in fundamental research across the full spectrum of scientific, engineering and mathematical disciplines.
- Increase focus on partnerships - university-industry partnerships, and industry-government-university partnerships.
- Improve the policy environment for both private-sector and university research.

Thank you for this opportunity to address this urgent topic.

Federal obligations for ENGINEERING research performed at universities and colleges, by agency and field of science and engineering: fiscal year 1997 (estimated)



**Federal obligations for research performed at universities and colleges, by agency and field of science and engineering:
fiscal year 1997 (estimated)**





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Information for Contributors
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Editorial & News Contacts
 North America: 1200 New York Avenue, NW, Washington, DC 20005 Editorial: 202-326-6501, FAX 202-289-7562, News: 202-326-6500, FAX 202-371-9227 • Bureau: Berkeley, CA: 510-841-1154, FAX 510-841-6339, San Diego, CA: 760-942-3252, FAX 760-942-4979, Chicago, IL: 312-360-1227, FAX 312-360-0537
 Europe Headquarters: Battenan House, 82-88 Hills Road, Cambridge, UK CB2 1LQ; (44) 1223-326500, FAX (44) 1223-326501 Paris Correspondent: (33) 1-49-29-09-01, FAX (33) 1-49-29-09-00

Asia News Bureau: Dennis Normile, (81) 3-3335-9925, FAX (81) 3-3335-4898; dnormile@twiki.com
 • Japan Office: Asca Corporation, Elio Ishikawa, Fusako Tamura, 1-8-13, Hirano-cho, Chuo-ku, Osaka-shi, Osaka, 541 Japan; (81) 6-202-6272, FAX (81) 6-202-6271; asca@os.galileo.jp • China Office: Hao Xin, (86) 10-6253-9478; science@public3.bta.net.cn • India correspondent: Pallava Bagla, (91) 11-271-2899; pbagla@ndvsnl.in

Congress and U.S. Research

Erich Bloch and Charles M. Vest

Washington memories are short. Many a good idea has gotten buried between the end of one Congress and the start of a new one. One idea that the 106th Congress must not bury is the growing recognition that the federal government has an important responsibility to fund research and to provide an appropriate policy environment that stimulates private-sector investment in research and development (R&D).

Last year, the House of Representatives unanimously adopted a resolution, HR578, that takes into consideration the principles outlined in the 1998 report *Unlocking the Future—Toward a New National Science Policy*, authored by Representative Vernon Ehlers (R-MI), vice chairman of the House Science Committee. And the Senate unanimously passed a bill (S2217) promoting federal investment in R&D that was sponsored by Senators Bill Frist (R-TN), John D. Rockefeller (D-WV), Pete V. Domenici (R-NM), and Joseph Lieberman (D-CT). These two congressional actions, together with a plethora of independent reports on R&D investment and the changing policy environment, establish a momentum that must be embraced and accelerated by the new Congress.

There is plenty of disagreement about the details of how U.S. science and technology policy should move forward. However, we wish to point to four recommendations of the Ehlers report that are especially worthy of strong bipartisan support in the 106th Congress.

First, Congress should give high priority to stable and substantial federal funding for fundamental scientific research. Such research is the basis for future developments in areas ranging from health and medicine to computers and software and thus is essential to maintain our nation's economic strength. Federal support of fundamental research has declined as a percentage of gross domestic product during this decade. Ironically, our research base has not benefited from the very economic expansion it helped to create.

Second, the federal government should invest in fundamental research across a wide spectrum of disciplines in science, mathematics, and engineering. The Ehlers report specifically warns against concentration of funds in any particular area. The seamlessness of science and technology and the interrelation of their subfields are demonstrated every day. Advances in one area are necessary for progress in another, and synergies at their interfaces are increasingly important.

Third, an increased focus on partnerships is needed. University-industry partnerships, government-industry partnerships, and three-way efforts are required today because of the complicated relationship between research and the needs and constraints of each sector. Furthermore, we learned in the past decade that research is increasingly expensive and that the rates of scientific discovery and technological change are too great and resources too scarce for every company, government laboratory, or university to go it alone.

Finally, the policy environment for research must be improved. The Research and Experimentation Tax Credit must be strengthened and made permanent. This credit has been on again, off again during the past 15 years, despite its effectiveness in stimulating private industry to invest in R&D. This impermanence discourages industry from using it effectively. Well-conceived modifications include incentives to encourage capitalization of new companies that focus on long-term research or stimulate industry-sponsored university research. The Ehlers report points out the importance of removing a number of unnecessary regulations that damage or inhibit research or that stimulate companies to conduct research offshore. A familiar example is the medical device industry, for which time to market is much longer in the United States than in many other countries that have a similar record of safety.

With HR578 as a base and S2217 as a context, Congress, during hearings on the administration's FY2000 budget, should ensure that R&D, especially fundamental research, receives the priority it deserves and that partnerships between government, academia, and the private sector are given an objective hearing. The research community, in turn, cannot assume that research is a protected and preferred expenditure in the federal budget. At every opportunity, we need to explain the benefits of this national investment to the public, to Congress, and to the administration.

Erich Bloch is a distinguished fellow and Charles M. Vest is vice chairman at the Council on Competitiveness in Washington, DC. Vest is also president of the Massachusetts Institute of Technology in Cambridge, MA.

Congress should ensure that R&D receives the priority it deserves.

Testimony of
ARIEL KLECKNER, PRESIDENT AND COO
REDGORILLA.COM

Before the

JOINT ECONOMIC COMMITTEE
NATIONAL SUMMIT ON HIGH TECHNOLOGY
June 15, 1999

Mr. Chairman and Members of the Committee, thank you for the opportunity to testify today. My name is Ariel Kleckner and I am Founder, President and COO of RedGorilla.com. RedGorilla is an internet start-up company that I founded with three colleagues earlier this year. We are headquartered in Silicon Valley, San Francisco to be exact, and we provide free and low-cost web-based services that help small businesses and independent consultants track their financials. We are looking forward to a successful launch of our new product on September 1, 1999.

My academic background, like that of many of my peers in Silicon Valley, is not in computer science. I have bachelors and masters degrees in Geochemistry, and in fact was fully primed to enter a career in the oil industry after completing my studies. Instead, I opted to enter the world of high-tech, where opportunities and excitement were and continue to be. I haven't looked back since.

