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CONSULENZA INFORMATICA

THE INFORMATION SUPERHIGHWAY

John Favaro

Viareggio, 19 November 1994

Prologue

A year ago, at Christmas of 1993, I returned to my home in San Francisco, California to do some work. As it turned out, I spent six months there. My lecture today was inspired by what I experienced there during those six months. For San Francisco, California isn't just a nice place to visit, it is also the home of what is known throughout the world as "Silicon Valley"—the most important, exciting, and advanced center of computers in the entire world. Anything that happens in computers almost always happens first in Silicon Valley.

When you are in Silicon Valley, it is a very exciting atmosphere, because of all the intelligent, innovative people around you. It is probably like being in Hollywood for an actor or a movie director. You can almost "hear the noise of the people thinking around you."

Whenever I visit Silicon Valley, there is always some "Hot Topic" — something about which everybody is excited. Many years ago it was the Apple Macintosh computer, then it was the IBM PC computer, then it was something else. But this year, everybody was talking about what is known as the Information Superhighway, a nationwide network (in Italian, *rete*) of high-speed communication.

You might ask, Why all of this interest *now* in the Information Superhighway? Why didn't it happen earlier? For that matter, why not later? One of the main reasons is that for the first time, an important politician has understood the importance of communications technology. Up until now, politicians were usually not very technical people—certainly Helmut Kohl and Umberto Bossi aren't thought of in terms of their technical interests. But this time it's different.

The Vice President of the United States, Mr. Al Gore, has been interested in communications technology for a long time; and in fact, it was he who invented the term "Information Superhighway" fifteen years ago. Now that he is the vice president under the Clinton Administration, he has the opportunity to realize this dream. On January 11, 1994, Al Gore announced formally the plan of the Clinton Administration for the creation of the National Information Infrastructure.

The National Information Infrastructure is not a reality yet. It is being designed now. But there is a global computer network in existence now which has fired the imagination of people the world over, and it is the real subject of my talk today. It is called the **Internet**.

The History of the Internet

First I would like to tell you something about the history of the Internet, so that you understand what it is. I was actually personally involved as one of the earlier users of the Internet. In the old days, people bought computers and installed them in their buildings somewhere in a big computing center. Remember, computers were very large in those days. The universities and the research institutions had the largest, fastest, and most expensive computers. Everybody wanted to work on those computers because they were the best ones. But only a few places had them, because of the expense.

And so, over twenty years ago, in the early 1970s, the United States government had an idea: why not connect those computers to the telephone network, in the same way that people connect their fax

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machines to the telephone network today? After all, computers are just machines like telephones and faxes, so they can also communicate over the telephone lines. In this way, people from far away could "call up" those big, expensive computers, and give them work to do, even if they were physically located far away. And so they began to experiment with this idea, connecting a few machines, maybe about fifty of them, to see whether people were able to work with them from far away.

During the late 1970s, I was a student at the University of California at Berkeley on the West Coast of the United States. For my work, I needed a big and powerful computer, and the only one that was big enough was located 5000 kilometers away, at the Massachusetts Institute of Technology in Boston. I was able to use that computer through the telephone lines. So I wrote my entire Master's Thesis (Italian: *tesi di laurea*) sitting in my home in California, using a computer 5000 kilometers away in Boston. This kind of work was one of the first uses of the Internet.

Connecting to the Network Through a Modem

How does it work to connect your computer to the network? It is very simple, you simply use a device which you can buy in a computer store anywhere nowadays. It is called a **modem** (which officially means "modulator/demodulator").

[An acoustic coupler is an earlier version of a modem]

Once the computer is connected to the telephone network through the modem, it can call up the other computers in much the same way as you call people on the network.

Electronic Mail

As I said earlier, the original reason for the Internet was to allow people to use the big, expensive computers that were located somewhere else, in order to get their work done. But the funny thing is that this turned out *not* to be the reason why the Internet became as important as it is today. The real reason was something completely different.

Since the computers in those early days were all connected together, people realized that they could use this network not only to call up the computers and do programming, but they could also use it to send each other messages. After all, the network was there, the computers were connected, and each person had his own network address. So it was an easy step to send messages to each other.

