

support for high-cost areas, making the subsidies explicit, sustainable, predictable, and competitively neutral. Once again, in devising this system, we will need to make sure that it is calculated to send the correct economic signals and does not deter efficient investment. We want to stimulate investment that is justified by business case, not by distortions of legacy regulation.

I want to take a moment now to acknowledge that one major deterrent to investment is risk, and one major risk confronted by investors in the telecommunications marketplace is regulatory uncertainty. As a former banker, I understand that well. I try to minimize the problem wherever I can. Of course, there are numerous regulatory uncertainties that are beyond my power of control. Courts sometimes surprise us, as the Eighth Circuit has on more than one occasion, and a district court in Texas did on New Year's Eve. Congress, too, can change the rules of the game at any time, or place us in a position where we are compelled to change course, and it is their right to do that. Changes in the composition of the commission can also lead to changes in rulings, even when the underlying law, facts, and logic have not changed. So, even in the absence of any of these factors, a reconsideration process may also cause us to see things differently on the second go-round than we did on the first.

I can not tell you with confidence, therefore, that anything the commission has decided is settled. I can tell you, however, that I personally believe policymakers should avoid change for the sake of change. I hope that my new colleagues will likewise recognize the desirability of maintaining as steady a course as possible, consistent with their right to question the wisdom of what has been done by their predecessors. I think you can also count on us to prefer competition to regulation, and to back off from involvement in markets as competition emerges.

However, it is important to note that Congress did not embrace the notion that the best way to encourage competition and investment is to eliminate all rules on everyone, even before competition appears on the scene. *Unregulated monopoly, Congress recognized, is the worst of both worlds.*

I would like to focus now on why investment matters in another context: namely, investment in advanced telecommunications for schools and libraries. Congress wisely enacted this new Rockefeller Center of Universal Service, providing discounts on telecommunications services to schools and libraries. The cost of this program is borne by all telecommunications carriers, many of which will enjoy greater revenues as a result of these provisions.

Why is such investment important? Our next generation of leaders must have the tools to prepare them for competition in the twenty-first century. A skilled labor force pays dividends a hundred times over. Moreover, our trading partners are making these very same investments in their students, many at far greater amounts per capita. Now, some carriers, looking at the short-term bottom line, are challenging these provisions in court, but I would proffer the point that investment matters. Investment in our students matter. Our investment in our telecommunications infrastructure for our schools and libraries is going to yield great dividends and we must sustain that effort.

I offer one final thought. I am well aware that investment comes from the marketplace, not from government. You put your dollars at risk. We want to encourage you to continue doing that, so this country can continue to lead the world in the quality of its

communications infrastructure and services. The role of government is not to pick winners and losers.

I repeat that: the role of government is not to pick winners and losers, but to make sure that the doors of opportunity are open. It should not be the FCC that decides whether consumers will get HDSL or ADSL or DSL light. Neither should it be an incumbent monopolist who makes that decision. The beauty of the Telecommunications Act is that it presents a variety of solutions to be tested in the marketplace, and may the best prevail.

I am heartened by the emerging competition between XDSL solutions offered by the telephone companies and the cable modem solutions offered by the cable companies. I think this emerging rivalry bodes well for consumers, in quenching their thirst for more bandwidth to go with the increasing speeds of their PCs. I believe that you can count on the newly reconstituted FCC and the state commissions to create an environment that is conducive to competitive investment.

However, let us all remember that it takes time for technology to mature, for demand to develop, and for technologies to be deployed. With that in mind, I think we can conclude that the telecom act is beginning to produce the desired results, and the benefits of rampant local competition will soon be upon us. In the foreseeable future, my nine-year-old will get up from the dinner table and answer calls from telemarketers offering us an opportunity to switch our local telephone service. Now, that is progress.

Thank you very much.

Erik R. Olbeter, Economic Strategy Institute

MR. OLBETER: Thank you, Commissioner Ness. I want now to run through a quick presentation of something ESI has been working on for a while.

The first thing I have to tell you is that this title page is a teaser. Is America investing in communications networks? That is the ten-billion-dollar question. I am not going to answer the question, but I am going to speak to one small piece of the question.

In essence, we at the Economic Strategy Institute have been looking at some of the numbers, looking at the publicly filed data of the FCC and the Securities and Exchange Commission, as well as some of the annual reports and 10Ks and stuff. We have been investigating to discover what investment is actually occurring, where is the level of investment, and what is the aggregate composition of that investment. Incidentally, this presentation will be photocopied and you can pick up copies at the front desk as you leave.

As Commissioner Ness mentioned, there are really three types of investment. The first is maintenance: upkeep of the existing network, making sure that the lines are there and that they continue to run, keeping the switches updated, etc. The second type of investment is extension of the network: putting in second lines, extending the capacity of existing switches, and so forth. The third type of investment is modernization, or what the Commissioner referred to as enhancement: adding new elements to one's network, such as conditioning lines for ISDN, adding routers and multiplexers, and building advanced infrastructure.

When we talk about investment, and when we talk about broadband investment, we are really talking about modernization and, to some extent, maintenance of the network. It becomes difficult, in accounting terms, to separate those two, but we are working at that.

First we took a look at the Wall Street conventional wisdom on investment. This presentation deals with the ILECs, and we are only a couple of days away from completing the same analysis for the CLECs.

What is Wall Street saying about everything that is going on? First, capital expenditures, or cap-ex, the amount of money they are actually investing in any given year, per access line, has been constant over the past few years, for the ILECs. Capex per line has been relatively constant.

Second, capex has been diminishing as a percentage of the depreciation of existing plant. This is sometimes referred to as harvesting, adding less plant than you are removing from your books through the natural course of depreciation, if cost elements are not changing. However, if the reduction in plant stock is a result of cost declines in plant, then it simply reflects the natural course of doing business.

Third, telephone investment, as a percentage of total phone company investment, has been declining. As more ILECS get into wireless services, into data services and long distance, their actual investment in their local telephone plant has been declining relatively.

Fourth, a substantial amount of new investment is in second lines to the home.

Some analysts on Wall Street are basically suggesting that the investment we are getting now is primarily composed of second lines. This means two things for competition. For the first, the level of investment has been declining over the last few years. For the second, as it relates to the composition of investment, Wall Street's conventional wisdom is suggesting that network extension, as opposed to modernization and maintenance, are really driving investment today.

So, we at ESI decided to find out what is the actual level and composition of investment to date. We used FCC's publicly filed tariffs, basically the SOCCs. We employed costing data from Wall Street investment firms. Then we disaggregated the data into investment categories for the wireline phone network. So, what did we come up with?

The first thing I want to note is that this chart is actually deceiving. The base that you see here is actually \$114 billion. On the top, it is \$117.5 billion. This is operating plant; we did not look at non-operating equipment, cars and trucks on the road, etc. The net plant for all ILECs has been declining in real terms over the course of these years. A better way to look at this is to look at it as an annual change, so you can get rid of the distortion that comes with those charts. We see here a negative, or actual decrease in the annual plant, net plant, in '92, '93, '94, and '95. There was a small increase in 1996, and '96 was a real interesting figure, a real interesting year for investment.

