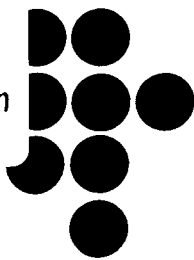# COMMUNICATIONS
FORUM

"Communications, Computing, and Creatures"
10 November 1993
Bartos Theatre
20 Ames Street
4:00 to 6:00 p.m.
Massachusetts Institute of Technology
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Ellwood R. Kerkeslager, Vice President
Technology/Infrastructure
American Telephone and Telegraph

Harvey M. Sapolsky, Moderator
Department of Political Science
Massachusetts Institute of Technology

Kelly M. Greenhill, Rapporteur
Graduate Student, Department of Political Science
Massachusetts Institute of Technology

Moderator HARVEY SAPOLSKY: Welcome to the M.I.T. Communications Forum. Today we are trying a new format, a format that I think we'll find quite interesting. It occurred to me that since telecommunications is a very dynamic industry, we ought to try to keep up with the products and services that are coming out in this field. What better way to start than to have the largest, and one of the most dynamic companies in the business, make a presentation about its plans and strategies in terms of products and services. That company is AT&T, and representing AT&T today is Ellwood Kerkeslager, Vice-President for Technology/Infrastructure.

      Woody, as he is known, is a graduate of Penn State, where he received his bachelor's degree in electrical engineering. He also received a masters degree in electrical engineering from N.Y.U. and an M.B.A. from the University of Chicago. Mr. Kerkeslager started his career at Bell Labs, and has done a variety of things for AT&T. What I hope he'll do for us today is to describe what is on the horizon for AT&T. We hope this format will become a regular feature of the Forum, one in which we learn about what is going on in the companies that are shaping the industry.

ELLWOOD (WOODY) KERKESLAGER (WK): What I would like to do today is give you some perspective on the way AT&T looks at the market, both in the United States and around the world. I will try to present a picture of the ways in which we serve consumers and business customers, as well as what we see as impediments to providing the kinds of services we want to offer to our customers. With that background in mind, I would like to show you our technology, starting with the technology here and now -- an abbreviated presentation of products and services we have on the marketplace, and then moving on to the near term leading edge technologies, and then finally looking farther out in the future in terms of what we see, into the first decade of the 21st century.

      The best way to talk about the marketplace as we see it, is in terms of the current buzzword in Washington, "the National Information Infrastructure" (NII). I will tell you how we view the NII from an AT&T perspective. From a policy perspective, the NII is key to the United States' global competitiveness, and key to our overall society in terms of social benefits and the quality of life for every American, not only in terms of jobs, but also in terms of education and health care and many other factors of life. I will explain this in some detail in a minute.

      First, I will discuss the components of a National Information Infrastructure. The reason we do this is that many people in Washington are asked to make policy decisions that relate to technology or relate to the NII, and they have no feeling for what the NII actually is. We have defined the NII as having three physical components [i.e., information appliances, communications networks, and information resources], and a non-physical component [i.e., human resources] because our view is that the only thing that matters to consumers and business customers is a useful application. They often do not care about some of the products we are going to show you, nor do they care about certain services. They only care if it can be useful to them, if it is affordable, and if it is available when they need it -- those are the components. In the context of the NII, you have to combine the three physical components with the fourth piece, human resources, which reminds us that the physical applications are only there for the benefit of people, and have to be easy for individuals to use.

      Many times when getting into a discussion of products and services, people focus on a single application or on a single user, and then try and generalize it to the whole world. They falsely assume that the whole world has the same needs. So, in order to counteract that view, we try to point out the diversity of situations in which we live and work. Some examples of different needs to be met by the NII include those involving health care, industry, research laboratories, transportation, education, and housing. Drawing on this diversity of examples provides us with a good platform for talking about marketing to government policy-makers, who often do not have business school backgrounds or the experience of selling products for a profit. This way we can explain

the vast difference between trying to provide a service to 90 million homes and trying to provide one to 20 supercomputer centers.

Next, I'll just give you a brief overview of what we see as trends in the consumer market and in the business market. Consumers are reacting to an increasingly complex world, and at AT&T [as a business, as technologists, as researchers], we are telling them nothing is going to change, expect that things are going to move more rapidly, and are going to get more complex. What consumers want, first and foremost, is to simplify that complex world, and make it easy to live in. So they like it when we tell them there will be a lot of information available, but they also want this information to be easy to use. They want it to cater to their own particular needs, and they want to be able to shut it off when they choose. For their own purposes they want to be productive individuals, therefore they want this world to be user friendly and allow them to become more productive and efficient. They want to reduce paper, and given the increasing amount of information being made available, they want to glean and personalize that information. Finally, to repeat a point, they really want to alleviate unwanted clutter.

QUESTION 1: Affordable access has not been mentioned as a priority. Does AT&T not consider that to be important?

WK: We think that affordable access is fundamental. In fact, we view it as so fundamental that we did not even list it separately. But yes, we think it is crucial.

QUESTION 2: What is the profile of the typical consumer?

WK: There is no "typical" consumer. When we do market research, for either business or consumer markets, we have to go in and understand each segment separately. I could talk about specific segments by, for example, age, or what kind of work you have been trained for, or one's academic background is, but not in terms of one type of consumer. Does that get at your question?

QUESTION 2, response: What percentage of the population feels that these particular articulated needs mirror their own?