It has been a whirlwind year of 18-hour workdays, cell phones ringing off the hook and lots of coffee. I'd like to tell you about some of the specific challenges that RedGorilla faced, that I believe point to larger issues for the high tech industry, and for Congress, to consider.

Challenge #1: Attracting a talented workforce

We founded RedGorilla several months ago with a good idea and a team of four people with enough enthusiasm, energy and experience to turn this idea into a business. This four-person management team has been and will continue to be our key differentiator. There are a lot of people with a lot of great ideas in Silicon Valley – but the management team is what truly differentiates the success stories from the pipe dreams. The management team attracts investors, excitement and key employees to a young company.

Once we had our team in place, the real work began. We quickly ran into the greatest challenge facing high-tech companies today: attracting talented employees. At present, there are more technical jobs in Silicon Valley than there are technically-trained people to fill them. This has been the greatest concern of mine as president of a young company, and a substantial amount of my time has been devoted to finding and recruiting the fifteen highly trained engineers, programmers, graphic designers and systems architects that comprise RedGorilla's workforce.

Industry, Congress and the Administration need to work together to ensure a capable, technically-trained American workforce for the future. We must educate American schoolchildren at the K-12 level so that they appreciate and enjoy science and math. And we must ensure that American workers of all ages are trained or retrained in the skills necessary to contribute to the ever-changing high tech economy.

In my own view, strong exposure to science and math during the K-12 education is most critical and should be our highest priority. The roundabout way that I arrived in the technology industry is not unusual. Though things are changing now, when I was in college, students were not getting degrees in systems administration or web design. In fact, most everyone I know in the computer industry arrived there by happenstance. Different paths brought us to high tech, but we were all lured by the unique opportunity to pursue the challenging, fast-changing, entrepreneurial and, yes, lucrative careers that Silicon Valley offers. And all of us were prepared to seize those opportunities because, at an early age, we had a strong science and mathematics education and the benefit of role models in the scientific disciplines.

Information technology professionals are the bedrock of America's high tech industry. A shortage of qualified professionals will result in slower innovation, diminished productivity and lost business opportunities for the U.S. economy. We must act now to ensure that we have the workforce necessary for the challenges of the next millennium.

Challenge #2: Retaining and rewarding talent through employee ownership

We at RedGorilla have been able to assemble a talented technical team by granting stock options in our new company. Stock options are a key factor in the ability of young technology companies like RedGorilla to employ a talented workforce when salary dollars are scarce - they are our currency. In fact, enabling employee ownership through stock options has long been a cornerstone for emerging growth companies in industries like biotech, Internet and software. It has given workers a stake in the success of their firms and fueled America's entrepreneurial culture.

Stock options are also a critical means by which emerging technology companies and venture capital firms secure competent people to serve on their Boards of Directors. It is essential that young companies like RedGorilla attract experienced and qualified directors, who can provide entrepreneurs like myself with the business guidance that is crucial for a firm's survival. For my company, attracting such directors would be impossible if we could not rely on stock options for compensation. Smaller firms often cannot pay directors' fees in cash. And providing stock compensation has the obvious benefit of giving directors the greatest incentive to see the company through to success.

Despite the benefits of granting stock options to employees and to directors, a threat to this practice has emerged in the form of a proposal from a private-sector regulatory group called the Financial Accounting Standards Board (FASB). FASB could issue two rulings

this year that will have a significant adverse impact on the ability of technology companies to use stock compensation.

First, FASB has proposed that if a company reprices its stock options and then sees a rise in the price of the stock, the increase in value of these options must be deducted from the company's earnings. The result: issuing stock options will become prohibitively expensive.

Second, FASB has issued a proposal that would require the expensing of options granted to members of a board of directors or to independent contractors, meaning that the value of the options would have to be deducted from the firm's profits.

In raising these issues today I want to make clear that technology companies recognize that financial accounting standards must require the fair presentation of the economic substance of business transactions. We also respect the independent standard-setting role of FASB. FASB's role is clearly to ensure that accounting rules accurately reflect the values of liabilities of corporations for the benefit of investors. Indeed, that is essential to technology firms, who also rely heavily on accurate financial statements.

But at the same time, I think we should look carefully at whether these proposed rule changes really improve the financial reporting model. More importantly, do these proposals reflect a full understanding of the technology-driven New Economy? Do the expensing of employee stock options and options granted to outside directors accurately reflect the assets and liabilities of these growth companies?

In 1995, FASB determined that they did not. After extensive deliberations and review of the proper accounting treatment for stock options, FASB determined that companies issuing option grants are not required to consider the cost of issuing them a business expense. Companies may either take a charge against earnings based on the cost of issuing options, or describe, in footnotes to their financial statements, the impact that stock options would have had on their earnings had they been considered a compensation expense. Four years later, I believe this remains a sound approach that provides accurate information to investors without adversely impacting technology companies.

The technology industry is engaging FASB constructively on these issues. We are encouraging them to slow down and take a more comprehensive look at the entire accounting treatment of intangible assets. I hope that we will reach an understanding on these issues.

In the meantime, I believe industry and Congress should continue to be mindful of the critical role that public policies will continue to play in the growth of the New Economy, even in areas as esoteric as financial accounting standards. Unlike the traditional economy, today's technology-driven economy is built not on assets, not on physical products, but on mindshare. Even the most profitable of high-tech companies often have little more than lines of computer code to call their own. But financial incentives exist to allow entrepreneurs to take the risks necessary to get started in this industry.

We need to work together to keep intact these incentives that will continue to attract young Americans to the technology industry. Granting equity to employees and directors in the form of stock compensation is among the most important of these financial incentives.

The Next Generation of Challenges: Building and Launching an Internet Business

Now that our technical team is in place, we've begun to build our site. Our engineers and systems architects will spend this summer working through the design and construction of RedGorilla's back-end technology. At the same time, we are also working with the graphic designers and user interface experts that will design the front-end, with the people that will market our new service to small businesses, and with the team that will work hard to drive traffic to our website and acquire registered and loyal users of RedGorilla's services once we have launched.