Here again, we take a look at this as far as percentage change in net plant, and it is interesting to talk about a billion dollars here, a billion dollars there, and all of a sudden we are talking more money. When it comes to investing in the local exchange, a billion dollars here really is not a tremendous amount, if you consider the full percentage of investment that actually is needed in the local exchange.

Okay, let us now separate out the different types of composition, the different aggregate categories. What do we have? What you see here is actually net plant, the extension of it, the building of second lines. Basically, we took the number of second lines that were added that year and timed it by a capital expenditure.

Now, remember that the first chart we looked at was net plant, and it represented everything: maintenance, enhancements, and extension. Well, basically, we have subtracted that, and this is what we find for annual plant change, for network modernization and maintenance.

Under the old regime, therefore, through 1995, we had constantly decreasing changes in net plant. Then, in 1996, we actually saw a reversal of that trend. What does this all mean? Basically, Wall Street's conventional wisdom seems to be proven out by public data. One of the impressive things about this is that the ILECS have made substantial investments in network extension, and, again, it is just a responsiveness to the market demand for second lines. Then again, total investment in maintenance and in modernization, the category that encompasses the broadband features, appears to have been negative.

What does this mean? We have showed you dire pictures and graphs about network investment. However, that is not necessarily what the analysis reveals. You would be wrong to look at these exhibits and conclude that investment has just been decreasing, and there have really been no upgrades. There have been enhancements and modernization going on. We know, for example, that ISDN has been rolled out in a lot of areas. We know that XDSL, XDSL light, and ATSL are actually being deployed. Digital switches are up past ninety percent for the ILECs. It also appears that ILECs have been harvesting the local exchange since about 1992.

The other interesting thing about the data is that, for different ILECs, the numbers are all over the board. For instance, if we look at US West, they have had positive increases in modernization and enhancement of their network in every single year. If we look at some of the other major carriers, it is just not there. We see increasing declines. So, we do not have consistent, across-the-board, around the country, investment patterns, with the same responses to market policy forces. Rather, we see radically different responses in investment levels.

Now, I mentioned 1996 a number of times, and I want to get back to that. When we broke down the data and started looking at 1996 by quarters, which we can in some of the Wall Street data, as well as some of the SEC data, we began to see that investment patterns changed. Yes, they were still negative, but there were significant changes occurring in the ILEC community.

Of course, as Commissioner Ness hinted, this could be a response to the Telecommunication Act of 1996. We had the Act itself passed in February. We had local competition rules passed in the summer.

However, there are actually a number of other possible explanations, and we simply cannot account for them because the data is not there. The numerical changes could be explained by construction of long-distance networks. As mentioned before, some of it may have been due to acceleration of broadband projects, preparation for competition, OSS systems, getting networks conditioned so that unbundled network elements could be offered, or possibly something else. If this seems ambiguous, remember that the biggest thing our six months of analysis taught us is that we do not have the data tools to get a picture of what type of investment is occurring in the ILEC community.

This, of course, does not provide much material for dialogue. It would be a mistake to leave here saying, "My goodness, these guys have been harvesting local exchange, they're just taking investment out and not putting anything in!" That is not necessarily true. Investment levels and categories are a result of the financial markets policy, as well as the consumer markets and technological forces that need to be explored further. It is clear, however, that past policies have resulted in declining levels of new investment. Under the last regime, going up to 1996, we see a continual downward turn.

As for 1996, the jury is really still out. We do not quite know what is happening. We know that something is occurring in the investment market. Some incentive has changed. My personal feeling is that competition is starting to spur investment, but we will not know until the 1997 data becomes available.

So, I hope that what we have done here today, as well as the report we will publish in a couple of weeks, will shed a little bit of light on what type of investment is going on in switches, in lines, and so forth. There is something different in the market now, and we are seeing some sort of an investment in the ILEC community that we need to discuss. We have a

great panel ahead of us that is going to talk about some of that investment and how it is affecting them. For the moment, I will take a couple of questions, if there are any, and then we will move on to the panel. Yes.

MR. PEPPER: I have three questions. First, has CAPEX per line been declining over the years? Second, hasn't the cost of equipment been declining since 1990, which would explain the general decline in both CAPEX and operating plant? Third, What has your research shown in regards to Price Cap policy? Does it suggest that price caps have caused a decline in investment?

MR. OLBETER: Let me just take those in succession. Regarding capital expenditure per line for all ILECS, that has remained constant, according to most Wall Street analysts. We got this information from a number of investment houses, and I would be happy to share it with you. Essentially, it shows that capital expenditure per line has stayed the same. It has varied somewhat, but, relatively speaking, it has been constant.

Your second point had to do with declining costs, meaning the costs of switches and other equipment. We took that into account. What you see is actually net investment in some of the components that have actually decreased in price. The actual net plant has increased. We have actually seen more switches go on. So, there is some accounting for the actual declining cost of some of the other components. On CAPEX, we actually went with the Wall Street figures, and again, they do fluctuate heavily, depending on what ILEC we are talking about.

As for price caps, they could definitely be one of the factors. The introduction of price caps could certainly be spurring the decline we are starting to see.

[Inaudible question]

MR. OLBETER: That is exactly right. The next part of this is actually to take a look at the selection of the satellites, which, as Commissioner Ness mentioned, are important players. The numbers are interesting because, regardless of the new entrants, we see a substantial shift in 1996. It coincides with the introduction of competition, or at least the beginnings of an introduction. It coincides with the preparations for possibly getting the long distance. The trend that we saw, which could possibly be a result of price caps, changed all of a sudden.

It will be interesting in 1997 to see if this continues to go up. We will combine this with the other information.

Panel I: Impacts of Broadband Investment on High-Tech Industries

Bob Collet, Vice President & General Manager, Data Services and Network Systems, Teleglobe International

John Giere, Vice President Public and External Relations, Ericsson

Mike Maibach, Vice President, Intel (comments inaudible)

Tim Regan, Vice President Government Affairs, Corning

Tim Stone, Vice President New Business Platforms, Motorola

Moderator: Aaron Pressman, Reuters

MR. HAMILTON: In this panel, we will continue to look at the impacts of broadband investment on high-tech industries. Our moderator for the panel is Mr. Aaron Pressman, who covers technology, electronic commerce, and telecommunications issues in Washington for Reuters, the world's largest news service. Prior to his current assignment, Aaron wrote about financial markets for Reuters in New York, and also worked with *Investment Dealer's Digest*. His freelance work has also appeared in *Wired Magazine*. For researchers like me, there is always at least one Aaron Pressman article in my research pile each week. Welcome, Mr. Aaron Pressman.

MR. PRESSMAN: Welcome to the first panel. We are going to talk a little bit about the impact of all the different, competing schemes for broadband on the companies that actually have to provide the services and products.

It is interesting that we are talking about all the different ways of providing broadband services. I was at the White House not long ago and had the good fortune to meet Bob Kahn and Vint Cerf, who helped invent the TCP/IP protocol that underlies the Internet. Contrary to the popular myth, they told me that the reason they made that decentralized network to work that way was not so that it could survive nuclear war. Their mission was to connect different kinds of networks, from satellites to radio wireless networks, with telephone companies. Twenty-five years later, that protocol is still working, as we strive to connect to the Internet in a broadband way, through satellites and things like that.