This kind of communication came to be known as **electronic mail**. For short, it is called **e-mail**. The funny thing is that people soon discovered that this electronic mail service that the Internet gave them was actually more useful to them than the original purpose of the network. It was a new way to communicate, more useful than the telephone and more useful than the fax.

Each person using the computer network has his own "network address", which is very much like a telephone number in the telephone book, except that it consists of names instead of numbers. For example, my own network address looks like this:

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favaro@pisa.intecs.it
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The Growth of the Internet

And so it was things like the electronic mail service started the Internet growing, during the 1980s. Then some other critical things happened. One of them was the coming of the inexpensive personal computer. It became possible for everybody to have his own computer right on his desk. And so more and more people could be connected to the network.

The first message was sent over the Internet (then called the ARPANET) on November 21, 1969.This year, the Internet celebrated its twenty-fifth birthday.

In the early 1990s, the Internet exploded in size. The Internet currently has about twenty-five million users in the world, and it is doubling in size every year. There are currently two thousand registered users of the Internet in Italy. There are three million in the United States.

Getting on the Internet in Italy

In California, it is very easy now to connect yourself to the Internet. There are private services in almost every city, and you can sign up just like you sign up for a telephone here with SIP (now called Telecom Italia). But here in Italy, things are not so far along. However, in the November 1994 issue of the magazine *Zero Uno*, there are articles explaining how you can connect to the Internet here in Italy. The best places are still Milan and Rome, of course, the big centers. This issue of the magazine should give you all the information you need to use the Internet.

Who Owns the Internet?

Who owns the Internet? Who runs the Internet? Actually, nobody does, or everybody does. The Internet was originally designed by the United States Department of Defense in order to be resistant to nuclear attack. So it was built with no central control center. So if one nuclear bomb wiped out one computer or one part of the network, the rest of the Internet would be able to keep functioning. It now links universities, government centers, businesses, and individuals all over the world, and everybody shares the cost of keeping it running. It is the closest thing to anarchy you can find in the world of communications.

In fact, the Internet has been called the Electronic Frontier. This is how it has been described in those terms by the Electronic Frontier Foundation: "Whether by one telephone [line] or millions [of them], [these computers] are all connected to one another. Collectively, they form what their inhabitants call the [Internet]. It extends across that immense region of electron states, microwaves, magnetic fields, light pulses and though which [science fiction] writer William Gibson named Cyberspace. Cyberspace, in its present condition, has a lot in common with the 19th Century [American] West. It is vast, unmapped, culturally and legally ambiguous, verbally [synthetic], hard to [move] around in, and [out there for anybody to take]. To enter it, one forsakes both body and place and becomes a thing of words alone. It is, of course, a perfect breeding ground for both outlaws and new ideas about liberty."

During the rest of my talk I'm going to speak about some of these phenomena: about who is out there on the Internet, how they talk with each other, the laws, and the outlaws.

The Discussion Groups

By far the most frequent use of the Internet is for electronic mail, which is often called email for short. Normal postal mail service is called "snail (Italian: *lumaca*) mail", because it is so slow!

But there is another important use of the Internet by its users. This is a large set of so-called "discussion groups" in which people express their opinions about every possible kind of subject in the world. These discussion groups are also called "electronic bulletin boards" (Italian: *bacheca*) because they are like that: somebody sends a electronic message to one of these bulletin boards and it is "posted" there so that everybody else can see it. Then anybody who wants to can post his own message in response to that one. So a kind of world-wide discussion of that topic takes place.

The worldwide system of these discussion groups is called USENET. How many different discussion groups are there? Currently, there are more than 2600 of them. They concern every possible subject imaginable. Here is just a small selection of what they are:

Cooking, sociology, classical music, rock music, fishing, computer technology, humor, cars, philosophy, law, television, medicine, film, every sport (football, swimming, tennis, etc.).

There are discussions about religion. In California, where everybody seems to belong to some variant of a religion, there is an Internet discussion group where you can start your own new religion.