What makes all of this so interesting is that there are no "tried and true" methods of marketing on or for the web. The industry is evolving so rapidly, and the technology is advancing so quickly, that we are creating the rules as we apply them. New job titles and entire marketing departments appear overnight to meet the growing and evolving needs of an increasingly savvy population of web-surfers. We work with people whose sole objectives are things like "Search Engine Optimization", "Online Promotions" or "Affinity Programs" that work to partner businesses by cross-promoting each other on their websites.

The ultimate goal of all of these efforts is to drive traffic to websites. And as the public's trust in the security of the Internet increases, all of this traffic will drive on-line commerce: E-commerce. Electronic commerce represents unprecedented opportunities for innovation and economic growth. It allows a small company like RedGorilla to compete globally and to take on even large corporations.

What does this all mean in terms of policy? Simply that the potential and benefits of the Internet economy and of E-commerce are limitless -- if they are permitted to grow. I believe that government and industry must work together to ensure that today's fast-changing competitive environment is not choked by excessive regulation or taxation so that the Internet economy can grow with America in the lead.

Conclusion

Today we are at the dawn of a new era, a new information age. Whether you call it the digital revolution, the new millennium or the New Economy -- the Internet is changing more than just our ability to communicate. We are witnessing a fundamental shift in human interaction. The Internet is a powerhouse for economic growth, and E-commerce will drive fundamental shifts in the way people and companies do business. What extraordinary times we live in.

I greatly appreciate the Joint Economic Committee's leadership in holding these hearings. It is essential for industry and government to share our many different perspectives on the technology industry and to learn from each other. I am glad to be part of what is, in a sense, a celebration of the New Economy and the technology industries. But I also believe these hearings are an opportunity for government and industry to begin to focus together on how we can support policies that will encourage our nation's continued technological and economic leadership.

I believe we have seen only the beginning. The rapid change, advancement and innovation that began in Silicon Valley are spreading at Internet speed to the rest of our country and around the world. And with these changes comes the promise of enhanced prosperity and a better quality of life for all of us. Thank you.

TESTIMONY OF JOHN F. KEANE
CEO & CHAIRMAN OF THE BOARD
KEANE, INC.
BOSTON, MASSACHUSETTS

Testimony prepared for:
The Joint Economic Committee
Washington, D.C.
June 15, 1999

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

Thank you for the opportunity to tell you a little about the Information Technology services industry, and to outline some of the ways Government can be helpful.

Information Technology services companies design and implement the technology that helps organizations be more successful. They are the people that integrate the computers, telecommunications software products, and business processes and make them work together. They make a bank's ATM work, they enable Charles Schwab to trade stocks, and their work allows Amazon.com to function on the Internet.

I am John Keane, founder and CEO of Keane, Inc., a software services company headquartered in Boston, with operations throughout the United States, Canada, and the United Kingdom. Keane helps organizations Plan, Build and Manage Applications Software. Our clients include Fortune 2000 companies, government agencies, and healthcare organizations.

I started Keane in 1965. And, like many other start-up technology companies, began with few tangible resources – mainly myself and a telephone. I located in an office over a doughnut shop in Hingham, Massachusetts. I was young, and had the desire to build a new business. I knew I could help companies apply new Information Technology to their business operations, much more effectively than they could do it themselves.

Today, Keane is a company with over \$1 billion in annual revenues, and 12,000 employees. We are still applying new technology to our clients' operations and improving their business processes. But, we are doing it on a much larger scale, and much more effectively than we did in 1965.

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Information Technology services companies are making an enormous contribution to the American economy. In each of the last five years, an average of 7200 such companies have been started, and during this time over 380,000 new jobs have been created. Because of these efforts, United States is clearly leading the world in the use of computer technology. According to a recent IDC report, almost 49% of the world-wide base of PCs at Home and Education is located in the United States, and 47% of world-wide spending on IT software and services is done in the United States. And, U.S. companies clearly dominate the market for computer hardware, software and services.

A key question for all of us is: How does the U.S. maintain this leadership in a global environment that is becoming increasingly more competitive, and which is changing very rapidly?

In the few minutes I have this morning, I would like to focus on three things that I believe contribute to our industry's success to date -- and which are going to continue to be important to success in the future. They are:

1. Open markets, free and fair competition
2. An educated and flexible pool of labor
3. Protection of intellectual property

First, Open Markets. Virtually every Information Technology company begins from a standing start, just as Keane did. New ideas, creativity, but little in the way of financial resources. This is the definition of "entrepreneur." It is important to note that many new businesses fail. However, some succeed, and a few succeed big. These are the companies that permanently change how we do things. For the optimum benefit of society, it is essential that the winners be determined by meritocracy, in a system based on open and fair competition.

Contrary to some people's opinion, it is small companies that characterize the Information Technology industry. All of us are aware of the Microsofts and the Oracles, because they are successful – just as we are aware of the Mark Maguires and the Sammy Sosas because of their success. Whereas it is the farm system that makes baseball, it is the emerging small businesses that give our industry its vitality.

In my home State of Massachusetts, we have over 2500 Information Technology companies, employing 125,000 people, and generating \$8 billion in annual revenues. About 75% of these companies employ fewer than 25 employees. Public policy should recognize the importance of, and support the needs of these companies. The first principle, as it is in the Hippocratic oath, should be "do no harm."

We cannot strangle America's high tech innovation with regulations, taxation and oversight. Work force, work place, and industry legislation must be minimized for this industry to flourish; taxes, such as the so-called internet tax, can have a major dampening effect on the pace of innovation required to maintain our leadership position in this global electronic economy. Constant government oversight will have a similar negative impact on high tech businesses whose existence depends on their ability to respond to market dynamics unfettered by bureaucratic obstacles.

Second, An Educated and Flexible Pool of Labor. Information Technology requires an educated workforce. Because of rapid changes in technology, there is a major shortage of talent. And where talent exists, there is a need for continuous learning. Public policy should focus on the effective education of our youth, which will be the builders and users of Information Technology tomorrow. Policy should also facilitate the reaching outside of our national borders to bring in educated and skilled personnel. America has always been the land of opportunity – and overseas skills can contribute significantly to the continued development of our industry.

Legislation and programs must be introduced which fund K-12 education initiatives to

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promote science and math interest at an early age; we must initiate programs to encourage the pursuit of advanced degrees in the hard sciences, and we must adopt flexible immigration laws to ensure the availability of skilled high tech workers and talented educators in this country.