Vint said they wanted to be able to throw a bunch of radios out of the back of a plane and have it work at the Internet. I keep waiting for Bell Atlantic to throw a T1 connection out of a plane into my back yard, but it hasn't happened yet.

No doubt, though, as these competing schemes for providing access go forward, there will be a lot of dramatic and unpredictable effects on high-tech companies. If we look at earlier eras, when we moved to PCs from mainframes, or when we move to Windows from DOS, there were a lot of winners and losers. Two companies that were big winners in those earlier eras are still with us. Today, we will hear from Tom Cohen, representing Corning.

Microsoft, the other big winner during that era, is not here today. They are apparently tied-up on Capitol Hill. However, Bill Gates was recently quoted as saying that they planned to hedge their bets. They were going to have Web TV that would hook up through telephone lines, Web TV that would hook up through DSL, Web TV that would hook up through cable, and Web TV that would hook up through satellite. So, it would appear that some players are hedging their bets, and we are seeing a lot of joint ventures.

We will also hear from Bob Collet, who is a vice president and general manager of the Teleglobe International Corporation, a leading ISP and corporate intranet provider. We will hear from John Giere, a vice president of public and international relations at Ericsson, which makes cell phones and lots of other switching equipment. We will hear from Michael Maibach, vice president of government affairs for Intel and, prior to that, government affairs manager for Caterpillar. We also have Timothy Stone, vice president from Motorola. We will begin with Mr. Collet.

Bob Collet, Teleglobe

MR. COLLET: Good morning, everybody. It is a pleasure to be here on behalf of Teleglobe. As one of the sponsors this morning, I would like to welcome everybody.

I want to talk a little bit about broadband investment from two perspectives: from the perspective of an international carrier, which we are, and also from the perspective of the Internet service-provider community. So, my remarks will come from a Teleglobe perspective and from the perspective of the Commercial Internet Exchange Association (CIX), of which I am the chairman. CIX has about one hundred and seventy Internet service providers, half of them domestic, and we spend a lot of time involved in telecom issues, copyright issues, content issues, issues of decency, defamation, electronic commerce, encryption, all the kinds of public policy issues that impact the Internet service-provider community. Access to broadband is definitely a very big issue for us. So, I will address this issue from those two perspectives. Let's go to the next slide.

I want to address for a moment the definition of broadband from a carrier perspective. I will talk a few minutes about the international issues, the domestic issues, some technology issues that could impact investment, some of the applications we are seeing in broadband these days and, lastly, some of the expected economic effects.

This is probably the engineer's view of how the broadband market is segmented, so I have to apologize for coming at it from an engineering perspective rather than from a money perspective. Today, however, in the broadband area, we can probably segregate things into three areas. We have a local area, of course, then the wide area and, as I guess we will hear in a

minute, the back plan area. These will obviously be working at different speeds, and we all need to have them converge into something useful, so that we have end-to-end service.

Today, our speeds are roughly about one hundred megabits per second. We have fast ethernet, we have fiber distributed data interface (FDDI), and we have ATM at the local area level, and now we have seen the emergence of gigabit ethernet. The battle of the marketplace right now is at the local area network level. Who will win? Will it be ATM blowing switches or will it be gigabit ethernet?

In the wide area, which is obviously carrier-based, we have, at the high speed today, E3 and DS3. E3 is a European standard, operating at thirty-four megabits per second. DS3, operating at forty-five megabits, is the North American standard. The emerging high-speed link, OC3, which will link service that one can buy, operates at one hundred and fifty-five megabits per second. Also, emerging in some places now is the deployment of OC12 services, and we will eventually see deployment up to OC192, operating at a ten-gigabit-per-second range.

Okay, next slide. Clyde said a moment ago that America might be lagging a bit. That caught me by surprise, because, from both an international and a domestic, competitive respective, it seems the United States is actually doing pretty well and, to some degree, actually pulling ahead of the competition when it comes to broadband investment.

If we look at the international issues from an American perspective, we have those that are international and those that are foreign. So, when I say international, I guess I mean intercontinental. You can see from this chart that there is some very serious investment going into the water for intercontinental transmission capacity. Teleglobe operates one of these cables today, a ten-gigabit system, and, as an international carrier, actually has ownership in all of these. So, today in the Atlantic, we have a number of cables in operation. Gemini just became operational about a month or so ago and Atlantic Crossing should be operational in the summer. In the future, we will be seeing around fourteen systems, probably operating at eighty gigabits and above. So, the Atlantic looks like it is coming along with some pretty healthy intercontinental bandwidth.

The Pacific is a bit behind. The existing cable system, which carries most of the traffic between the Pacific and the United States, is the TPC5 cable system, and it is very highly over-subscribed. There is not enough capacity in the Pacific these days to handle all the needs, actually, of the Internet service providers, and I will get to that in a moment. There you see a spur for the construction of China/US Cable, which was just started, costing about one billion dollars, and the Southern Cross, which takes us down into Australia, New Zealand, and the Southeast Asian territory.

On a global scale, we have an operational system called Fiber-Optic Link Around the Globe (FLAG), which operates, I believe, at about ten gigabits per second. Probably the most ambitious system of all will have one hundred and fifty-two landing sites, costing approximately twelve billion dollars. A lot of this activity is a direct result of the WTO agreement, which presumably should be taking down barriers to find entry offshore.

These systems cost enormous amounts of money, and one could pretty much say that the activity in this area is dominated by the Americans, at this point. In the satellite area, we see the traditional systems continuing to grow, in terms of broadband capability and the emergence of new systems, such as Teledesic, Sylestry, and Sky Bridge, which I think Susan

mentioned a moment ago. All of these are operating in the broadband area, one hundred and fifty-five megabits and above.

When we look at the foreign national networks, those that I have on the slide here are the leaders. From a domestic point of view, there is no doubt in my mind that the United States is by the far the world's leader, and that is driven principally by Internet consumption. Canada, the United Kingdom, and France are investing at not nearly the same rate that we are.

Perhaps the best harbinger of the future now is a little country called Finland, and I am sure the gentleman from Ericsson will talk about that in a moment. That market deregulated a long time ago, both long distance and domestically. Quite frankly, there is no place on earth with the same kind of frenzied activity as you will see in Finland. The monopoly carrier, Telecom Finland, was left with absolutely no protection, but somehow figured out a way to survive.

An interesting point on the international issues is how the emergence of Internet traffic has made itself visible. Today, on the US/Japan route, Internet is about twice the bandwidth of voice. Between the United States and the United Kingdom, it is about one-to-one. I do not have exact numbers for this, but, between the United States and Sweden, it is about eight-to-one. So, a key policy issue, or investment issue, to consider is the emergence of Internet profit, and its strong growth.

Next slide, please. This is obviously good news for a carrier of global infrastructure. We are very proud to have North America's second largest, and, on a global basis, third or fourth largest infrastructure. This network here carried about three billion minutes, not only Canadian traffic, but also a tremendous amount of traffic that neither originated nor terminated in Canada.