WK: These needs are distillations of a great deal of research and general conclusions. So I would say that these needs represent a feeling which spreads fairly broadly across the population, across a majority of people. I could characterize it that way. For instance, in terms of getting rid of unwanted clutter, too much complexity, and alleviating information overload, there is very broad feeling across the population that we want to alleviate these things. Separate segments may express it differently, but they are all distilled into this comment. So the solution to this is not one particular solution, but different sets of solutions for different people.

QUESTION 3: There are large numbers of people who are functionally illiterate in our society. Do these same priorities/needs apply to them? They are not suffering from information overload. Perhaps they are suffering from information underload. Do they need to be filtered, or do they need more inputs?

WK: True, they are not suffering from information overload. But they are functioning in a frustrating environment, in which they do not understand what is happening to them, or how to function in this world. I think that that class of individuals has needs, which can be addressed by the NII, by the kinds of work that is going on here in the Media Lab -- projects that make it easier and more natural to interact and get information, lifting them from an educational process that was not very useful in training them. So yes, I think it has a specific function.

QUESTION 4: To what extent is the NII directed at consumers versus business and commercial applications?

WK: The NII exists now, and is used by consumers, business, and government at all levels. What we need to do now is to make it evolve more rapidly. Technology is moving swiftly, what we want is for it to move more easily and more rapidly into useful applications.

Some of the things I said about consumer needs are true for business as well. Virtually every business, global or domestic, faces competition and recognizes that since things are moving rapidly, they need to decrease their time to market with new products. They need to improve their customer service, expand globally [if that is appropriate for their businesses] and to form alliances. If a company is into any sophisticated product or service development, which spans a number of capabilities, there is a tendency to need to form alliances. Very few companies are in such niches that they can avoid doing so. Certainly if one is in a broad market, like AT&T, one needs to form alliances. It is impossible to keep up with all of the technologies and capabilities on one's own.

Furthermore, businesses also need to speed up the customer-supplier processes, while stressing a commitment to quality and the need for businesses to operate in a quality mode, with their suppliers, their customers, and in their own operations. To operate competitively, business also needs to reduce travel expenses, something that can be uniquely affected by the NII. The NII can act as a force multiplier for a businesses' customers and employees, while reducing costs. We also need to reduce time to market. Work in a globally, rapidly moving market suggests that things must happen quickly. Business has to use new services and new applications. If that is going to happen, the technologies have to be brought out and applications need to be built around them. That sequence needs to be repeated over and over again as time moves on. Unfortunately that usually does not happen, or happens in an uneven manner.

We have already spoken about consumer and business benefits. Now I would like to talk about societal benefits, such as health care, education, and intelligent manufacturing. Nationally, these are three of the biggest areas of concern at the present time. Some of the potential applications of the NII include computers, communications, information appliances, communication resources,. The applications at work on these can address for instance, health care, in thousands of ways. It does affect it now, but a heavy dose of the NII could reduce administrative costs by as much as 20 to 30 percent by most estimates. This could mean a savings of $10 to $20 billion per year, by conservative estimates. The NII can also improve the coverage of care by removing the distance limitations of health care. It can improve the equality of care, by making it as easy to care for a person in Utah, as in suburbia, as in Boston. Those are some of the benefits that the NII can bring, but only if certain impediments are removed.

The situation with education is analogous. Believe it or not, my own personal feeling is that health care, as messy as it is, will respond to applications of the NII before education will because there are fewer in health care than in education. I am speaking specifically about the K-12 environment, in which each and every school board sets its own standards, such that there are an endless series of independent marketplaces, for which we cannot provide products, since no one can agree. It is a very difficult problem.

Intelligent manufacturing is now focused on the need to help small manufacturers gain the benefits of advanced manufacturing techniques and modeling -- the kinds of costly, sophisticated applications that tend only to be affordable only by the large manufacturers, or by government. So we are trying to bring small manufacturers on-line and network them with larger manufacturers. There are a number of bills in Congress that do just that.

Some of the other societal benefits for the NII relate to employment, training, rural issues (e.g., lack of jobs, lack of medical facilities, etc.) and inner-city issues (many of

which mirror the rural issues). Each can be addressed in slightly different ways. Other benefits may include national competitiveness, international trade issues, aid to developing countries, etc. One of the straight-forward applications of an organization like the Media Lab, is looking at different ways to apply multi-media to aid people with disabilities. Other applications include consumer fraud prevention, work-at-home telecommuting, and AIDS information distribution.

Now, let us briefly talk about who provides the NII at present. In the United States, the NII exists between a half trillion and a trillion dollars a year of business. There are a lot of companies out there who provide it. The information appliance business is a highly competitive marketplace, but it is unique in that it tends to be layered by technology and by function. Likewise, the communications networks are provided by many players. On the exchange side, they are somewhat layered like information appliances. They are matched up one to the other. The long-distance business and the data networks tend to be more multi-function, and as for the information resources, there are lots of information and application providers out there.

The functioning of the NII is basically to enable connectivity, link people, provide access to a variety of information, transmit it in any form or combination of forms, and do it via an ubiquitous, affordable, interconnected, interoperable set of commercial networks. "Commercial" means not provided by the federal government, the state government, or any individual in government; it is provided by commercial companies now, and it should continue to be so. "Inter-connected" and "inter-operable" are a great deal easier now that the fundamental technology base is digital. And it must be "ubiquitous" because if we are going to provide uniform capabilities [and not information haves and information have-nots] the NII has to be ubiquitous and affordable. Moreover, we must remember that one size does not serve all; one network will not work for all people.