In addition to talent, a major contributing factor to the success of our economy has been a flexible workforce. The implementation of technology, by definition, is disruptive to the status quo. Painful at times, changes are necessary for American businesses to be competitive in a global marketplace. Public policy should do what it can to assist in the shaping of a flexible and competitive workforce.

Third, Protection of Intellectual Property. Intellectual content is the basis of the Information Age. Conceptually, this is very different from the Industrial Age where tangible property was king. We should do everything we can to encourage the development and protection of intellectual content. Copyright and patent laws need review and updating to accommodate this new technology, both within our own country and globally.

Thank you for inviting me this morning. We all recognize that we are in a world of change — one that is driven by technology. I leave you with a quote. It goes something like this: *"It is not the strongest, nor even the most intelligent that survives, it is the most adaptable."* The author is Charles Darwin. His thoughts, which were directed to the evolution of living species, is extraordinarily relevant to the development and success of the American species and its way of life. Thank you.

Testimony of Michael J. Durham
President and Chief Executive Officer
The Sabre Group, Inc.
Before the Joint Economic Committee
June 15, 1999

Good morning Chairman Mack, Vice Chairman Saxton, and Members of the Committee. My name is Michael Durham, I am President and CEO of The Sabre Group, and I am honored to be here to discuss some of the important economic challenges faced by our company and the information technology industry.

Sabre is a global diversified information technology company, with two principal lines of business – electronic travel distribution and information technology solutions. We are perhaps best known for our groundbreaking computerized reservations system, or CRS, through which travel agents and others electronically book over \$70 billion of travel per year, representing almost one-third of worldwide air travel. Sabre's twenty years of experience in electronic travel distribution, originally as an operating division of American Airlines and now as a separate company, have ideally positioned us to participate today on the cutting edge of electronic commerce. Our industry-leading online travel distribution web site, Travelocity.com, currently boasts over 6 million subscribers – and continues to set new booking and membership records. Tomorrow, we look forward to demonstrating some of the exciting new technologies we have in

development to enhance travel planning and purchasing for consumers and businesses in the 21st century.

On the IT solutions side of our business, we are providing a full array of technology outsourcing services to a growing number of airlines, including American Airlines, US Airways, Canadian Airlines, Gulf Air, and Aerolineas Argentinas. We provide these airlines with strategic hardware and software solutions that touch every portion of their businesses – from scheduling aircraft and crews, to pricing seats, from internal reservations systems, to improving flight safety programs. These airlines are part of a growing roster of carriers that are helping Sabre to establish its position as the company of choice to provide technology solutions to the travel and transportation industries.

In short, like many companies in the high tech sector who have testified before this Committee, Sabre is enjoying a booming demand for our products and services. Nevertheless, there are obstacles in the marketplace that we must overcome if we are to continue our economic success. Congress should be aware of these obstacles, and where appropriate, should fashion policies to knock them down. The key common element of these obstacles can be summed up in one word – “access.” Specifically, access to skilled labor, access to online consumers and access to worldwide markets must be available for high technology companies like Sabre to thrive. My testimony will take up each of these issues in turn.

Access to Skilled Labor

If the U.S. high technology and information services industry is the engine that is powering the U.S. economy, then the people working in the high tech sector represent that engine's fuel. In recent years, the demand for highly-skilled computer scientists, mathematicians, and industrial engineers who provide the technical know-how to serve our customers has been nothing short of insatiable. Sabre's workforce numbered 8000 at the end of 1997 - in 1998, we added more than 3000 people. The trend is continuing this year. Approximately 80% of these new workers are information technology professionals. Our business success depends on our ability to match skilled workers with our projects; our status as a worldwide leader in travel and transportation technology hinges on our uninterrupted access to labor.

Unfortunately, on the supply side of the equation, the situation is grim. Even with our recent hiring, at any time we continue to have several hundred open positions to fill. The supply and demand curves in the high tech labor market not only do not intersect, they are not even trending toward each other. Last year the Information Technology Association of America (ITAA) and the Virginia Polytechnic Institute reported that nearly 350,000 IT positions within the U.S. remained vacant, and all indications are that the number is rising.

In the midst of this severe labor shortage, for the second year in a row we find ourselves in mid-June staring into an empty barrel of H-1B visas, which, when available, enable us to bridge an important part of the skilled worker gap. There is no replenishment of these visas in sight until the next fiscal year begins in October. Even with the increase in the cap from 65,000 to 115,000 as a result of Congressional action last year, the relentless demand for high tech workers has quickly eclipsed even the higher number. Further, the current law's requirement that our industry must return to dramatically lower levels of immigration within a few short years, ratcheting back to 65,000 H-1B's by 2002, ignores the reality of this situation. Unless something is done, the high tech worker shortage is going to become a deepening crisis with potentially devastating impact on the U.S. economy.

I am mindful that hiring foreign workers on H-1B visas is not a long-term solution to the high tech worker shortage. The government, educational institutions and industry must commit significant resources to attract more U.S. workers and students into careers in the high tech sector. Senator Kent Conrad's proposed IT Training Tax Credit is one excellent idea. Sabre spends approximately \$9 million each year in technical training and we are prepared to do more. We are also active participants in state and local efforts to promote technical education in grade schools and colleges. As a member of the North Texas Science and Technology Coalition, we work to bring corporations, governmental bodies and educational institutions together to address these critical workforce issues. These long-term solutions must be pursued vigorously, and we believe that it is our obligation to do our part. However, long-term solutions will not solve the immediate

crisis. The supply and demand curves will likely take many years to intersect, and will require a major shift in educational priorities, probably from the primary school level. Here is the reality: for the high tech industry to compete and grow in this country we must have access to foreign professionals today.

We recruit from 30 U.S. universities and grant interviews to virtually *all* U.S. citizens who apply. However, MIT reports that 49 percent of its graduate students in operations research and industrial engineering and 52 percent of its graduate students in mathematics are foreign nationals. The U.S. opens its technical universities to these foreign citizens, who receive the finest training in the world. And yet, the foreign members of the Class of '99 are currently getting diplomas, handshakes and best wishes for the careers they may pursue anywhere but here. They are now returning to foreign countries and bringing their exceptional talent to new careers with foreign companies, where they will compete in the high technology sector against U.S. companies because we have reached the immigration cap. This makes absolutely no sense.