This might be the right moment to describe exactly who Teleglobe is. The Telecom act of 1996 was very important to us. Teleglobe continues to be kind of an international carrier. It has been a monopoly for about forty years, and deregulation is slipping through Canada just like it is in the United States. With deregulation comes a loss of protected markets, of course, and a need to expand into more interesting areas of business. With deregulation happening here and elsewhere, and with Washington being the hub of telecom throughout the world, our telecommunications group, which had been headquartered in Montreal, was relocated here in Vienna, Virginia. We have a huge building under construction out in Reston. Over the last year, we have hired three hundred employees, and we are going to continue to do that. Why? Because the United States is a great place to do business, and it is the hub of the telecommunications world.

Next slide. I am going to shift gears a little bit and talk about the domestic issues, principally from the Internet service-provider perspective. Aaron mentioned that Teleglobe is an international service provider. Today, we are principally operating at the global level. We are actually number two when it comes to carriage of global Internet traffic. However, in the United States, at the retail level, there are four thousand ISPs, and we have not put our toe into that market. Therefore, my comments here are going to come from my members at the Commercial Internet Exchange Association.

The good news is that, at the inter-exchange level, there is a lot of investment going on. AT&T, MCI, and Sprint, which is where I used to work before coming over to Teleglobe, have invested a great deal in capacity. It just seems that, no matter how much capacity you put in the ground, it gets consumed. As a matter of fact, because of the surprising growth of our international business, we had to find a way of obtaining domestic capacity to carry the amount of traffic that a global ISP must do. So, we now have a very healthy U.S. facilities-based infrastructure.

ISPs at the international level today are looking for one hundred and fifty-five megabit circuits. They combine DS3s. We have been doing the same thing. However, now the upgrades to one hundred and fifty-five megabits have to be made. Big guys like InternetMCI and Sprintnet recently made a conversion over to OC12, which is six hundred and twenty-two megabits.

When one is talking about speeds of this type, the bottom line is that facilities matter. So, we see UUNet being merged into Worldcom. We see InternetMCI obviously being a carrier-based organization. It is the same with Sprint. To survive with these kinds of bandwidth, it is necessary to have access to facilities.

So, what does one get? Today, one can buy private-line services, ATM services and, last but certainly not least, IP routed services, which I will get to in a moment.

Let us take a look at the domestic issues in the next slide: namely, investments in the local exchange, with SonNet and xDSL deployments. The Telecom Act of 96 has definitely opened some new doors for CLECs. The United States will soon have choices for how they reach their customer.

I have to tell you that there is presently a great deal of disappointment in the ISP community, because the needs of consumers and businesses have been growing so much, in terms of bandwidth requirements, that ISPs are coming to realize that they must have more direct access to the local loop. There is discussion now about whether that access will ever happen. Of course, we have xDSL being deployed, but ISP does not have direct access to xDSL. It may be forced to gain access through an intermediate ATM connection. In the Telecom Act of 1996, we see that co-location for carriers in RBOC facilities is there, but not for Internet service providers. If the ISPs are going to be delivering the kind of broadband services that businesses and consumers want, it will be necessary to get closer to the local loop.

So, many of the companies in our association are really concerned and upset about not having the ability to co-locate in RBOC facilities. Of course, there are some open network architecture provisions that might be able to help us out here, but the problem is big enough that the FCC recently asked how rules need to be changed, or how regimes need to be changed, to accommodate better the needs of service providers. The good news, of course, is that we have cable, we have local multi-point distribution systems (LMDS), and we have broadcast. Those will help. However, from a mass perspective, either the CLECs or the cable companies will be the best bet for reaching the homes.

So, with ISPs demanding access to the local loop and RBOCs not knowing whether they will be fully compensated for the deployments, I would characterize the situation right now as a stalemate. The demand is there, and both parties are trying to position themselves to see who is going to own the customer in the long run, but the ISP has access to xDSL. That means the ISP can start providing voice. That is obviously a terrifying prospect to an

incumbent. On the other hand, if the RBOC or the ILEC is providing the xDSL service, and there is no additional competition, we will never see the opportunity to provide voice services nor fulfill Susan Ness' wish that customers receive phone calls in the evening asking them to switch their local service. So, we are at a stalemate, I would say.

Complicating the issue further will be some technology problems, or questions. A lot of technology going in the ground right now is switched. The big question is whether the switched service will prevail in the long run. Maybe it is an IP routed one. If one looks at the nature of Internet profit, one will find that call set-up and tear-down time are many times greater than what one would find in the traditional circuit switch network. Just think of what we do in our homes when we are logged in to our Internet service. We are going from web page to web page, from web site to web site to web site, at a frequency far greater than we typically make phone calls out of our homes, or even in our businesses. That could put an unbelievable load on a network that is circuit switch oriented. By contrast, the Internet, as we know it, handles these kinds of requests in a rather straightforward way, and the technology is connectionless.

So, from an investor point of view, at the logical level, one has to ask who is going to win in the long run. Is it going to be a circuit switch world, or is it going to be a connectionless world?

Next slide. This slide comes from a start-up company called Pluris, in northern California. As you know, today's leader in Internet backbone routing is Cisco. They have done a superb job anticipating market demand and have continuously built routers that have been large enough and smart enough to handle the growth of Internet traffic. Now, 1993 to 1994 was probably the time of greatest crisis in the Internet community. We all owe a great deal of debt to the U.S. government for leading the Internet community out of what would have been a disaster, which was the complete shortage of IP address space and the inability of technology to keep up with the growth of the Iverson tables in the Internet. The National Science Foundation, as well as the Federal Engineering Planning Group, developed a set of technical solutions that were implemented by Internet service providers just in the nick of time.

Now, however, we are faced with continued growth. As one of the previous speakers said, it is doubling every four months. In our network, it is actually growing a bit more than that, because we are tapping the foreign demand for access to the U.S. Internet. Our friend, Michael Dow, chief technology officer at UUNet frequently says that, if you are not scared, you should be. There is no experience in the past for dealing with that kind of growth.

This chart was developed by Pluris to show their premise for being: namely, that today's router technology probably can not keep up with the demand we will be seeing in the late 1990s. Therefore, they and probably five or six other companies are now trying to develop advanced routers that will be able to scale to very, very high speeds. Backbone speeds will then be approaching E12, the six hundred and twenty-three megahertz range, and we will be graduating to OC48 next year, which is 2.4 gigabits, and eventually to OC192, the ten-gigabit range.

So, equipment will be needed. The fiber is one thing, the transmission is one thing, but we will need the ability to route that traffic. So, going back to my previous slide, about the

switch versus the connectionless world, if I were an investor here, I would look to see what the switch vendors are doing to run at these speeds and to handle the kinds of call requirements that the Internet, the Internet provider community, or the Internet users, want out of this business. One could conclude that, in the long run, an IP-routed infrastructure will win.

Let's look at the next slide. Strangely enough, there has been a lot of government direction or encouragement to develop broadband services, and, at the international level, the G7 nations have put together what is called global interoperability of broadband networks (GIBN). (Incidentally, if anybody would like a copy of my slides, just give me a copy of your card and I will make sure it gets mailed to you.) In the GIBN program, there are eighteen broadband-oriented projects, things like remote telemedicine, process control, that kind of thing, and a strange thing happened over the last couple of years. These connections were going in at the one hundred and fifty-five megabit level. Now we are seeing a shift in power line. Whereas the deployment of broadband infrastructure had been driven by unique broadband applications, it is now driven by the general purpose commodity, the commercial business requirements of the Internet.