Given what I have said, this is the model we use at AT&T to decide what kinds of capabilities need to be provided to make these applications available to individuals. In short, we envision a series of networks with information appliances and information resources at the ends, using all different kinds of technologies, providing all different bandwidths, and using all different modes of communications, not only to fixed points, but to anyone, anywhere, at anytime.

As I mentioned previously, this is an ideal model of what should happen and the kinds of things that should be made available, but there are some impediments in the way. This is where the government can step in and where it should have a role in helping to move the development of the NII along efficiently. Some of the impediment that currently obstruct implementation of the NII include, professional reluctance, gaps in critical, enabling technologies, government research funds not focused on critical technologies, and lack of focused investment and research and development incentives.

QUESTION 5: Are you pleased with the Bell Atlantic and TCI merger, and presumably with more of those combinations going forward?

WK: On the positive side, there is the potential for creating competition. As that competition grows, this could lead to very positive results. We tend to look at these developments as positive, and we would rather view this as the likely outcome. There are scenarios in which these mergers could lead to a duopoly, which would be negative. But for now, let's just assume that is not going to happen.

QUESTION 6: What does what you have called "professional reluctance" stand for?

WK: "Professional reluctance" stands for the fact that a doctor, teacher, dentist, or similar professional may display a tendency not to want to use an application, not to use a personal computer, or not to go on-line to use a particular application, because they are afraid,

because it might affect their job, or more commonly because it is too difficult, and they simply do not want to take the time to do it in a way that might help them.

QUESTION 7: What are some of the "gaps in technology" you mentioned?

WK: The gaps in technology we are talking about are either things that are moving too slowly to allow a good application to work, or those in which the U.S. has a relatively weak position. One example I might give is high quality flat panel display TV technology. I clearly want to emphasize as often as possible the difficulty of use and the human element in the NII. Given that we all agree that computing-oriented and communications-oriented technologies are growing in power so quickly and that the costs are coming down, we have to take this opportunity to make the NII easy to use. That is what we are trying to focus on.

Outside of the United States, it is a different ball game to a certain extent. An individual company does not have standing in many fora. There are international standards, negotiations for marketing standards, etc. Those kinds of issues are government to government, and here again the U.S. government has a role to play vis-à-vis American companies and the countries to which we are trying to gain access, by making sure that standards are not being set specifically to prevent competition.

Some positive things that government can do to stimulate the NII include, being a leader in creating the vision and defining the national challenge, acting as an enlightened regulator, being a protector of innovation by legislating and regulating limits on liability in targeted areas, and by being a wise-funder, directing any appropriate subsidies to end-users who can freely select from the market.

QUESTION 8: The phrases "enlightened regulator" and "appropriate subsidies" seem to be oxymorons. What do you mean by these phrases?

WK: What I am trying to get across there is that there is an appropriate time and place for regulation. When the market will not work, that is when it is appropriate to regulate. An enlightened regulator is one who says that this market can work without my interference. An enlightened regulator will step aside and let the market work by itself. So, it may not be something we see too frequently, but it is something we would like to see.

An appropriate subsidy, I feel, is not an oxymoron. There are individuals is society who we feel should be subsidized, whether it be food stamps or telephone stamps. The mechanism we use in the telephone industry at present moves tens of billions of dollars across the industry. That movement of money across the industry, which provides those subsidies, simply distorts the market and provides subsidies to a number of people who do not need them. An appropriate subsidy is one that goes to someone who needs it, as identified by the government. Such a subsidy goes directly to the individual, so they can purchase what they need in the open market. This is in contrast to providing "lifeline" services at reduced rates that anyone in this audience can buy, many of us who do not need [and cannot justify] a subsidy.

This model of creating applications with computing and communications to the betterment of consumers and communications and government as customers is the model in which AT&T operates. We have four areas of business in which we are involved. The largest is communications networks -- long-distance networks in the United States and networks internationally. The second part of our business is what we call communications products -- telephones, modems, multiplexers, things like that. The third piece is communications equipment, which is sold to telephone companies. This piece includes the big switches used by AT&T and the local operating companies. It also includes the transmission facilities, the physical media of copper and fiber, and microwave systems and all of the support that goes with it. The fourth piece is our computer business, NCR,

which produces a range of computers, from sub-notebook, to notebook, to workstations and up through large multi-processor systems.

What we would like to do is show you a videotape that talks about some of the advertisements that feature new AT&T products. Pay particular attention to some of the new technologies presented.

[Mr. Kerkeslager shows the AT&T ad video, which show a series of diverse technologies including video-phones, utilization of information kiosks, telecom classes, remote video teleconferencing,]

The technologies shown are virtually all in service now. We recently moved from a prototype to an operational system on that "intelligent vehicular highway system." Some of the others were based on information kiosks, using an ATM structure in an information retrieval format. The other one was using a public phone into a Videophone 2500. Those are current products. The capabilities on the voice-recognition technologies to open a door are fairly commonplace now. Those are the kinds of applications which are useful to people. When we are talking about applications, these are the kinds of things we mean. Putting together the appliances, the networks, the information to make them useful to individuals. Those are some examples in our advertisements.

What I would like to do is show you some slides about our current products, and I would like to step through them in pieces. The first one will be information appliances, starting with telephones. Now, I am not going to dwell on telephones; the only purpose of putting this first is that this is probably what you think of when you think of AT&T. One step up is a transmission to the telephone of a calling line id. That issue, which raises privacy and all those related issues. Next, we see a proto-typical example of a cellular phone. This is a fully digital answering machine, which has some advantages going for it. As you move functionality out of a single purpose device like this into a computer or into some other information appliance, we see technologies like the following: here, for example, we have a specialized non-handset oriented digital answering machine. The niche to which this was addressed was those people who said they wanted as little space as possible taken up by their answering machine; this uses a scant 10 inches of desk space.