With each crippling hiring hiatus, U.S. high technology companies consider relocating some or all U.S. operations abroad – Sabre included. Armed with our employee's minds and laptops, we know we will find countries to welcome us (and our tax revenues) with open arms. This is not our first choice. We would like to bring our next 3000 jobs to Texas, Oklahoma and other states where we might otherwise expand our presence. U.S. companies compete in a highly competitive global economy, and our

country's rigid immigration policies are forcing us to make very discomforting calculations about where we should go.

What should be done? One possibility is to raise the cap again, perhaps to 200,000, as Senator Phil Gramm has recently suggested. If political support could be mustered to do this in the aftermath of last year's debate, no doubt the high tech community would be quite pleased. But if the will is not there, perhaps some new solutions to this chronic problem should be considered.

For example, nearly half of Sabre's workers who come to us on the H-1B program have attained their masters or Ph.D degrees. I believe such workers deserve enhanced priority or even a special classification outside of the H-1B quota. It is hard to imagine a group less controversial, and more deserving of admittance to our country, than those who bring extraordinary skills that will increase America's competitiveness in the worldwide economy.

In exchange for such an exception, companies who hire such advanced-degree workers should be prepared to do more to bring U.S. workers into the high tech field. This should not be done through Department of Labor or other government programs funded through increased application fees. Instead, companies should be allowed to spend funds directly on those internal and external training programs they believe will help encourage U.S. citizens to pursue careers in high tech.

This country should not chain itself to an inflexible quota of foreign workers in the face of such critical, relentless demand, which, if satisfied, will allow the U.S. economy, and particularly the high technology sector, to continue to soar. Those who believe in a "field of dreams" – that is, by keeping foreigners out, U.S. citizens will come – are deluding themselves. They ignore that the employment rate among U.S. citizens in the United States is currently at a 30 year high. They ignore that insufficient numbers of U.S. citizens pursuing careers in technology are rooted in the quality and emphasis of U.S. education from the primary school level. And they ignore that even if high technology companies could find sufficient numbers of interested potential U.S. workers, the time lag to get enough of them properly trained to fill our specialized jobs is too long. U.S. companies need to hire people right now but the law says we cannot do so. This crisis needs to be revisited immediately.

Access to Online Consumers

In order to understand this potential obstacle to our economic growth, it is first necessary to turn the clock back and review the origins of the computerized reservation system industry in the mid-1970s. We believe there are telling analogies between the early history of the CRS industry and the current circumstances of the Internet, particularly with respect to how products and services are displayed for consumers. Learning these lessons is important because the extent to which competition -- rather than concentration -- characterizes the Internet software market may well determine the success of the nation's widespread transition to digital commerce.

The original CRS's were developed essentially as marketing tools for the airlines who owned them and who found themselves in the brutally competitive industry that emerged as a result of deregulation of air transportation by the Congress. These first CRS's evolved gradually from remote terminals connected to the owning carriers' internal reservations systems into full-fledged information systems with the schedules and fares of most major airlines. As the functionality and acceptance of these systems increased, and automation became a competitive necessity for travel agents, the importance of these systems to airline distribution grew.

Ultimately, those carriers who had not invested in automation found themselves at a competitive disadvantage in at least three respects relative to the CRS owners. First, there was the issue of screen preference or display bias, as it was pejoratively described. Many believed that even subtle forms of bias in the display of information on the computer screen could have a dramatic effect on the purchasing patterns of consumers. The Sabre system was designed to favor American's flights, Apollo was biased to favor United's flights, and so on.

Our early entry into e-commerce taught us something about the virtual world that retailers in the physical world had known for years -- that consumers buy what they see, and far more often than not, they buy what they see first. This is why a breakfast cereal manufacturer fights for eye level shelf space in a supermarket, an anchor department store positions itself between the parking lot and the other shops in a mall, and a

bookseller turns the books it particularly wants to move off the shelves sideways. In the airline industry, a study showed that more than 50% of travel agents selected the flight shown on the first line of the computer screen, and more than 90% chose a flight from the first screen. By ensuring that their own flights appeared on the first line (or the first screen) disproportionately often, industry observers believed that CRS owners had the ability to shift a significant number of passengers and associated incremental revenues to their own airlines.

Second, the owners of the systems were able to charge widely different access fees to airlines who were reliant on the systems for distribution. Airlines that agreed in the early years to help the owning carriers market the systems to travel agents were generally charged very low fees - as little as 25 cents a booking - while carriers that came later to the scene paid as much as a dozen times more for the same service.

Third, those carriers who were not CRS owners protested the control that the owners enjoyed over the architecture of the systems, including the application program interfaces that exist between the system and third-party hardware and software. These carriers complained that the proprietary nature of these systems gave their owners the ability to determine not only the speed and frequency with which functional enhancements were meted out to competitors but also the reliability of the transactions being performed in the systems on those carriers.

In 1984, the Civil Aeronautics Board, in consultation with the Department of Justice, became concerned and adopted federal computer reservation system rules requiring neutral displays, non-discriminatory pricing and disclosure of CRS technical standards.

Sabre's history thus demonstrates both the benefits -- and pitfalls -- of electronic commerce. This form of distribution gives participating businesses highly valuable, and yet relatively inexpensive, access to millions of consumers, while putting near-perfect product and price information in the hands of the customer. At the same time, the history of electronic travel distribution should serve as a cautionary tale about the power that arises from controlling the automated connection between the customer (or sales agent) and retailers. In 1984, the largest CRS had a market share of 43%, yet in the eyes of those charged with ensuring a competitive marketplace (during the Reagan Administration), it was deemed to be sufficient power to compel government action.

Today's analogy is, of course, the computer operating system. Microsoft Corporation, which has about 95% of the world market for PC operating systems, has enormous market power. Regardless of how Microsoft acquired its market power, the question for policy makers today is whether any one company should be permitted to use a monopoly position to exert control over the interface between consumers and the Internet, the place where most commerce will be conducted in the next century.