Looking at the next slide, government-encouraged investment in communications and infrastructure is clearly a good thing. The military has said that communications is a force multiplier, and that is very true. In the economic world, without a doubt, our economy has been stimulated nicely over the last few years by the growth of the Internet and communications infrastructure.

In conclusion, however, the job is not over by any stretch. The last mile is very, very critical. Though we be in a bit of a stalemate here, high-capacity services are clearly needed and, in the long run, the router infrastructure is going to win, in terms of carriage of Internet traffic and data.

Thank you.

John Giere, Ericsson

MR. GIERE: Good morning. Ericsson, as you probably know, is one of the largest telecommunications equipment suppliers in the world. So, obviously, we focus on a number of markets, one of which Bob has focused on a great deal.

I want to focus today on some investment decisions. This is a presentation, or a narrow subset of a presentation, that I just gave to ALS on Wall Street, with regard to one particular market segment, which is what we call the new modernization market statement, as outlined by Erik in his beginning. More specifically, I am going to talk about third-generation (3G) wireless services.

Before I do that, however, let me touch on Ericsson's view of the future of our industry. As you can see, it is not some great state secret that - like most of our competitors, I'm sure - we see a growing, increasing convergence of a variety of services that are provided by a variety of equipment suppliers. As we see it, one of the keys to the future is how one is going to fit into the information/communication industry, on what niche and on what segment one is going to focus, in the way of providing equipment and networks.

We see the convergence, but we ask what are some of the trends we are seeing.

Looking at the next slide, the wireless market evolution, as we see it going forward, has two segments. There is obviously the mass market segment, which, in this country, very candidly, is stuttering its way towards a more mature growth. If one looks at the marketplace today, one sees a lot of the underlying service providers looking at mass markets and trying to design a phone service comparable, if you will, to what one sees on the local and long-distance side today. The type of functionality in the future is what those customers are looking for.

Down below that is the business segment. Obviously, we divide that into large and small businesses, because both of them are going to have unique needs on the wireless side.

The next slide gives a market segmentation look, from our viewpoint. Bob touched on certain components of this, certainly on the wide area network (WAN) group. However, as we go down the value chain to the residential side, we see a wireless/wireline mix. With wireless access increasingly becoming important, on the corporate side, wireless accessibility is going to be more and more important. That is important, because, as you can see, the corporate side is going to drive a lot of wireless applications in usage.

Going back to my original slide, we will start to see more feature-rich and service-rich environments in corporations, such as Internet accessibility, trailers for your phones, things like that. We are going to see those networks beginning to integrate. Bob touched a bit on that one issue about switch for packing networks.

There is a variety of even broader issues there. For example, how will satellites integrate with the local phone, and with the various types of service providers? They are trying to go over these various networks. On the right hand side, the instruments being used will also compress. Thanks to Microsoft, Intel, and others, we will be seeing much more intelligent PC modems, PC handsets, and a variety of television technologies. Sony just announced a PC version of the TV-radio-cellular phone, coming shortly in the future.

Next slide: what will these personalized services be? You can see here a variety of suggestions on our part. In the middle, you see the underlying networks that we bill to. On the outside are the variety of services that we see, either already in place or very rapidly coming into place, with regard to what someone is going to be looking for in network delivery on the broadband side.

The next slide shows some of the requirements we are going to be seeing in the third-generation systems. So far, the most active parts of these systems have been in Asia - Japan, in particular - and in Europe, where they are beginning to build to a third-generation standard. You can see that it involves a much wider kilobits per second, all the way up to two megabits. Obviously, data is going to be an integral component of these networks in real-time and non-real-time capabilities.

In this final slide, you see some technology trends. Software has increasingly become important. At Ericsson, we have over eighteen thousand R&D engineers in twenty-three countries, primarily focused away from the network infrastructure to the software side. Micro-electronics is obviously important. As for radio access - in this case, on the wireless side - the broadband technology will rapidly become more and more advanced. On the computer side, we will be seeing greater and greater market segmentation. We are already beginning to see that. If one looks at the European marketplace, the average cellular phone user has roughly

about 2.5 services. In this marketplace, it is right around one. Indeed, it surprises even me that voice mail is only selected by about thirty percent of the customers right now. I think you will begin to see that market segmentation become robust.

If one looks at current investing on the wireless side in this marketplace, a large amount of customers, as Bob mentioned, are just being introduced to wireless capabilities and wireless accessibility. In fact, most of them are putting what I call a toe in the water. They have not exactly developed a full dependency on that type of infrastructure and that type of service, but, obviously, if we look at some segmented statistics in the state of Louisiana and other places, we see a larger and larger, and growing, market of folks who are beginning to exchange a certain portion of their wireline needs for wireless needs. I think you will increasingly see more of that, obviously through the corporate side, and, frankly, through availability and better engineering of what we can provide to the customer in the way of specifically targeted and segmented service.

Generally, across the board, if you look at investments, we recently announced that most of our competitors have done a formation of data networks and data solutions groups. Obviously, most of that is going into the broadband networks that are supporting a lot of the Internet providers. That is clearly the fastest growing market segment. If you look across "the world," at the traditional market players, I think you see right now what I like to call the business strategy phase. I think a lot of folks are sitting down right now with their green eyeshades, and various forecasters are trying to figure out what they want their network to look at in five or ten years. So, there is a bit of reluctance to make a significant investment in modernization, because there is a multitude of opportunities.

With that I will close, but we do see the marketplace moving rapidly towards the millennium, and I think you will see some renewed, significant investment in broadband. Thank you very much.

Timothy Stone, Motorola

MR. STONE: ...talking about forty-two minute, one hour, and two hour Internet sessions. You want to be on all the time. You do not want to set up and tear down phone calls. We have done surveys of this at Motorola. There are surveys out there that say access to the Internet, particularly for the teenage population, is more important than television. A recent Reuters survey showed that, among all things teenagers would give up, the last thing that they would give up is their access to the Internet. So, this is a very fundamental change confronting all of us.

There is also what I call the drag race over how fast one can send or receive a file. We have had experiences in our company, and I am sure you have experienced this too, when you put together a wonderful report or a wonderful document, with lots of graphical content, and then you try to transmit it somewhere. Oftentimes, you can not even move the whole file. You have to chop it up in pieces. There is a major issue about the ability to transfer files. Shown here is a ten-megabit file transferred at 14.4 and higher rates. It does make a difference. If you want to wait minutes for files versus seconds for files, the kind of bandwidth you have available does make a difference, and it is not just downstream receipt or downloading of files.

We believe the future is about symmetrical, interactive kinds of applications. Therefore, we have to ask ourselves not just whether there is enough bandwidth going in when we need it, but is it the right kind of bandwidth, and are there enough choices out there in the marketplace, in different technologies, with different vendors, to provide the end-user with a kind of bandwidth investment he or she needs?

If one goes a little further out and talks to people like Vint Cerf, one starts thinking about IPV4 and IPV6 chips, coffee cups, coding, and so on. We are having a hard time grappling with that, although we love the semiconductor consequence of that.