There are also direct discussions between users using what is called the Internet Relay Chat, where if you send a message on the Internet it is immediately received by everyone else who is waiting. In fact, just recently, in order to celebrate the 430th birthday of William Shakespeare, a group of Internet Shakespeare fans staged a live performance of Macbeth on the Internet. And an international cast of seventeen players performed this play, with each of the "performers" sitting at home at his computer.

The production appeared on computer screens throughout the world. This Internet Shakespearean theater group calls itself "Ham-net."

What Is the Internet Used For?

From the Internet companion: "The Internet community is expanding not only in numbers but in breadth of application. Journalists use the Internet to cover topics from the computer business to world news, and some even conduct interviews over the Internet. Medical researchers share information on diseases such as AIDS. Doctors transmit X-ray or CAT-scan images to medical centers for further analysis. Students travel in the Internet in geography and language arts lessons, learning about other cultures. Librarians love the Internet for its advanced document searching tools."

Business people contact clients and accept orders over the network, and many of them are beginning to add their email addresses to their business cards. For example, my own business card has my email address on it.

There are now magazines for Internet users, including *Internet World*, whose July 1994 issue was all about doing business on the Internet.

As an example of business on the Internet, just a couple of months ago, a company in New York made it possible to order pizza over the Internet. You send an email message to them, describing what kind of pizza you want, and their nearest restaurant will make it and bring it to you.

One of the funniest applications I have ever seen was a couple of friends of mine in California who are fanatics about wine. They equipped their wine cellar with temperature sensors, and connected those sensors to the Internet, so now no matter where they are in the world, they can check over the Internet to find out whether their wine cellar has the correct temperature.

What other kinds of things do people do with the Internet? I decided to let them tell you for themselves, and so last week I got onto the Internet, and I sent a message to two discussion groups. One of the groups discusses the topic of the Internet and its Effect on Society, and the other group discusses Italian literature and culture. In my message, I said that I would be giving a talk to the Anglo-Italian Club of Viareggio, and would like for somebody to send a message to the Club members greeting them, and telling them something about how they use the Internet. Here are some of the replies I received:

(A number of replies from all over the world were read to the group.)

The Internet and Writing

Since this is a group whose main purpose is to talk about language, I'm going to talk now about the effect the Internet and electronic mail is having on language and the written word.

One of the unintended side effects of the invention of the telephone was that in many countries writing went out of style. I remember my parents always writing letters, and I remember writing letters as a young boy. But I remember my mother telling me that my generation doesn't write any more—we just call on the telephone. I remember when I first traveled to Europe twenty years ago, I wrote letters to my parents. But as the telephone developed and transatlantic telephone service became better and less expensive, I stopped writing letters to my parents—I simply picked up the telephone and called them.

With the fax machine, a change began. Many people began to use written faxes instead of the telephone, first for business, then for personal letters. In fact, it has become quite common to have a fax in your house to receive letters—my parents have one in their home, and their children often communicate now with them by sending faxes.

But the real revolution happened with the growth of the Internet. People all over the world are now sitting down every evening, not passively in front of their television sets as they used to do, but actively in front of their computers—and writing (well, actually, *typing*), in all forms: electronic mail, discussion groups, even short stories and poems.

The poems may be found in the `rec.art.poems` USENET group.

Extracts from Time magazine, July 4, 1994:

> The journalist Jon Carroll of the newspaper *The San Francisco Chronicle* wrote: "It is my overwhelming belief that electronic mail and computer conferencing is teaching an entire generation about the flexibility and utility of prose." Patrick Nielsen Hayden, an editor at Tor Books in New York City, compares electronic bulletin boards with the so-called "scribblers' compacts" of the late 18th and early 19th centuries, in which members passed letters from hand to hand, adding a little more at each turn. Another interesting comparison was made to an observation by Mark Twain, the American writer, when he arrived in San Francisco in the 1860s and saw what was happening there in literary circles. People were re-inventing journalism by combining it with the folk tradition of telling stories. And finally, some have even compared today with the Elizabethan epoch, when a whole generation of English writers suddenly became intoxicated with language and the written word, because of another technical invention: the Gutenberg press.