Next, we have a home FAX and answering machine, fully digital, automatic poling up to 170 locations, made specifically for the home. Here is a Merlin telephone, a typical device for a small office with a number of lines; it also has a FAX machine. We see a wireless home security system. Here we have an application for the deaf, a TDD, a specialized device that is very user friendly. We must bring these kinds of devices into greater use, to allow people with disabilities full usage of the NII. Finally, one of the telephones we are putting into place, Public Phone 2000, has a full video display screen, standard PC input terminal, a multi-purpose card reader, which will read magnetic stripes and other kinds of cards.

QUESTION 10: What is the current capacity [what is working in the laboratory] in terms of fiber transmission speeds, and when is it going to be available commercially?

WK: The current networks in the U.S., and under the ocean, operate at 1.7 gigabits per second; that is fairly common. There are four-plus long distance networks that are predominantly fiber, and each operating telephone company around the U.S. also has fiber. All of our new systems going in under the ocean are fiber. In the laboratory, we have systems running at 10 to 20 gigabits. We can wave-division multiplex those on a system. So you can multiply that 10 to 20 gigabits by 10 to 20; but keep in mind those are laboratory systems. Current estimates of the theoretical limits on fiber is around 25 terabits. Twenty-five terabits, which is way into the 21st century, would be about 350 million telephone calls on one pair of fibers. We have at the present time, more capacity

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than we need in our fiber networks, so there is not a real push to get more capacity. We are continuing the research to do it, but there is no market demand for it right now.

QUESTION 11: What plans are there to bring these technologies into homes and offices? Specifically, how do we convince the government to finance these sorts of technologies, how do we make sure they share AT&T's "vision" of the future?

WK: We are trying to convince the federal, state and local governments that they can help by clarifying their views on what are the social and economic priorities that they want the NII to address. If one feels that there is a field or a business need that the NII can help address -- health care, education, etc. -- we feel it is the elected official's responsibility to have a clear view of what they feel are the priorities, what they want to be done with these industries. If there are things the government can do to make that happen, they should get on the ball, and do their part of the job.

QUESTION 11, response: Well, it seems to me that, for elected officials, "vision" seems to come from mailbags. With enough letters, Congressmen tend to develop "vision" suddenly, with "vision" being fear of not being reelected. But since it has gotten so hard to understand technologies today, there probably will not be many mail bags full of letters demanding these technologies. So, I am curious where this vision is going to come from and who is going to pay for it. In short, what should industry be doing to educate consumers, businesses, and voters, in terms of what are the issues? And who shall pay for it?

WK: As far as the first issue goes, that is a new point that I shall take back as an action item to consider. We should think about what industry should do and what we should be doing to educate the public. Your second point about who is going to pay for it has a pretty straightforward answer. Our view is that industry should pay for it, and they should provide it in a competitive environment. If they make money, great, and if they lose money, that's tough, it is their money to do it. We do not see any case where the government has to put money in to do this or built that. There are some players in the industry who believe government needs to help industry, to put fiber in or whatever. We do not agree. This view goes hand and glove with the idea that we do not feel we need to put a fiber into every home, capable of carrying 30 to 300 million telephone calls, to provide the kind of information that the average consumer needs.

The average consumer, if we drive the copper wire to its capacity now, can get six megabits over that wire. The average consumer can probably get by with an enhanced copper wire, either with ISDN or ASDL. If one puts electronics on the end of copper, it goes faster. The next step up is coaxial cable, which can either be connected to the telephone, or to a fiber backbone, or through wireless connection to the home. There are many different options. But we do not need subsidies; we need competition to get these technologies into homes.

QUESTION 12: Do you really think the Baby Bells will do anything without local loop competition?

WK: Yes. Traditionally the industry has been divided into monopolies and duopolies. It was appropriate previously because the technology at the time they were set up, a regulated monopoly worked best. But the advances in technology have been such that now these barriers are breaking down, and now is the time to allow competition. The government needs to be involved anytime we are transitioning from monopoly to competitive market to make sure it is smooth, and there is not anti-competitive activity, but as soon as that happens, the government should get out of the way and let industry make these capabilities available to consumers in their homes.

QUESTION 13: Secretary of Commerce Brown is heading up a NII task force, composed principally of administration people, some academics, some policy analysts, etc. Do you believe this group will be effective in generating policies surrounding the NII?

WK: I do not know, but we believe the government should operate in a quality model between customer and supplier, where we are the customer, you are the supplier. If there is going to be a government program, they ought to ask the citizens [the customers] of the U.S. I hope the task force succeeds; at least it is a step in the right direction.

QUESTION 14: Do you see the mega-mergers that are taking place obviating the need for the MFJ restrictions on long distance carriers over time as competition grows?

WK: The answer is yes. The restrictions are currently there because the local line exchange wire line is literally a bottleneck. But if effective competition is introduced, add an enlightened regulator, and you get out of the way. We think that is a positive, simple, and effective way to address these issues.

QUESTION 15: You spoke earlier about alleviating information clutter. What do you see happening that will, in fact, reduce such clutter? And who will regulate it?

WK: I hope no one regulates the bit stream, per se. I hope the information flows freely, but what is available to consumers and business would be a number of service providers who would pull information together and organize it. So if, for example, you want to research a particular topic, they would provide a platform for use. Alternatively, they might provide capabilities by which they would have all the information flow through them, and only let relevant information flow through to the customer. Hopefully there will be a competitive market of either active or passive intelligence agents to do that, but not regulated in the sense of government intervening.