In many respects the CRS debate of the mid-1980's is applicable to today's debate over the PC operating system monopoly. Microsoft's proprietary control over Windows and supporting licensing restrictions with PC makers enable it to bias the screen to favor its own Internet content offerings. Its control over the screen will allow it to establish access fees for placement in the Windows environment. As the owner of the operating system, Microsoft can release according to its own schedule and terms the programming interfaces that are needed for third party software applications. Biased screens, access fees for screen placement and withheld programming interfaces were precisely the issues the CRS industry grappled with 15 years ago.

One aspect of the current debate of particular interest to content providers, such as Sabre, is known in the industry as "the boot-up restriction." This is the component of the Windows licensing agreement that forbids the PC maker from overriding the first screen that consumers see. We think it is important that content providers be given the opportunity to negotiate for screen presence with a variety of vendors, in particular the computer manufacturers, so that there is no single portal to the Internet, and no single set of products featured on that portal.

Microsoft is not "just a software company," as its executives are fond of saying. Its Windows operating system software monopoly is the source of much of Microsoft's extraordinary power, but Microsoft is now extending that monopoly into Internet content, and indeed into virtually every aspect of the human experience. Microsoft sells, among other things, travel (Expedia), cars (CarPoint), real estate (HomeAdvisor), news and

information (MSNBC and Sidewalk), financial services (Money Central), even encyclopedias (Encarta). Microsoft is executing a strategy of using its monopoly position in Windows and its extraordinary cash position to put its portal site, MSN.com, with its direct links to all of the content listed above, on or directly behind the first screen of every computer, every television set top box, and every cellular phone sold. Before having the opportunity to see anything or go anywhere else, the consumer will first be forced to browse through the ubiquitous Microsoft company stores. This represents a significant future obstacle to growth in electronic commerce and creates an issue worthy of our government's continued vigilance.

Access to Worldwide Markets

Foreign market access barriers are not unique to the high tech industry, but they pose a very significant problem. Certain foreign businesses, often with the acquiescence or participation of their governments, systematically seek to exclude competitive U.S. companies from their markets. While we operate in an increasingly global marketplace, unfair protectionist policies and anti-competitive activity do continue to thrive in many places around the world, and our country needs to be better prepared to respond. Our CRS example is a sobering reminder of how far we still need to go.

The CRS industry was founded in the United States over twenty years ago, and has grown into a worldwide electronic business with enormous potential for U.S. CRS's seeking to expand abroad. However, the growth of this commerce for U.S. companies

remains unrealized in many places. U.S. computer reservations systems have faced severe and persistent trade barriers in their efforts to establish their foreign market presence. It is imperative that we have access to these markets to grow our business – the international sector is where we expect our greatest growth in electronic travel distribution to occur.

Several foreign air carriers and transportation providers, many wholly or partially owned by their governments, have deliberately withheld fare and schedule information and other enhancements from U.S. CRS's, while sharing such features with the foreign CRS's they own or market. If a U.S. CRS does not contain the best information about a foreign country's flag carrier and other major travel providers, it will not be selected by travel agents. Likewise, when the European CRS is allowed exclusively to offer a popular service such as electronic ticketing on the country's flag carrier, a foreign travel agent's choice of CRS is made easy. Travel agents seek the best access to the information and services that their customers use the most, and U.S. CRS's are unfairly handicapped in their effort to provide such access to their potential foreign customers.

In countries where Sabre is allowed to compete on the merits of our system, we routinely capture a robust market share; however, in some European countries, our shares are anemic or non-existent. The bitter irony is that while U.S. CRS companies are being chronically discriminated against in Europe, and while European regulators turn a blind eye, foreign airlines and the foreign CRS responsible for this discrimination enjoy

unfettered access to the U.S. market. What's more, they receive the full protection of the U.S. Department of Transportation rules ensuring fair treatment of all airlines and CRS's.

These inequities have been the subject of several antitrust investigations conducted in the U.S. and abroad. The United States Trade Representative has included computer reservation services in its listing of Services Barriers in the National Trade Estimate Report. In addition to these measures, the key to obtaining open foreign markets will be vigilance by the Department of Transportation and a willingness to enforce new rules aimed at stopping discriminatory behavior. To that end, fifteen United States Senators have written to DOT Secretary Slater urging the Department to adopt CRS rules that would allow all U.S. marketed CRS's to cease displaying and ticketing a foreign carrier's flights, when the Department finds that the carrier has engaged in unjust discrimination. They have noted that it is wrong that foreign carriers and their CRS's can discriminate against U.S. companies abroad, and still receive the protection of the U.S. rules as they market their flights and products in our country. This Committee's further support for this position would be most helpful.

Chairman Mack, Vice Chairman Saxton, thank you again for the opportunity to share my views with the Joint Economic Committee. Sabre looks forward to continuing to participate in your consideration of the economic challenges and opportunities the high technology industry faces today and in the years to come.

Testimony of
GENE HOFFMAN
CO-FOUNDER, PRESIDENT & CEO
EMusic, Inc.

Before the

JOINT ECONOMIC COMMITTEE
NATIONAL SUMMIT ON HIGH TECHNOLOGY

15 June 1999

Introduction

Mr. Chairman, Mr. Vice Chairman and Members of the Committee. I am Gene Hoffman, co-founder, President and CEO, of EMusic Incorporated. Thank you for the opportunity to testify at this first-ever National Summit on High Technology. It is an honor to appear before you to talk about how and why high technology changes our economy and shapes and often creates public policy. I will focus my remarks on why a start up company like my own, barely 18 months old, must have a public position on the New Economy and believes in helping shape public policy by working with government, consumers and the private sector.

Mr. Start Up Goes To Washington

I am 23 years old and about to get married. EMusic, formerly known as the GoodNoise Corporation, was founded in Silicon Valley in January 1998 by Bob Kohn and myself in the living room of my home. Through funding of our own, from friends and family and through some angel investors we quickly got underway to build the market leading

company for downloading music over the Internet. We became a public company in May of 1998 by taking over the corporate shell of a firm already traded on the Over the Counter Exchange or OTC. In March we closed a round of private financing that brought in over thirty million dollars from well established institutional investors. And just two weeks ago we changed our name from GoodNoise to EMusic when we moved from the OTC to NASDAQ where we are listed as EMUS. All this time we have built up one of the largest and the commercially viable licensed collections of music of all genres available for download. It is an exciting industry and many new and old companies are entering the digital music space daily. We have tripled our staff from 20 in March to 60 this month and we will continue to grow rapidly. How much longer will we remain a small start up? At the rapid pace that we have moved so far, it may not be very long at all!