The Email Writing Style

Now let's take a closer look at this new epoch of writing that is flowering around the Internet, and see just what kind of writing it is. One of the most fascinating aspects of written communication on the Internet is the difference in style to ordinary writing. It is not the same.

To put it simply, writing on the Internet is like "written speech." It is somewhere between small talk conversation in a bar and a real letter. One of the most obvious characteristics of email communication when you see it is that messages are *short*. Sometimes they consist of only one sentence. Sometimes they consist of only one word. Why is that?

Think about how much effort it takes to write and send a normal letter. First you have to write it on a piece of paper, then put it in the envelope, find the address and write it on the envelope, put a stamp on it (if you have one—you may have to go to the post office to buy one), then go to the mailbox to mail it (or the post office). And even then, it still takes days, or weeks, or even months to arrive at its destination.

Contrast that to how easy it is to send an electronic piece of mail. You can type in any amount of text, even only a word, and press a button, and it arrives at its destination in *seconds*. Furthermore, most people can't type very fast, so that also encourages them to write short letters. Also, there is something about the medium of the Internet that encourages short communications. It seems dynamic, fast-moving, and when you are sitting in front of that computer writing, there is a kind of adrenaline inside of you that makes you want to finish your message as soon as possible and send it off. Maybe the high speed of the electronic network makes us also want to write our messages at high speed!

Acronyms on the Internet

One consequence of this tendency towards a short, staccato writing style is that a kind of shorthand (Italian: *stenografia*) has evolved on the Internet that people use to make their messages even shorter. These are acronyms that people write instead of writing out the entire message. As you can see, it is more like conversation than letter-writing.

(*Examples were presented, such as IMO, LOL, etc.*)

Expressing Emotions Through Email

Another even more fascinating phenomenon is how people manage to show emotion over the Internet. Think about it. You are sitting in front of what is essentially a typewriter. And you have to find a way to express the whole range of human emotions through this typewriter. Now, in traditional prose, of course, writers express emotions through the content of the writing itself, through description and dialogue.

But that is careful, thought out writing. As we have seen, writing on the Internet is fast, conversational writing. And in conversation, emotions are expressed not only in *what* you say, but on *how* you say it.

Visually, through your facial expressions (whether you are smiling or frowning); and orally, by the tone of your voice (whether you are shouting or whispering, laughing or crying).

But how can you express these things over a typewriter? The Internet writing community has been ingenious in finding ways to do this. Of course, people still use all of the traditional punctuation to express emotions, such as the exclamation point. And, one of the simplest and most used ways to express shouting is to write everything in capital letters. Strangely enough—or maybe not so strangely—people often get angry and "shout" at each other over the Internet. They seem to be bolder, more aggressive, more assertive. I think that maybe it's the same phenomenon as driving a car: have you noticed how people also become more aggressive when they're driving a car? Psychologists are pretty much in agreement that this phenomenon is related to the fact that they are in the safety of this big metal box that also alienates them from the outside world. It turns the other person into an abstract object that he doesn't have to deal with directly on human terms.

Flaming

So you will find a lot of people on the Internet "shouting" at others by writing in capital letters. And it is considered bad "netiquette" to shout if you don't have a good reason. This kind of shouting is called a **flame**—I suppose, because it's like a fire flaming up.

Emoticons

But how do people show visual expressions, like smiling and laughing, with a simple typewriter? This is one of the most ingenious solutions I have ever seen. Over time, a collection of so-called "emotional icons" has appeared on the Internet that people use to actually show facial expressions. They use only the letters of the typewriter keyboard in order to construct faces. They are very primitive, but I think that they are very, very ingenious and one of the most entertaining aspects of electronic communication on the Internet.

(*Examples of emoticons were shown, such as* :-) *and* :-( )

Quality of Writing on the Internet

So you can see that writing on the Internet is quite different from ordinary writing like you might see in books or in newspapers. It is faster, more free-flowing, more "multimedia." In fact, when traditional prose is placed next to it, the traditional polished prose seems slow, plodding, pompous, self-important. Most important, it is getting young people in the habit of *writing*. One reporter in Washington said: "There is a whole generation of young kids out there who can put a sentence together better than their blue-blooded peers simply because they get onto the Internet all the time and write, write, write."