Some people, however, say that this growth of Internet access, the things as well as people, is going to be dramatic, and we have to be prepared with the right communications products and infrastructure to support that growing need. Bob and others on the panel here have already commented about the dramatic growth in data versus voice. That came from an MIT study, published late last year, that shows, in the case of MCI, I believe, a dramatic shift in data versus voice, crossing well over the fifty percent mark on many links. The world is becoming a very data-driven world, thanks to Internet. One can imagine that a time will come when voice will ride for free and data will be paying the bill. So, that raises a lot of questions about the kinds of networks, packet versus circuit, and whether the investments being made today and in the future are going to be in the right kinds of robust, networks from a data standpoint.

So, we move from today, with a world of networks - basically either narrow band telephony, voice-oriented networks, or very asymmetrical broadband kinds of networks, via satellite or first-generation cable - to a future where the data rate will be very, very important, and the network will be more symmetrical. People are publishers. They are sending out valuable information, not just bringing it into their homes.

So, we like to present a new-frontier space, shown in grey here, with data rates in the megabits versus kilobits, and with affordable cost to the consumer. We have to ask ourselves what are the choices, what are the solutions that are going to fill that space? Some are wire lines, some are wireless, some are satellite. We think that is a tremendous space, which many of the current choices may not adequately fill.

How big is this market? We have done our slicing and dicing to figure out what it is. I do not know if you can read the very top of this view graph, but we have taken the U.S. population and cut it by income level, by age and every other combination we can think of, and, calculating for the year 2001, we estimate that somewhere between fourteen and sixteen million U.S. consumers will be wanting higher-than-ISDN rates. Furthermore, we believe that number is growing exponentially. Looking here at market research data that projects how many subscribers are going to have the different combinations of xDSL, two-way cable, and wireless satellite options, we find ourselves straining to reach fourteen-to-sixteen million users. Moreover, the projections we have made for the future beyond this time period show broadband demand growing exponentially.

However, investment in broadband is only growing linearly. The gap gets larger. So, from the standpoint of a major wireless communications manufacturer, we are beginning to think now about the future, and about whether there is something else beyond our current

investments and beyond second-generation and third-generation cellular systems. Is there an opportunity here for wireless?

We also believe, by the way, that, given the tremendous growth in broadband demand, no one solution is going to fill all the needs. As I said earlier, cable will never reach me where I live, in Chicago's distant suburban area. So, there is a role for wireless, there is a role for satellite, there is a role for all these technologies we have heard about, and the question is whether the investment will come in time and be fast enough to support the growth of industries such as the computer industry, the automotive industry, and other industries that are terribly important to our company and to the companies represented on this panel. So, thank you very much for your time.

Tom Cohen, Davidson and Cohen

MR. COHEN: I am here today because of a phone call around noon yesterday, from my friend, Tim Regan of Corning, who said, to paraphrase Henry Youngman, who died last week, "Take my speech...please!" Now, anyone who has ever seen Tim knows that no one can replace him, and I am not even going to try. However, I will try as best I can to represent Corning's viewpoint. Tim, in fact, not trusting me entirely, sent John down from Corning just to keep an eye on me.

I want to get back to the issue that we have all touched on. We can call it broadband or bandwidth, but, for Corning, all those words mean fiber, fiber, and more fiber.

Tim wanted me to contrast for you what happened after divestiture, back in 1984, what happened after the Cable Act was passed in 1992, and what has happened since the Telecom Act passed in '96, in terms of investment in fiber.

Divestiture, in fact, was the major event for Corning, in terms of getting fiber into the marketplace. MCI made a major purchase right after divestiture was announced. If one looks in that time frame, they went from nothing, in effect, up to three hundred and twelve total kilometers, in almost no time at all. That is eighty-five percent growth.

After the Cable Act, the cable industry began to face competition from DBS providers. The program access provisions, in particular, allowed those providers to get hold of the other programming and, again, use of fiber in the cable world shot upwards.

As was shown in Erik's slides, however, investment by the ILECs has gone down since the 1996 Act. In fact, in today's *Communications Daily*, there is an article about TIA's new numbers. In terms of fiber, to the surprise of no one who follows Quest or IXC or Next Level, the long-distance industry went up about eighty percent last year. Last year, for the first time, the cable industry put in more fiber than did the ILEC industry. The ILEC industry, and we are really talking about the last-mile feeder plant, dropped.

What has happened? Why is it going down? I am going to focus on that part. I am not going to address questions about what to do about it and the like, but just to talk about what has happened. From Corning's perspective, it has been a collaboration of several things coming together: (1) regulatory policy, (2) technology, and (3) the nature of the businesses in the market out there.

Again, let me go back here and try to contrast what has happened in each instance. With regard to regulation, divestiture was a relatively clean policy. It was structural separation, and did not have that much of an administrative or regulative component to it. There was some regulation with equal access and a few other parts, but it was a clean break separating the long-distance and equipment side from what was still seen to be the local monopoly.

In the Cable Act, there were some problems in getting the program access provisions out, but, again, it was relatively confined.

In contrast, the 1996 Act turned a lot of new ground. It was administratively top heavy, and there was a lot of regulation. The FCC did an admirable job. They did the best they could, considering that it involves a lot of uncharted territory. Unbundled elements have to be made available, and terms and conditions need to be determined. A combination of federal and state law is involved. Local barriers have to be dealt with. Susan Ness addressed this in her speech, when she said it is too much to expect that we will have full-blown competition two years after the Telecom Act. There is just simply too much that has to be done, and a lot of uncharted territory.

In addition, there are other regulatory incentives in place. For example, Bob Pepper asked a question of Erik about whether price cap regulations may be one of the causes of reluctance to invest. There are other factors out there as well. There is the uncertainty with the court review, and that will overhang this industry for all of the next year, until the Supreme Court at least deals with the eighth circuit. So, we have a situation of greater regulatory uncertainty.

The second issue is the technology. Others here have mentioned the various technologies that could emerge in the market. If one is trying to enter the bandwidth market, what does one do? If we think back to the beginning of divestiture, it was essentially a long-distance competition, and not all that difficult. We were still in the fourth-kilohertz voice business in those days, and we were putting in microwave first, and then fiber, in the fourth-kilohertz voice business. In the days of cable and DBS, technology was pretty well set as well, if we were into the TV business.

Today, however, in the bandwidth business, as we have seen from the other charts, we are in a lot of different businesses, and there are a lot of different ways to look at those businesses, in order to produce bandwidth. Are we going to approach it from a telephony side, or are we going to come at it from a broadcasters side, with DTV, or with other folks who have the capability of putting greater capacity onto their networks?

Right now, we are going through the LMDS auctions. At first, people thought of LMDS as just a competitor for cable. Now, the bidders are looking at something quite different, which is bandwidth, high-speed Internet access, and whether they can do it. The holy grail out there is getting that bandwidth. Everyone is trying to do it. So, that is confusing the folks out there. It is also a difficult decision for risk-averse companies, and we have those with a lot of incumbents.

In the broadcasting industry, we are still living with technology that is forty or fifty years old, and older. We are still living with copper plant, for example. The telecom industry,

the cable industry, and coax have put it in a long time ago. That is fundamentally what we are living with.