And with the market moving so fast, one may ask why does a start up have the time or focus to come to Washington to help shape public policy?

Too often many high tech executives and their firms dismiss the importance of public policy. This has been changing over the recent years as more and more companies become engaged with government. The Technology Network (TechNet) is one good example of how industry has organized itself to help shape public policy and in the wake of the New Economy. Trade associations like the Information Technology Association of America (ITAA) provide an excellent vehicle for companies to come together to work on issues of common interest. However, most of the firms involved in public policy are

either large firms or at least companies that have been around for a while. Rarely do you see a small, new company get engaged. One example of that would be Netscape Communications. Netscape lobbied the California legislature concerning digital signatures in January 1995 – seven months before its now famous IPO. Netscape also came to Washington DC in May 1995 to lobby Congress on the now infamous Communications Decency Act (CDA). There are two reasons why a start up like Netscape got involved in public policy: (1) Netscape's management was seasoned – Jim Clark, Jim Barksdale and Roberta Katz, among others, had all touched upon significant regulatory issues during their careers at other firms such as McCaw Cellular (now AT&T Wireless), Federal Express, and Silicon Graphics; (2) Netscape's product changed the software industry, communications and society with the commercialization of the web browser and the unleashing of the Internet's potential.

Not every start up has one or both of these characteristics. And I am certainly not "seasoned" in the same sense as someone of Mr. Barksdale's caliber. However, I can say that I have been around the block a few times, even at my young age. In my previous two jobs, I lobbied the Federal Trade Commission on privacy and advertising issues in 1996, and lobbied the Department of Commerce on export controls on encryption and the Federal Government generally on privacy issues in 1996 and 1997. Also, EMusic's Chairman and co-founder, Bob Kohn, has been a senior executive at many firms that have had to deal with litigation and regulation matters ranging from antitrust, to copyright infringement, to software piracy. Many of our other senior executives come from the

entertainment industry where they saw government regulation of content in the 1980s and 1990s with, for example, parental advisory labels on music and the V-chip.

Bottom line: a start up is more likely than not to not succeed if it does not pay attention to public policy. In fact, one of the legends of the Internet, Vint Cerf, may have put it best. Just last week at the Federal Trade Commission's Workshop on Consumer Protection in the Global Electronic Market, Vint Cerf said that engineering innovation and technology used to drive the market, but that today it is public policy that shapes business and the economy. If the father of the Internet believes that public policy is this important, every entrepreneur, young and old should certainly pay more attention to public policy issues. In fact, I pay more and more attention to public policy as I move from one start up to the next. While 19 years old and in college at The University of North Carolina, Chapel Hill, I started a company called PrivNet. Privacy and encryption issues became central to my business. I took part in a 1996 Federal Trade Commission workshop on privacy, demonstrating how PrivNet's products enabled users to protect their privacy by blocking cookies from being downloaded from websites to one's computer. PrivNet's products also empowered consumers to control whether or not they saw advertising banners. In late 1996 I sold PrivNet to Pretty Good Privacy, Inc., and moved to Silicon Valley. PGP, now infamous for its work on easy to use encryption for individuals and their email, had many export control issues with the US government. We dealt with the Department of Commerce and other agencies as well as the Congress on a regular basis. We even hired our own in-house lobbyist who has stayed on with the company that acquired PGP in late 1997. After having been through two start ups, I am living proof that Vint Cerf is dead

on. I would not be a successful entrepreneur and businessperson without having had paid attention to public policy all these years.

Exploring Issues of Importance to the Internet Economy

I have been using computers and logging on to the Internet since 1988. I have been using the revolutionizing open source operating system Linux since 1993. I am an early adopter. While new technologies come and go, some of the most important public policy issues remain in process over long spans of time. New companies can bring a fresh perspective to these issues and help them evolve toward a solution or at least a compromise. Given the central role encryption plays in the New Economy I will focus on encryption as an exemplary substantive issue. This issue, among others, illustrates how the private sector and the government need to continue their work on developing effective public policy so that the New Economy can continue to flourish.

Export controls on high technology have been around for several decades – they come from an era before I was even born. There are very important reasons why they exist but economics and technology have outstripped them. Congress has demonstrated significant leadership in recent years by hosting hearings on export controls on encryption, considering legislation, and by bringing industry leaders together with law enforcement and national security officials to try to hammer out their differences. While encryption is a complex issue, I can point out one salient fact that bears directly on its intersection with the Internet Economy – this New Economy. US industry warned Congress and this Administration that US export controls would only drive the development of strong

encryption products overseas. Indeed, firms in Canada, Ireland, the UK, Germany, Japan, China, Australia, South Africa, Sweden, Switzerland, France, and Russia, to name a few countries have exploited the artificial market vacuum created by US export controls laws. Many firms market their products rather glibly as not subject to US export controls. Entrepreneurs have seized electronic distribution of software and the global marketplace to compete with US firms and to take hold of market share. Just as Amazon.com has used the Internet to disintermediate the brick and mortar book store industry, non-US crypto firms can use the Internet to change the balance of power with the established US mass market software and hardware firms. Overseas firms harness the worldwide community of software developers and security experts to create, hack, rewrite and improve their code. They may not have the internal resources of a Microsoft or an IBM, but they can leverage the Internet to collaborate with the best engineering minds, to create, test and market a product. And they can use the Internet to sell their product into the US, as there are no import controls. Thus, the same qualities that comprise the Internet and that enable all the explosive economic growth during the past five years are the same elements that undermine the effectiveness and practicality of US export controls on encryption.

Moreover, as entrepreneurship and market leadership is driven overseas, the US economy and security is at risk. Most encryption technology is developed and owned by non-US firms. Therefore, who can the US government go to for help when it wants to understand how a bad actor uses such non-US products to defeat US law enforcement? Also, US industry and consumers now have to rely on technical standards and products that are not

made here. Can we trust our information to technology that we may not completely understand? Canada's government understands this dilemma all too well. Several years ago when its native firm Entrust wanted to export robust 128 bit encryption, the Canadian government made a departure from its long standing policy of having export controls that were harmonious with those of the US. Canada declared that its economic security drives its national security; Canadian firms had to be able to compete in the global market so that its firms could continue to develop market leading technologies and products.