Potential Problems on the Information Superhighway

I've talked about all the great things that are going to happen with the Information Superhighway. Now I'd like to talk about some of the bad things that are going to happen — the problems associated with the Information Superhighway:

Crime on the Information Superhighway

Unfortunately, there is a big potential for crime on the Internet. There is no security provided, and since there is no central authority, the Internet depends on everybody being a "nice person." As we all know, not everybody in this world is nice, and it is very possible for some bad people to be using the Internet to do bad things.

Here is an example: As you probably know, computer users are getting younger all the time, and some of the most enthusiastic users are the youngest ones—teenagers especially, and now even very young people maybe only eight or ten years old. People are starting very early to use computers. And so it's possible for these young people to use the networks to communicate with other people. It's like the old days when young people had "pen pals" — they exchanged letters with other young people from all over the world. The Internet, with electronic mail, is the modern version of "pen pals" for these young people.

The Internet also attracts some very strange people, unfortunately — people with serious psychological disturbances. One reason for this is that they can remain anonymous—faceless. They can hide behind their computer and communicate without having to show who they really are and reveal their problems like they would if they had to meet people personally.

This is a deadly combination. Earlier this year, the police in Silicon Valley, California, arrested a man who had been using the Internet to make contact with young boys with electronic mail. He would then arrange to meet these young boys so that he could molest them sexually. They monitored his communications with these boys for several months in order to gather the evidence.

The problem is so serious that the San Jose, California Police Department has started its own special force of computer experts to combat Internet crime. They have their own address on the Internet and you can contact them for information about their work.

Computer Viruses

One of the biggest dangers on the Internet is the computer virus. Some of you probably already know what a computer virus is, but I'll tell the rest of you now. A computer virus is a little computer program that was created by some bad person who wants to destroy the other programs on a computer. A very intelligent bad person, who is a very good programmer, can create a virus program that is so clever that nobody knows it is there. It "hides" inside the computer along with the other programs, and you can't see it. Then, at some time determined by the programmer—sometimes a very long time—the program comes out of hiding and destroys the other programs.

Since people don't know the virus program is there, they might carry it around on their computer diskette and put it in somebody else's computer, and then that other computer will also have the computer virus program, and its programs will also be destroyed.

Now you can see why it is called a "virus." It is in some ways like the AIDS virus, which is transmitted from person to person, usually by people who don't even know that they have it, and then after a long time flares up to destroy the person. In fact, they even have programs that are designed to check a computer to see whether it has a computer virus. These are called "Doctor" programs, because they check to see whether the computer is "infected."

In earlier years, computer users could protect themselves from computer viruses by being careful about which programs they used. But now with the Internet, the problem is much worse, because the Internet has millions of computers connected with each other, and a computer virus could quickly infect the entire network—millions of computers!

This would be like the old days of the Black Plague (*il peste*) in Europe, where the disease spread among millions of people, or like one of those science fiction novels where some enemy agent infects the entire water supply of a country with poison.

And this is exactly what happened a couple of years ago in the United States. I am talking about the famous case of the "Internet Worm." A worm program (*verme*) is similar to a virus program, except that it is active. It jumps from one computer to another in the Internet. On November 2, 1988, people working on the Internet began to notice that their computers were sick. They had stopped functioning. They were infected with a virus. These were researchers all over the world: researchers in physics, mathematics, astronomy, and their computers were completely paralyzed. The virus spread quickly: in only fifteen hours, which is about half a day, *two thousand* computers on the Internet were paralyzed by this virus. In only half a day!

The search began, to try to find the person who had created the virus. They finally found him—he turned out to be a student of computer science at Harvard University (subsequently at Cornell) who had written the virus just for technical curiosity—he only wanted to play and experiment with it. Then, when he sent it out on the Internet, he discovered what he had done and could not control it any more. He went into hiding, and he was finally found and admitted what he had done. The funny thing about this was: he turned out to be the son of the most important man in the National Security Agency; the man most responsible for computer security for the entire United States!