QUESTION 16: A lot of the improvements in efficiency and effectiveness in telecommunications may lead to reductions in jobs. Who is thinking about these kinds of issues, and what is being done about it?

WK: In some cases that is true, but it is not true in all cases. For example, there are a great many people not being served by health care at present, and I can actually see some jobs being created, which would allow some less well trained people to get jobs to effectively teach or to practice a form of medicine or treatment. So I think there is a potential upside there. In those cases where jobs are eliminated, we need to establish retraining and reeducation programs. If we are successful at setting up the NII and getting it to run efficiently, one of its first missions will be job training and retraining. It is not just helpful for health care, education, and things like that. It is also very helpful at training people from scratch; it is one of the best training mechanisms that exists.

QUESTION 17: We agree that it is more efficient for private industry to do the information highway. But problems arise with standards harmonization when different technologies are being produced. How are we going to deal with this? Usually by the time a standard is introduced, it is already obsolete.

WK: Yes, this is a major, major issue. Government definitely has a role to play in standards, but industry is the primary driver. Industry, in the U.S., sets the primary standards. Unfortunately, the process is exceedingly slow and is much longer than the product cycle. We have to change that. Some recently developed models seem to work effectively to set pro forma standards in a relatively short period of time. The basic idea is

to take the proposed protocol outside of the normal process, see if it works through a series of rapid trials, and if so, submit it to ANSI. So if we have such a process that allows us to move quickly and reach an answer, we believe things can run more smoothly. So we agree with you, we need to speed up the process without giving up the good parts of the standardization process, which are, in fact, very good.

QUESTION 18: It is interesting to note that the standardization process you just described is the opposite of competition. How do you account for this?

WK: Well, this is not exactly true. We see it more as standing in before the fight, and agreeing upon the rules by which one shall fight or play the game. Then having agreed upon the rules, we go at it. We are not going to try to win the competition by playing games with the standards process. That is one of the reasons that standards take so long; people are playing games with each other. We are simply saying that it is important for all of us in the U.S. to agree on standards quickly. If we do not, and somebody else does, we lose. We may give up some of our relative advantage (across domestic companies), but we think it is to the overall advantage of all U.S. companies to agree.

QUESTION 18 response: I have a second question. You said that the average consumer does not need fiber optic capabilities, but I do not think we can know what the limitations will be until we put a group of humans together and see what they come up with, in terms of needs and technological limitations. I myself hesitate to make predictions about what these limitations will be. How can you be sure that you are making the right choices? We all know the story about the miscalculations surrounding the telephone, and how few people expected it to become the ubiquitous appliance that is now found in virtually every home.

WK: I agree with you, but with one amendment. At the present time, it is not worth the social cost to deploy fiber to every one's house, just to see if we will develop a need for it. The kind of information capabilities and structures we have at present do not need fiber. When we get to the point that a true market force will require fiber, it will be appropriate for the home.

My comment was more a reaction to the idea that the government should pay $500 billion right now to run fiber to every home; I believe this is a bad idea. We need to find out what we shall use it for, and get people used to using the information generated. Once that process is in motion, technologies and platforms will develop, and then if there is a need for fiber, it will be provided by industry.

I have got some charts that will address some of these issues, so let me turn back to those. This first slide is a photograph of a two year-old all optical switch, solid state devices as well as fibers, will operate much faster than current day digital switches, and when the technology matures, these will provide the foundation of an all optical network end to end.

AT&T's network itself is hard to picture. But what you can picture is a room with walls that are two stories high, about 60 feet wide, covered with rows of monitors that make up our network. That is how our network operations center looks, and in it we monitor what is happening throughout the world on our network. The people who sit in this room are not only able to see what is happening, they are also able to control access and fix problems in the network.

One example of this process in action is the 1989 San Francisco earthquake. After the quake, we terminated all calls going into San Francisco to allow for a greater volume of traffic coming out. Before we terminated incoming calls, the volume of calls was so large that no one could get through in either direction. So we allowed all of those in the Bay Area to call out, and let all of their friends and families that they were okay. That is an example of the kind of thing that happens in a natural disaster.

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We have also made great advances in terms of our digital network. We now have the capability, if a fiber is cut, to automatically reroute traffic around the problem. This process is fully automated. It used to take us many hours to fix a fiber cut, now we can reroute traffic and have the thing repaired within a couple of minutes. The network is made up of 131 big switches. Those switches handle about 130 million calls a day. There are 39 operator services switches; when you dial zero plus you go through those switches. Signal transfer and network control points are the switches and data bases that are outside the switches that provide the intelligence. And there are about one million fiber miles in the network.

Now I would like to show you a few products. We cannot actually demonstrate in live format for a number of logistical reasons, so I will hold them up and show you what they are.

[Mr. Kerkeslager now shows the audience a number of AT&T's new products, including the following: the EO, a notepad-style computer which focuses on communications and has full cellular connections, standard facsimile and electronic mail and database access capabilities; a basic cellular phone; a modified cellular phone that allows for the use of a SmartCard, which has its own processor, an operating system with independent memories and independent security controls; and a wrist radio telephone, reminiscent of Dick Tracy. The unit is very light, straps on easily, and has very effective transmission capabilities.]

I shall now show you a pair of video tapes, one which displays current technologies and products available, and one which shows a dramatization of what we believe life will look like in the year 2005, after fully incorporating many of the now and soon to be available technologies.