Let me go back now to the market, because I was alluding to it before. The mixture of companies going for this in the market is a tremendous range of companies, with various incentives. The incumbent telcos are low-risk-earnings companies out in the marketplace, monopolists with all the incentives that come with their status. Cable companies have their own set of incentives that go along with the market power they possess today. There are a series of CLECs now cropping up, and to talk about CLEC is probably to talk about it too broadly. There are such a variety of CLECs in the business, from cable companies branching into it, and straight-ahead CLECs putting in wire, to wireless CLECs at twenty-four gigahertz and thirty-eight gigahertz. Also, there is a new group, one of which we will be hearing from during the next panel discussion, and that is land companies that are coming from the inside out into the marketplace. These are people who know bandwidth and are bringing it out with them.

So, all of these are coming together, and, in Corning's opinion, we need to figure out, most importantly, on the regulatory side, what are the barriers to having everyone move forward and make this investment. Section 706 of the Act, the advanced telecommunications section, was designed for that purpose. The commission, this year, will have a proceeding dedicated to it, and we think that is the appropriate spot for everyone to get involved and try to answer this question and to see, particularly in this instance of the FCC, whether there are regulatory barriers standing in the way of making this happen. Thank you.

MR. PRESSMAN: Thank you very much. We have time for a few questions from the audience. If you can step up to one of the microphones, and please state your name and affiliation. Thank you.

MR. MAIBACH: It is both, Robin. First, we have all our homes and offices wired, which some countries do not, some regions do not, and we can get service pretty quickly. We do not have to wait weeks or months to get service, unlike, let's say, Eastern Europe or parts of Asia. However, it is a circuit switched network, and the switch-and-net-related technology has been a problem. Our view at Intel is that, if we can get some more competition in the local loop, a company can call you at dinner time and ask you to switch to them because they have a broadband package switch network. That might be helpful. I think it's both.

MR. COLLET: I would like to follow up on that from the perspective of an Internet service provider. There is no doubt that having access to copper is a major advantage. It is a function of will power and desire to put the right electronics on it, and it ought to carry ten megabits per second. I would much rather have it than not have it, absolutely.

MR. COHEN: It depends on which segment of the market you are looking at as an asset. For future uses, it may be more an albatross out there. But, in the current market, as it is evolving, it can be a great asset for being able to migrate, not only to use it for the current

market, with second lines, as we have discussed, but also to migrate to higher speeds with xDSL. So, it may provide a migration panel for it.

MR. NELSON: I am Mike Nelson, of the FCC. I have a two-part question. Half of it is for Tim Stone, and the other half is for John Giere. First to John: Ericsson recently announced an interesting new product, a splitter that allows someone using the Internet still to receive phone calls on a single line. I think that is a very interesting product that really has not gotten a lot of attention. It is interesting to me, because it could dramatically change the market and demand for second lines. If I can use one line and get both calls and Internet, that is going to change things. So, I would like to know a bit about how that product is going and how much demand there is for it.

Then, I have a broader question to Tim, about what consumers really want. How did you get that fourteen-million figure? How do you determine what the customer in the year 2001 is going to want and what they will pay for it?

MR. STONE: Let me start with the second question. We have actually run quantitative surveys on the Internet, to large samples of the population that are statistically linked to the total population. By the way, you can do that in a week's time, and the turnaround, if you use the Internet, is fabulous. So, that is one of the ways we sliced and diced it. Also, I have been in other gatherings where there has been a significant representation from the telephone industry, the cable industry, and the computer industry, and there has been a lot of sharing of what those numbers are all about. One hears estimates anywhere from fifteen to twenty million in the United States, from most of those organizations.

MR. MAIBACH: Most people think the sweet spot is going to be in the next couple of years, between a forty and fifty dollar flat rate. Then you have to ask the question about how much the subscriber is going to pay for the equipment itself if there is not subsidization of the equipment. As for your basic question of what people want, quite frankly, you have got to go out and talk to people, and I can not tell you how many focus group meetings we have had, with teenagers as well as adults, all across the nation. You would be amazed at how many people are so comfortable on the Internet, particularly young people below the age of twenty. If you ask them what kind of connection they have, they will tell you what kind of connection, what data rate, and who manufacturers their modem. They will also tell you what they want. Basically, they say that they want to be able to do things right now, and they do not want to hear excuses about bandwidth, or about how their computer does not want to run fast enough. They want CD's now. So, that is our future customer.

MR. GIERE: Mike, thank you for the opportunity to run a commercial here. Indeed, we did make that announcement. The product is in launch right now, so I have just approved a fairly large budget to advertise the availability of that project.

However, I want to tie that to one of the original questions, the question about whether you would rather own what you already know people will buy, use, and take advantage of; or would you rather own what you think they will use and take advantage of?

Frankly, it sounds prehistoric, but when I know what feature and functionality I am going to be able to sell, and when, just as Tim does, I can predict fairly well the demographics and usage and other things that customer is going to have, it is awfully hard to leave that comfort zone and go into the zone of new applications. It is a matter of Marketing 101, but you really do get an uptake on a very, very small subset of the population. It keeps your production levels low, it keeps all of your economies of scale difficult to bring out.

What is not happening fast enough, in my opinion, and Mike alluded to it in his presentation, is that we have seen enough of these services quickly to mature. It is unbelievable that my product, for instance, on the handset side, has an eighteen-month cycle in the market place. Believe it or not, for all the R&D that goes in, it is very difficult to get that product out and get it fast, get the maturation of it, obviously harvest the benefits of it economically, and get the consumer to use it, for a lot of reasons. First, if you are off, it is a big mistake. Second, a lot of customers tend to be somewhat reticent to go into that next level. They are getting into the computer and they are getting into the Internet, but they are not adding a lot of features and functionalities to it yet. We all know the statistic. You still get the Internet, you get Email, for the most part, and you are not mining further back in. I think that will happen with the teenagers and other people who are coming through, but it gets much slower even then. When you see fast service, you kind of get hyped up and say "it's coming, it's coming," but I think we are still above the curve.

[Question inaudible.]

MR. COLLET: The answer is yes, but you have to overcome the obvious benefits of building on a second line. Financially speaking, a lot of users, particularly high-end users, are a lot less price sensitive. Now, when you are into the residential side, absolutely, Mike, I think that market segment clearly is going to take to this type of product, and all the eventual, related products will come out. However, when you get back into the real drivers, the economy it's sort of a good news/bad news. If you have come up with these types of applications, you are clearly cutting off income opportunities, because a lot of the second lines have absolutely zero sensitivity to them. People have got to have a second line or multiple lines for business, or whatever, and they tend to get less and less price sensitive and more and more conscientious about what they are getting, whether they are getting good, fast delivery, and that kind of thing. It is absolutely a market challenge.

We think we are showing, in the early years, a lot of positive growth in that area. It is obviously targeted at residential users more than any other user. We are very optimistic. I think it also pushes more and more of the technology envelope, because, what else can you do to take care of the obvious problem we are discussing, which is that last-mile bandwidth? If you really get down to it, that is ultimately the part of the market in which we are trying to invest.