A most interesting question was: should the student be punished? After all, he was only "playing" with his virus program. He didn't intend to cause all that damage on the Internet. But in one of the most important landmark legal decisions, the court convicted him of a federal crime for the damage he caused. It was the first time that anybody had been convicted legally of this kind of crime. The reason given was that this kind of sabotage was so dangerous that they wanted to make an example for the future, so that nobody ever did it again.

The Cuckoo's Egg

You can read about the Internet Virus in the book called *The Cuckoo's Egg*. The subtitle of the book is "Tracking a Spy Through the Maze of Computer Espionage." The book was written by a young man who was a computer user at the University of California at Berkeley, on the West Coast of the United States. One day, he noticed that on his computer system, there was an error on the telephone bill of 75 cents — that is only about 1000 Lire. Most people don't care about that, but he was a real scientist, and so he became curious. He began watching his computer carefully to see who was using it from the Internet. He discovered that somebody was secretly entering the computer from the outside network. So he observed very carefully what the intruder was doing. He soon discovered that the intruder was looking for secret documents—for example, documents describing secret military projects in the United States. He traced the intruder for several months, and finally got the United States National Security Agency involved. And finally, he discovered that the intruder was in Germany, halfway around the world. It turned out to be a German student who was being paid by Soviet spies to use the Internet to try to break into United States computer to steal secret information.

The Law and the Information Superhighway

One of the problems that the Internet has is shared with all kinds of computer technology. The computer technology is advancing so fast that the legal system is no longer adequate to deal with it. Think about when the Italian constitution was created, in 1933. In 1933 there were no jet planes, no helicopters, no television, no fax—and there were no computers. And so there were no laws that covered the use of computers. For the first few years there weren't too many problems. It was possible to use the old laws to cover computers. But now with the technological explosion, the law is out of date.

Think about this problem: what kinds of things can you send through the Internet? We have seen now that you can send electronic mail messages. But what else can you send? You can send anything that you can store on a computer. What are these things?

One thing you can store, of course, are computer programs. But you can also store books; magazines; newspapers; letters; any kind of document.

But also music. After all, the compact disk is digital. Computers can store them.

In fact, yesterday (November 18, 1994) marked the first time that a rock concert was broadcast over the Internet. An article a few days ago in the *International Herald Tribune* said: "The Rolling Stones will be able to claim to be the greatest rock and roll band in cyberspace. The band, currently on a tour of North America, has allowed a multimedia company called Thinking Pictures to deliver the first five songs from their show on November 18 to Internet users around the world."

You can store any kind of picture on a computer; and video, movies. You can store a television show on a computer, or a Steven Spielberg movie.

Now you can send these things through the Internet, all over the world, to millions of people. What about the laws protecting the people who create these works? In the pre-computer days, someone wrote a book, and he had the copyright for the book. Whenever a copy of that book was sold to somebody, the author was given a royalty. But that was a physical copy of the book, and it was easy to keep track of how many copies of the book were sold, and who was buying the book.

But on the Internet, a book can be distributed electronically, in millions of copies, for no cost at all. How can the author be protected? Nobody knows for sure. New laws have to be created to deal with the new technology.

In fact, it will become more and more difficult to apply the law as more and more kinds of products are distributed through the Internet. Just this week, on November 14, 1994 the magazine *Newsweek* had an article on Crime on the Internet. Here are some of the crimes that are talked about in the article:

• One gang was recently caught that was stealing credit card numbers and distributing them through the Internet. Over 100 thousand telephone credit cards were stolen and distributed, and then people from all over the Internet used this credit cards to make phone calls. The estimated cost to the telephone company was estimated at fifty million dollars.

• A magazine sued a person who had published its copyrighted photographs in an Internet discussion group, so that anybody could get the photographs electronically for free.

• A music corporation sued another Internet discussion group for allowing its members to post more than five hundred of its copyrighted songs for free distribution.

Encryption and the Clipper Chip

But things will get even more complicated soon, when people start sending things like money over the Internet. Of course, people are already making bank transfers by wire. But that is done on private lines. They're not making them on the Internet yet, which is a global, public network. How do you keep people from stealing that money? In fact, how do you keep anything from being stolen on the Internet?