US export controls on encryption remind me of a quote from Douglass Rushkoff, author of the 1994 book "Cyberia." Rushkoff said that "[o]ur fear of technology is really a fear of empowerment. We now have the ability to design the reality we live in, and we have to step up to the occasion." By trying to force encryption back into some genie's bottle, by trying to skew the development of the free market with controls that would benefit vendors who supported key escrow with export relief, by ignoring overseas developments, the public policy of the Administration demonstrated its fear of technology. Fundamentally, the Internet is, in the words of Ithiel de Sola Pool, a "technology of freedom." The lesson I have taken away from working on the issue of encryption is that US public policy should empower people to lead the market.

What Does the Public Policy of the New Economy Mean For Young Americans?

Looking at the faces of the school children who have joined us here today from Michigan and Pennsylvania, how can the US government embrace the New Economy with an event such as the High Tech Summit, and yet have policies that curtail creativity and

entrepreneurship? New Economy issues are not just about growing companies and providing solutions to consumers; at a deeper level the public policy that shapes the New Economy will direct the involvement of Generation X and the generations that follow in political and business leadership. Essentially, I am asking this Committee to think about how public policy inspires or dissuades young people from having an interest in politics and how the US Government works. I hear many politicians state that they want to find a way to bring young people back into the political process. While Bill Gates' experience of being a Hill page may have something to do with his becoming a multibillionaire, this Government ought to really examine how its positions on issues ranging from content controls, to encryption, to privacy, to copyright, to antitrust, to education, to stock options, to research + development funding, to bandwidth and access, among others, intersect with our nation's youth – with the next wave of entrepreneurs and information economy workers.

The Internet has enabled kids in junior high school and even younger to build their own high-tech start ups and to work for established high-tech firms. Instead of having a paper route in grade school, Johnny or Jane now email their work assignments to their managers at high-tech firms. These kids and millions more are the so-called power users of the medium. They are the early adopters of change and innovation; often they see market trends before others do. Their opinion of how public policy shapes the New Economy should not be ignored or taken for granted.

Now I am not naïve enough to think that the problems that are out there in cyberspace – malevolent hackers, child pornographers, cyberstalkers, information terrorists – cannot be dealt with without placing some controls on the Internet. (I will probably be flamed for saying something like that!) Platitudes are annoying, but the more things change, the more they stay the same. Yes there are bad actors out there in cyberspace. But there are bad actors in every medium and public policy is still contending with them. As early as the late 1950s and early 1960s, experts deemed television to be a vast wasteland. The Government created the Corporation for Public Broadcasting in an attempt to create good content in hopes of attracting viewers away from the assumed less-than-desirable content that was being produced to suit perceived market demand. Government has regulated broadcast content to shield minors from excessive sex, violence and profanity. And recently President Clinton has proposed new controls to contend with violence in computer video games and other media. It seems to me that government and industry, old and new, are destined to work together on these issues on an ongoing, evolutionary basis. For if violent content in television was identified as an issue to be addressed over forty years ago and it is still being addressed today, how can one expect government or industry to resolve the issue of violence in computer games or other new media at all or in a shorter period of time?

There is a lot more history to this issue than I can comment on here; all I hope to offer is a perspective of proportionality and practicality. As a businessperson, you learn very quickly to focus on what you can accomplish and do so successfully. High technology public policy may have to track this model more than it has in the past in order to become

more effective. Overbroad measures not only are likely to fail to achieve their goals, but they are also likely to disenchant and disillusion young people as such measures illustrate big government that is ineffective in dealing with high-technology issues. Fortunately, not all government activity in the high technology area is this way. From its work on Uniform National Standards on Securities Litigation, to the e-rate, to R&D tax credits, to Research and Experimentation funding for universities, to digital signatures, to Internet taxation, the Congress has demonstrated its effectiveness on high tech issues. With more involvement from industry, especially start ups and young people, I think that the government will be best able to address issues like content control, intellectual property frameworks, and export controls on encryption going forward.

Conclusion

There is a theme that I would like to leave with you today. The New Economy enables young people – students – to become productive members of society as entrepreneurs and professionals – even in junior high, high school and of course college. No longer does one necessarily have to pursue a traditional path to have a successful career or to contribute back to society and to the nation's economy. Good government public policy should enable and empower people to be better. Government has played a significant role in the creation and operation of the Internet and the New Economy. A businessperson ignores the rich history of government leadership at his peril; if one looks at the issues before us today, it is hard to say that there is no role for government. From copyright law enforcement internationally, to reforming securities industry rules, to taxation of ecommerce, to privacy and consumer protection, to trade disputes with the

EU, to technology neutral copyright policy, industry needs to work with all levels of government – Federal, State, local and non-US national and sub-national governments as well as the international governmental institutions. If the valuation of the New Economy is as high as it is, the stakes of good public policy are very significant as well. As a manager of three start ups, as a young entrepreneur, I cannot afford to discount the role public policy plays in shaping the New Economy. I have a duty and obligation to my co-workers, shareholders and customers to be aware of all risks and opportunities. Public policy certainly provides for both in many ways.

Thank you for your time and it is an honor to be with you here today.

BIOGRAPHICAL INFORMATION

Gene Hoffman, Jr., co-founder, president and chief executive officer of EMusic, Inc., is an entrepreneur and high tech start up veteran. In November 1996, Hoffman joined Pretty Good Privacy, Inc., ("PGP") as its Director of Business Development and was later appointed Director of Interactive Marketing, responsible for the company's website operations, strategic marketing relationships, and electronic commerce operations. Prior to PGP, he was Executive Vice President of PrivNet, Inc., where he ran business affairs and technology licensing, performed certain development work for the company, and supervised its merger with PGP. Hoffman has a patent pending for his work with HTTP stream interception technology. Hoffman also worked at IBM's component facility in Charlotte, North Carolina. His musical background includes running a recording studio, freelance music production, band management, and work as a live sound re-enforcement engineer. Hoffman attended the University of North Carolina, Chapel Hill.

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