MR. PRESSMAN: Okay, if that is all of the questions, thank you very much, everyone.

28• *America's Broadband Future Conference. March 3, 1998*

Panel II: Delivering Broadband Services to the Home -- A Supplier's Perspective

Shant Hovnanian, Chief Executive Officer, CellularVision
Elwood Kerkeslager, Vice President Technology and Infrastructure, AT&T
Dhruv Khanna, General Counsel and Vice President, Covad (inaudible)
Tom Tauke, Senior Vice President, Bell Atlantic
George Vradenburg, Senior Vice President and General Counsel, America Online

Moderator: Jodie Allen, Washington Editor, Slate Magazine

MR.HAMILTON: Welcome to our second panel for this morning, which will build on some of the themes mentioned earlier and specifically address the subject of delivering broadband services to the home, from a supplier's perspective.

Leading us through this conversation will be our moderator, Miss Jodie Allen. Jodie is the Washington editor of *Slate Magazine*, which is Microsoft's online magazine of politics and culture. Before joining *Slate*, she was editor of "Outlook," the Sunday commentary section of the *Washington Post*. She has also been an editorial writer and business columnist at the *Post*. Her editorials have gotten her a Pulitzer Prize nomination, as well as a nomination for the Gerald Globe Award for business writing. She is a frequent guest on many shows, PBS, CNN, C-Span, BBC and NPR's marketplace. We have managed to convince her to be away from the Hill this morning.

MS. ALLEN: Thank you. We know that most of our readers, for example, do not take advantage of the video clips and even the audio clips that we provide for them, simply because it takes so darned much time. So, I'm somewhat horrified at the prospect, as one of the earlier speakers mentioned, of every man as his own publisher. As an editor, I know the pitfalls of that sort of activity. Nonetheless, we do look forward to a broader bandwidth.

I'm going to ask each of our five distinguished panelists to focus on problems. What is it that's keeping them from bringing stuff to the consumer faster? Is it technological problems? Is it a capital problem? Is Wall Street not providing what's needed? Is it a governmental problem? Is there too much regulation or, perhaps, too little regulation? Is the problem with market conditions? Are there too many competitors and too little apparent demand to justify the huge investments that many of the other speakers noted are now needed.

This is a pretty sophisticated audience, but I will ask the speakers not to get too deeply into jargon, and please not to get bogged down in the fight over who should provide local telephone service. Section 271 is very much at the heart of all these pictures.

I was going to introduce each of our five speakers as they spoke, so you could remember them better, but we are pressed for time, so I will just briefly tell you now who they are.

Our first speaker will be Mr. Shant Hovnanian who is the chairman, CEO and cofounder of CellularVision USA. Through its wholly owned subsidiary, CellularVision of New York, his company is the exclusive, FCC licensed, local multipoint distribution system provider of the multichannel, broad-based, wireless cellular television system. That system now serves 11,000 square miles in the New York statistical area.

Our second speaker is Mr. Ellwood, otherwise known as Woody, Kerkeslager, vice president for technology and infrastructure at AT&T. He has had extensive experience in the development and application of computer and communications technology in the U.S. and global information infrastructure. His early career at AT&T Bell Labs was focused on the development of computer-controlled telephone switching systems and other hardware and software. His current career is focused on the identification and application of new technologies to address user needs, and the management of ATT business unit functional areas.

Third, we have Mr. Dhruv Khanna, who has served as vice president and general counsel of Covad Communications since October '96. He was previously with Morrison and Foster and, also previously, a senior telecommunications attorney at Intel Corporation. He's had extensive experience with regulatory matters and business transactions involving telecommunications companies, and has helped shape the various provisions of the 1966 and subsequent regulations.

Our fourth speaker is Mr. Thomas Tauke, senior vice president for government relations at Bell Atlantic. For the past two decades, Mr. Tauke has been a leading voice in the nation for telecommunications concerns previously as a member of Congress, representing Iowa's second congressional district in the House of Representatives from January '79 to '91. During his congressional service, he served on the telecommunications subcommittee, along with many other committees. He is currently a member of many other boards, including the Visitors of the University of Maryland Public Policy.

Finally, we have Mr. George Vradenburg, senior vice president and general counsel of America Online.

Shant Hovnanian, CellularVision

MR. HOVNANIAN: Thank you, Jodie. Let me attempt to give you a synopsis of the creation of a new industry, a process that our company began about eleven years ago. That industry is known today as LMDS, which stands for Local Multipoint Distribution Service. When we started the project, there was no name for it. We had attempted to name it MLDS, and the FCC got creative and called it LMDS. Let me tell you what that stands for.

Over the last eleven years, we took on this effort and virtualized frequencies that were not used worldwide. Through research and development and the building of an operating system, we have spearheaded and developed an international platform for what is now known as LMDS. Because of our pioneering efforts, we are coined as the leader of this new industry.

LMDS is different mainly because of the capacity that we have. We have 1300 megahertz of wireless capacity, which is equivalent to the capacity of a fiber-optic line. It is the largest amount of spectrum ever licensed by the FCC to any operators in territories throughout the United States. The only operating system in the world is the one that we have built in New York and, as we speak, there are auctions going on for the regulatory territories throughout the country.

The unique characteristics of the frequency we have chosen are actually a major asset in urban areas, where we feel LMDS has a very large impact. The frequencies are very small and they bounce off of buildings, which makes it an ideal communication medium. Also, the wireless nature makes us a perfect complement to fiber optics, in terms of getting to the last mile or the last thousand feet.

Another unique feature is the cellularization approach that we have taken. We do not want to cover large territories. Our largest cell is a three-mile radius. We can get actually unlimited band width by reducing the size of the cell, which is actually a very unique advantage that we have.

The other feature the frequency gives us is that, because of its size, the millimeter wave band, the equipment associated with it, is very small. Our six-plus-six-inch dish has the equivalent gain of a thirty-foot satellite antennae at lower frequencies. Again, the cellularization gives us virtually unlimited capacity, being an appropriate complement for satellite networks, long-distance, and fiber networks going into major metropolitan areas.

Here is a chart that shows you the difference in capacity of various wireless operators. A television channel, VHF, is six megahertz wide. A cellular telephone operator has a license of 25 megahertz. The satellite transponder, on average, is 27 megahertz wide. A VCS operator, the new cellular telephones that are being promoted, has a license, in the best-case scenario, of 40 megahertz. A wireless cable operator, or MMPS, has, in the best case scenario, just under 200 megahertz. The bandwidth at LMDS frequencies, however, is an unprecedented 1300 megahertz. If you take all the other operators and add them together, you still only have roughly a third of what LMDS has.

The unique features I've gone over before, but one of the most important things to realize is that, with the cellular architecture, you can reuse the frequency over and over and over again, giving you virtually unlimited capacity.

Here you see a territory that we have a license for. We applied for this license in 1988 and received it in 1991. It is for the New York PMSA, and it covers approximately 8.5 million people and five burrows. The important part of this market is business traffic. During the day, from the outlying suburban areas of New York, two-and-a-half million people come into Manhattan for work. That gives us actually an increase in telecom traffic during the day - telecom traffic being Internet, high-speed data, T-1 lines, and T-3 lines. All of those are capable of being delivered by LMDS.