One way is by encryption, secret encoding. Remember that during World War II the enemies encoded their messages to each other so that the others could not read them? Well, this could also be done on the Internet, so that, for example, nobody else could read your electronic mail and you can guarantee your privacy. So everybody is now interested in how to make secret codes for Internet messages. And this has now led to one of the most interesting controversies today regarding the Internet. This controversy places the users of the Internet against none other than the United States Government.

As you know, the government likes to be able to tap telephone lines and listen into conversations of people. Usually this is for law enforcement, such as fighting Mafia bosses. But it could also be for political reasons, like monitoring leftist radicals. So there is always a balance between the people's right to privacy, and the government's right to protect the good people by watching over the bad people.

The United States government would like to be able to watch over the traffic on the Internet—for example, to watch for the kinds of crimes I listed above. But there's a problem. The technology of secret codes on the Internet is becoming so good that very soon, it will be possible for anybody to encrypt his message so that nobody else can break the code, not even the United States Government. The government doesn't like this, and so it has proposed something called the Clipper Chip. It is a computer chip that you can use to encode your messages on the Internet, with a guarantee that nobody else can bread the code—except the U.S. Government, because they will also have their own secret key. And right now there is a big legal battle going on in the courts of the United States of the people against the government. The people say that they want to protect their right of privacy, and the government says it wants to keep its ability to do law enforcement even on the high-technology Information Superhighway.

Isolation in the Virtual Community

The last problem I'd like to talk about concerns the social implications of the Internet. I mentioned earlier that people seem to change when they communicate over the Internet—they get bolder, more aggressive. They often change their personalities, and say things they wouldn't necessarily say in a real face-to-face conversation. There is a real worry that this could be a problem for society: the danger of isolation in this virtual community. The same people who used to watch television all night still sit alone in their home, in front of a computer. They don't go out and meet real people face-to-face in the cinema, bars, or the *piazza*.

In an interview, Vice President Al Gore was asked whether the Information Superhighway would lead to even more widespread isolation of people. He was asked the following question: "It is possible now to communicate and work with colleagues who you never see. If you and the President only communicated via electronic mail, would you be missing something that you now have?"

The Vice President's response was, "Of course, but I don't think that will happen. Many people are missing a great deal just by virtue of the automobile. I know a lot of people who don't even know the names of their neighbors because they drive into the garage at night and watch television and stay with their families. And the next morning they drive to work again. By taking advantage of network technology, many virtual communities can become very meaningful to other people who participate in them and strengthen real communities."

I also read another very interesting observation this regard in Time magazine: "There is something inherently democratic—perhaps even revolutionary—about the Internet technology. It has thrown together class of people who did not have much direct contact before: students, scientists, senior citizens, computer fanatics, and the press."

The White House Email Address

I believe that the Internet is a force for democracy. For example, during the coup (Italian: *golpe*) in the Soviet Union in August of 1991, when Mikail Gorbachov was briefly overthrown and held in prison, a small Internet company called RELCOM was the only connection to the outside Western world, and it delivered up-to-date information on the progress of the coup to organizations like CNN.

As another example, during this year's elections in the United States, which were held last week (November 8, 1994), for the first time ever, the Internet was used to send messages for political candidates.

(Relevant articles both in Italian and English were shown)

As another example, the President of the United States now also has an electronic mail address and anybody can send a message to him. In June 1993, President Clinton brought the presidency into the electronic age by inviting public comment via electronic mail. Since that program began, more than two-hundred-thousand messages have been sent to the White house, sometimes as many as one thousand per day.

And that is just what I did. Last week I wrote a message to the White House, telling them about this lecture, and this is the response I received.

(Message from the White House greeting the members of the Anglo-Italian Club)

The Meaning of the Information Superhighway

"Each of the last three centuries has been dominated by a particular technology," wrote Andy Tanenbaum, the networking expert. "In the eighteenth century, the large mechanical systems and factories came with the Industrial Revolution. In the nineteenth century the steam engine entered the workplace and brought us the railroads and new shipping power. And now, in the twentieth century, the most important technology has become the acquisition, processing, and distribution of information. Today, fully half of the work force is in some way employed in the information industry. By the year 2000 it is estimated that two thirds of the population will earn its living through the management and processing of information."