[Mr. Kerkeslager now shows the first videotape, which displays many of AT&T's new technologies, including the following: digital-audio compression capabilities, which should eventually allow for a CD quality replacement for FM radio in cars, powerful speech recognition and instantaneous language translation capabilities, first demonstrated at the Olympics in Barcelona; the world's "most technically advanced and reliable" network" in the world; and RightPages, a technology that allows for, among other things, on-line journal searches and browsing.]

We will have to cut this video here, but there are further examples of technologies including, SmartCard applications and a system that allows you to flip pages on the computer [a human factors experiment], and various other current and experimental technologies. We will now move forward to 2005 . . .

[Mr. Kerkeslager now shows a dramatization of life in the technologically advanced world of 2005, in which all of the following [and many additional technologies] are out in the marketplace and in the average American's home. Some of the technologies shown include: instantaneous language translation, trans-Atlantic video-phone service, voice recognition capabilities and telephone connections in notebook computers, full use of "intelligent agents," widespread use of virtual reality technologies by children, on-line shopping and dress designing capabilities, international video teleconferencing, and the extensive use of computers to individually educate children, which allows each student to advance at his or her own pace.]

HS: I think the new format is wonderful, and I am sure we have all learned a great deal today. I hope you will show your appreciation to Woody and to AT&T. Thank you very much for coming.
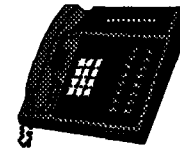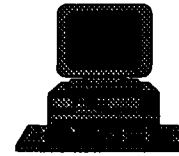
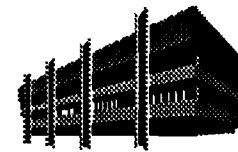# The National Information Infrastructure

Why is the NII Important?

- US global economic competitiveness

- Overall societal benefits

- Quality of life for every American
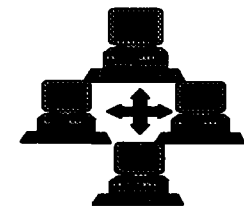
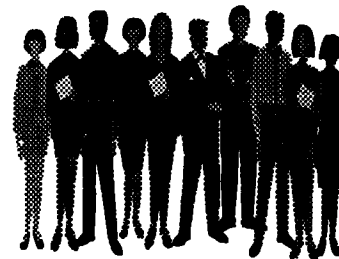# What are the Components of the NII?

- **Information Appliances**

- **Communications Networks**
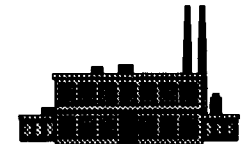
- **Information Resources**

- **Human Resources**

Who Uses the NII?

Health Care

Medical Practices	225,000
Dental Practices	105,000
Pharmacies	60,000
Hospitals	6,000

Industry

Small Businesses	
Retail Establishments	20,000,000
Corporate Offices	600,000
Factories	371,000

Research Laboratories

University Related	12,500
Commercial (Private)	11,300
Federal	726
Supercomputer Centers	20
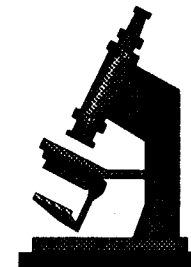
Who Uses the NII? (con't)

Transportation
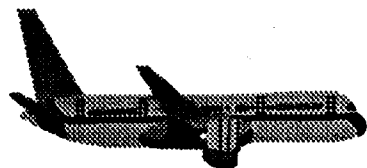
Passenger Cars	147,500,000
Trucks	15,200,000
Buses	18,400
Trains:	
Freight	1,231,000
Amtrak	1,986
Planes:	
Civilian	274,800
Commercial	3,190

Education

Day Care Centers	248,700
Schools (K-12)	110,000
Libraries	28,600
Colleges/Universities	2,807

Housing
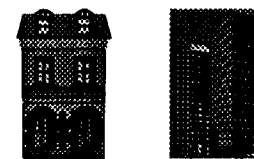
Privately Owned Residences	58,164,000
Leased Apartments	32,724,000

Trends in Consumer Needs

In an increasingly complex and fast-paced life:

- simplify a complex world, with information overload

- make technology "easier to use"

- increase productivity/efficiency

- reduce paper

- maximize choice for and personalize to a diverse population

- filter unwanted "clutter"

Trends in Business Needs

In an increasingly competitive and global marketplace

- shorten time-to-market

- improve customer service

- expand globally

- quickly form alliances

- speed "customer-suppler" processes

- reduce travel expenses

- act as "force-multipliers"

What are the Societal Benefits of the NII?

- **Health care**
  - on-line patient records
  - medical collaboration
  - human organ simulation

- **Education**
  - on-line job training libraries
  - electronic librarian
  - virtual laboratories and field trips
  - collaborative learning

- **Intelligent Manufacturing**
  - concurrent and distributed design, engineering, and manufacturing
  - virtual design and manufacturing