In previous centuries, information was localized, because transportation was slow, and people lived and worked in their own little spheres of influence. But now, with jet planes and other forms of fast transportation, the world has become a "global village" and the need for information has become global.

The balance of power in the world will be decided by who has access to information, and who doesn't. A perfect example was the Gulf War in Iraq in 1991. Everybody in the world was watching CNN, including Iraq and the United States, because it was the only source of information. Information is necessary today for education, for research and development, for politics, for business.

Alvin Toffler has put it this way: "Because so much of business now depends on getting and sending information, companies around the world have been rushing to link their employees through electronic networks. These networks form the key infrastructure of the 21st century, as critical to business success and national economic development as the railroads were in Morse's era."

"Knowledge is power." Up until now, where was knowledge stored? In books, in libraries. And only those with access to those libraries could acquire that knowledge. When Vice President Gore was asked where he thought the Information Superhighway would have the greatest impact, he replied: "Schools. Classroom. Learning at home." The first goal of the Clinton administration is to have every classroom, hospital and library in the United States connected to the National Information Infrastructure.

In Tuscany, a network has just been launched to link Pisa, Florence, and Siena. The professor in charge of it is Vincenzo Della Maggiore and he works at the University of Pisa. Think of how it would be to have access in your classroom to all of the libraries in the country. The University Library in Pisa, the national archives in Rome—all of them. Imagine a hospital to all of the best medical libraries in the country, including advice from the best specialists in the country. This is what the Information Superhighway is really all about.

Tele-Work

The Information Superhighway will also make possible tele-working: working at home, working in rural areas. The company I work for is now participating in a European effort to help doctors, professionals and farmers in rural areas to have access to networks for their work. Think of all the islands in Italy: Elba, Capraia, the Tremiti. Think of all of the isolated areas such as the Basilicata and Campania. We are now preparing a proposal for tele-work on the island of Elba. People who live on Elba could do their work from home, opening up the job market on the mainland to those living on Elba.

The possibility to work at home also represents a great opportunity for handicapped people. In fact, the person in charge of the computer network system in the White House in Washington is both deaf (Italian: *sordo*) and blind (Italian: *cieco*). The lack of face-to-face contact on the Internet has even been seen as an advantage for handicapped people. There are many handicapped people using the Internet now, because they don't face the barriers imposed by society there. There is a famous cartoon of two dogs sitting in front of a computer terminal and one says to the other one, "You know, on the Internet, no one knows you're a dog."

The Convergence of Information Technologies

I'd like to finish by talking about what the future is going to bring us.

During the twentieth century, the most important forms of electronic communication were developed separately—and used separately. You saw films in the cinema. You watched television on your television set. You made phone calls on your telephone. Maybe you sent a fax on your fax machine. And maybe you used your computer, too. All of these information technologies grew and flourished separately.

But now, as the end of the twentieth century draws near, something important is happening in the information technology industry. The rapid changes are something like the "Big Crunch" described by the British physicist Stephen Hawking—he's the man who wrote the popular book *A Brief History of Time*. He has a theory about the universe, that it is expanding. He says that at one point expansion will stop. Information industries are facing a similar Big Crunch in the convergence of cable, local telephone, long distance telephone, television, film, and computer industries.

And this takes us back to where we started at the beginning of my lecture. In California—where everything happens first—you can already see this convergence in the interaction between Hollywood and Silicon Valley. The Hollywood film studios now use the most sophisticated computer technology; and the computer companies are making many of the entertainment products such as video games.

As the twentieth century nears its end, the lines are blurring between different kinds of information. Telephone lines are being replaced now with fiber optic lines, which are capable of carrying any kind of information in nearly any quantity, whether it is television, telephone, or computer messages. Soon, all of these forms of information will be traveling together on fiber optic lines down the Information Superhighway. Nobody knows where that superhighway will end, but there is one thing we do know: it is taking us full speed into the twenty-first century.