Other Societal Benefits

- Employment/Work Force

- Rural Issues

- Inner City Issues

- US/National Competitiveness

- State/Regional Competitiveness

- International Trade

- US/International Support for
  Developing Countries

- People with Disabilities
  Empowerment

- Consumer Fraud Prevention

- Work-at-Home/Telecommuting

- Transportation

- Energy and Environment

- Leisure/Arts

- AIDS Information

Who Provides the NII?
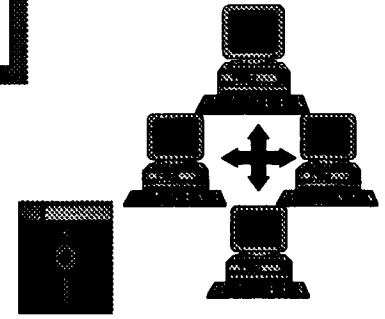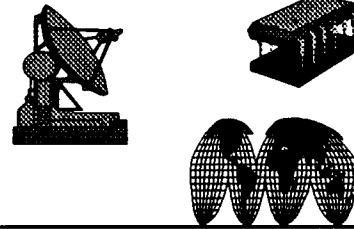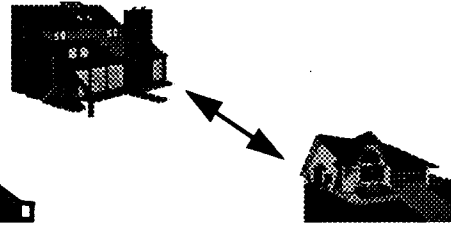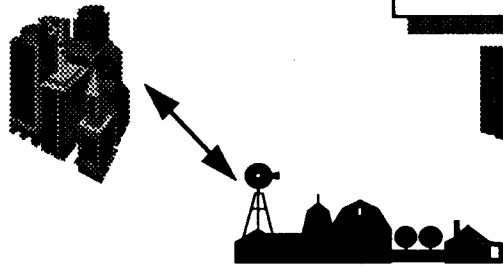
Customer Premises User Locations

Information Appliance Vendors

- Telephone
- Videophone
- TV
- Radio
- Computer
- Fax
- Pager
- Celluar Phone

Exchange/Metro Area

- LECs
- Cable TV Providers
- Alternate Access Providers
- TV Broadcasters
- Cellular Carriers
- Paging System Providers
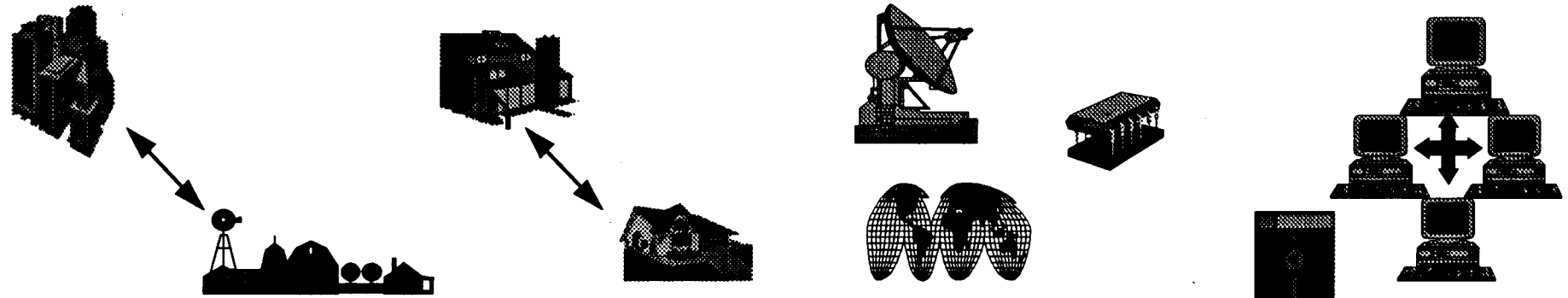- PCS Providers
- Alternate Access Vendors

Long Distance/ International

- Interexchange Carriers
- Data Carriers

Information Resources

- Information Service Providers
- Enhanced Service Providers
- Application/ Database Providers

What Technologies Support the NII?

Customer Premises User Locations	Exchange/Metro Area	Long Distance/ International	Information Resources

Information Appliances

Audio/Video Processing and Compression Systems

Display Systems

Software

Communications Systems
- Copper Wire
- Wireless
- Fiber Optic

Voice/Data/Video/Multimedia Switching Systems

Intelligent Network Nodes

Communications Protocols

Signal Processing and Compression Systems

Numbering and Addressing Schema

Network Management

Software

Information Appliances

Software

Human Interface Systems

Human Interface Systems

What does the NII Do?

- <u>Enables</u> connectivity among individuals and computing appliances

- <u>Links</u> people, homes, schools, libraries, hospitals, government, and business offices

- <u>Provides</u> access to a variety of public and private information resources

- <u>Transmits</u> audio, fax, text, images, video, and multimedia

via a ubiquitous set of interconnected and interoperable commercial networks.

The National Information Infrastructure

- **Wide disparity in number and types of users**
  - users, applications, performance

- **Diversity in communications requirements**
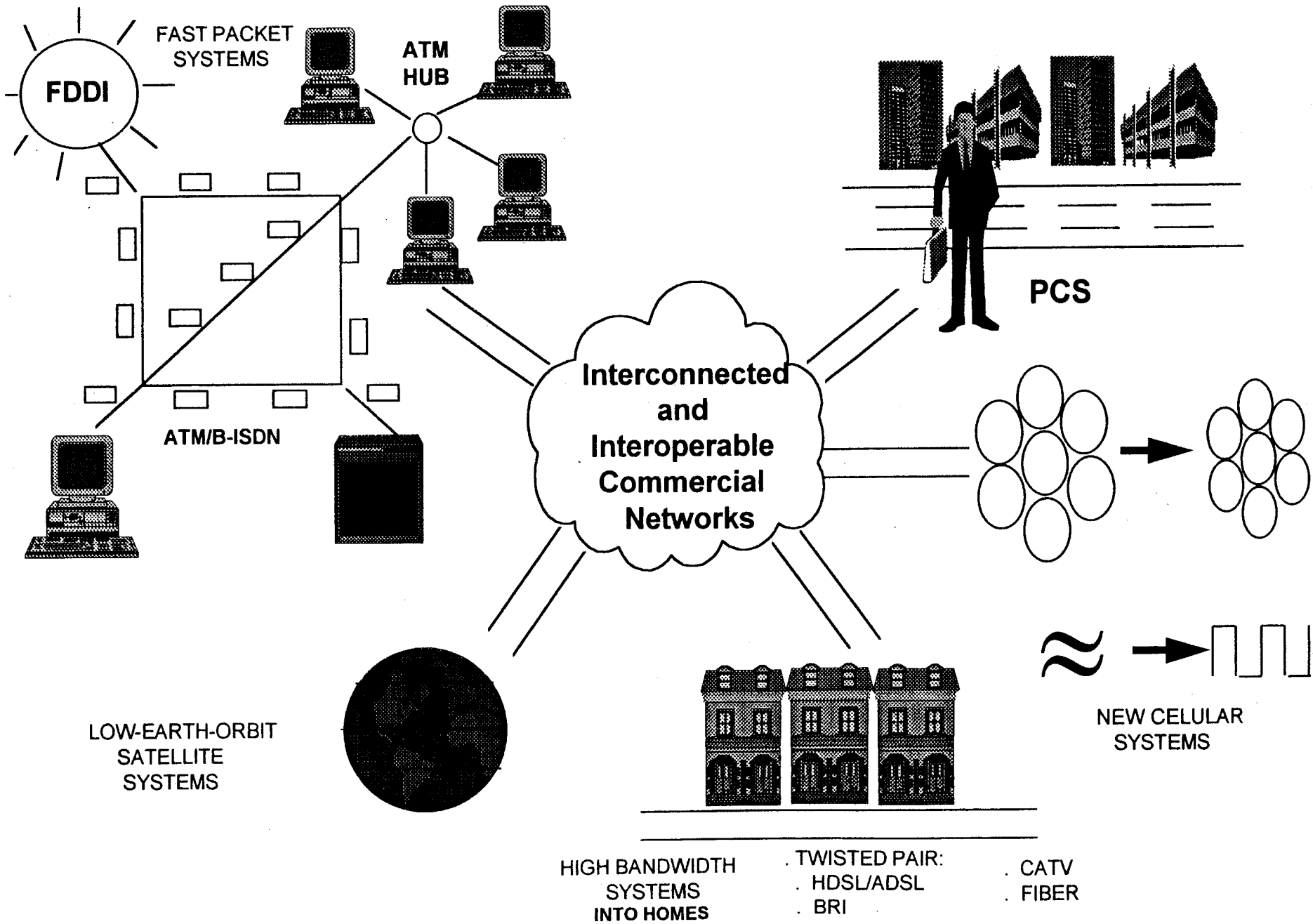 - distance, speed, delays, connection frequency, holding time

✔ **What is needed?**

- **A complex and diverse set of services**

- **Driven by competitive forces operating in free and open markets**

- **Striving to achieve price/value optimization for each user**

"One Size Does Not Fit All"

The National Information Infrastructure

FAST PACKET SYSTEMS

FDDI

ATM HUB

ATM/B-ISDN

PCS

Interconnected and Interoperable Commercial Networks

LOW-EARTH-ORBIT SATELLITE SYSTEMS

NEW CELULAR SYSTEMS

HIGH BANDWIDTH SYSTEMS INTO HOMES

. TWISTED PAIR:
. HDSL/ADSL
. BRI

. CATV
. FIBER

What are some Impediments to Enhancing and Improving the Current NII?

- **Lack of Exchange Communications Options**
  - affordable digital enhancements to copper
  - exchange communications competition

- **Professional Reluctance**

- **Gaps in Critical, Enabling Technologies**

- **Government Research Funds not Focused on Critical Technologies**

- **Lack of Focused Investment and R&D Incentives**

- **Protection of Intellectual Property Rights**

- **Protection of Privacy**

- **Security of Information**

What are some Impediments to Enhancing and Improving the Current NII? (con't)

- Liability for Information Transport
- Difficulty of Use
- Training/Ongoing Support
- Management of Government Administered, Technology-Enabling Resources
  - spectrum, numbers, Right-of-Way
- System and Network Incompatibilities
- Lack of Government Focus on Open, Public Industry Standards
  - government procurement
  - electronic access to government information
  - support of industry standards in international trade and standards issues
  - encouragement of rapid agreement on new technology standards

What are Some Impediments to Expanding the NII Globally?

- Foreign market barriers

- Market access parity

- Technology export restrictions

- Disadvantageous settlement rates

- Subsidized foreign competitors

What Can the Government Do?

The Government can stimulate the NII by being a:

- **Leader:** create the vision and define the national challenge
- **Innovator:** invest in precompetitive technology research at industry, government and university labs
- **Administrator:** effectively administer government controlled resources to enable competitive markets
- **Enlightened Regulator:** focus regulatory efforts on opening markets to competition and eliminate regulatory efforts which fine-tune working competitve markets
- **Motivator:** provide industry investment incentives
- **Facilitator:** support and adopt industry-developed interoperability standards
- **Protector of Innovation:** legislate/regulate limits on liability in targeted areas
- **Participant:** support inclusion of appropriate government information in databases and digital libraries
- **Wise-Funder:** direct any appropriate subsidies to end-users who can freely select from the market